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NET ASSESSMENT: AN EXAMINATION
OF THE PROCESS

by

Anthony Daniel Konecny

December 1988

Thesis Advisor:

James J. Tritten

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Net Assessment: An Examination of the Process

by

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Lieutenant, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

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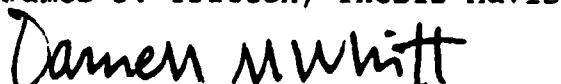
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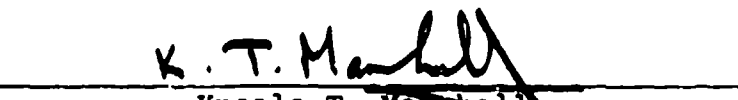

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ABSTRACT

Net Assessment is a systematic method of analysis that fulfills the need for an indirect decision support system and provides a major input to the strategic planning/management system in the Department of Defense. Through an established process of appraising two or more competitors as objectively as humanly possible, an analyst is guided to examine factors normally overlooked. Asymmetries that exist among competitors and the ability of a competitor to achieve its objectives in various conflicts are examples of some of these factors.

The net assessment process, useful applications of net assessment, and attempts to improve analysis are addressed in this thesis. These areas are examined to evaluate the effectiveness of net assessment as a method of analysis applicable to forecasting and policy modification.



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TABLE OF CONTENTS

| | | |
|------|--|----|
| I. | INTRODUCTION ----- | 1 |
| II. | MECHANICS OF NET ASSESSMENT ----- | 6 |
| | A. DEVELOPMENT ----- | 6 |
| | B. TYPES ----- | 11 |
| | C. PROCESS ----- | 14 |
| | D. SUMMARY ----- | 24 |
| III. | STRATEGIC NUCLEAR BALANCE CASE STUDY ----- | 25 |
| | A. INTRODUCTION ----- | 25 |
| | B. DEVELOPMENT OF U.S. STRATEGIC NUCLEAR FORCE POSTURES AND POLICIES ----- | 25 |
| | C. BALANCE ASSESSMENT ----- | 26 |
| | D. CASE STUDY OF SUBMARINE LAUNCHED BALLISTIC MISSILE (SLBM) EQUIVALENT MEGATONNAGE (EMT) - | 40 |
| | E. SUMMARY ----- | 44 |
| IV. | IMPROVED ANALYSIS METHODS ----- | 45 |
| | A. INTRODUCTION ----- | 45 |
| | B. DEFINITIONS ----- | 45 |
| | C. DEVELOPMENT ----- | 48 |
| | D. RAND STRATEGY ASSESSMENT SYSTEM (RSAS) ----- | 50 |
| | E. RSAS FEATURES ----- | 53 |
| | F. SUMMARY ----- | 55 |
| V. | FINDINGS AND CONCLUSIONS ----- | 57 |
| | LIST OF REFERENCES ----- | 61 |
| | INITIAL DISTRIBUTION LIST ----- | 64 |

ACKNOWLEDGMENTS

The purpose of this study is to gather information about a method of analysis used by the Department of Defense known as net assessment. It is not the intent of this paper to give an account of any current assessment but rather to provide a learning aid to those persons that make up and benefit from net assessments: members of the strategic planning and intelligence communities. The author has not had any practical experience in institutionalized net assessment but hopes that through his academic research, insight into the process will result. The material presented herein is drawn heavily from unpublished articles and interviews with people active in "net assessing." Of particular importance were the unpublished notes of CDR James J. Tritten, USN and CAPT Charles Pease, USN (Ret). Because net assessment is very complex and constantly evolving, it is hoped that this study will stimulate interest in others to continue research in this process which provides desperately needed information to our political and military decision-makers.

Special thanks deserve to be given to the following people for time spent during this research: LTC Barry Watts USAF (Ret), Dr. John Schrader, Mr. Dmitry Ponomareff, CDR George Krause USN, Dr. Darnell Whitt, Prof. Norm Channell,

and especially CDR Tritten who pointed me in the direction of this interesting field of study.

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I. INTRODUCTION

Providing decision-makers with an even-handed, objective appraisal of the balance of forces between two competitors is no easy task. When the adversary shrouds itself in secrecy and undertakes a program of disinformation, the difficulty in obtaining an accurate account of that balance increases exponentially. Obviously, any aid to see the status of competition more clearly is invaluable to the decision-maker. One such aid, the topic of this study, is the indirect decision support system called net assessment. This study will discuss net assessment, primarily as a method of analysis used by the Defense Department, and will make recommendations to improve the efforts already under way.

The purpose of net assessment is to provide executive level management with an appraisal of the state of affairs that affect the character and success of the total enterprise. Although emphasis is often placed on military analysis, the application of net assessment is just as functional in political and commercial arenas. A properly conducted net assessment will provide the policy-maker with adequate information to allow the building of successful objectives, goals, and strategies for the organization. Net assessment is not intended to act as a planning or

programming system, but the conclusions are bound to set the stage for these processes. The net assessor has done the job correctly if there is an adequate answer to the question "How do we stack up relative to the competition?" (Marshall, 1976a)

Net assessment is a method of broad analysis normally characterized by simultaneously focusing on two or more competitors or opponents through a comparative process (Marshall, 1976a, p. 1). It is not a specific technique or analytic tool nor is it a well-defined area of study (Marshall, 1976a, p. 1). Net assessment uses a number of analysis forms developed since its inception to provide impartial comparisons to any one or combination of competitors. Traditional analysis techniques tend to focus on statistical inputs or "bean counts," such as the number of missiles each side has. Net assessment takes the analysis deeper, shifting the emphasis toward such organizational outputs as cost and time required to achieve a given objective. Several types of net assessments are normally conducted concurrently to gather the essence of how well the organization will do. The various forms of analysis and types of net assessments just mentioned are discussed in more detail in Chapter II.

The concept of net assessment is not new. Assessments of the United States' ability to deal with external threats have been conducted since the beginning of American history

(Collins, 1980, p. 3). Anyone that attempts to make an appraisal of some situation is intuitively conducting a net assessment. Organizations which conduct net assessments in some form include the:

- 1) News media
 - a) Television networks
 - b) Newspapers
 - c) Professional journals
- 2) Academic community
- 3) Think Tanks and government contractors
 - a) The RAND Corporation
 - b) Center for Naval Analyses
- 4) Legislative Branch
 - a) Congressional Research Service
 - b) Government Accounting Office
 - c) Congressional Staffs
- 5) Executive Branch
 - a) National Security Council
 - b) Arms Control and Disarmament Agency
 - c) Department of State
 - d) Department of Defense
- 6) Foreign governments
 - a) Allies/NATO
 - b) USSR/Warsaw Pact
 - c) Other nations (the manner in which other nations do assessments, especially the Soviet Union, is of great importance to the analyst and is discussed in Chapter II).

The list of who conducts net assessments is obviously unlimited. Not all institutions, however, have access to sensitive information or have an established methodology for arriving at a well-rounded net assessment. Many agencies which claim to furnish a net assessment are instead only stating a simplistic, numerical count of existing forces thereby neglecting to consider other influential factors. The Department of Defense and other government agencies, which have both access to classified information and an established net assessment methodology, have been providing a useful product to the President and Congress for nearly two decades.

A present day application where net assessment could be quite useful to the U.S. Navy is identification of the Soviet naval threat. In the past, the U.S. Navy has demonstrated the expansion of the Soviet Navy by using the number of ship-days-out-of-area as an indicator. This indicator showed a rising number of ship-days, and thus an increasing Soviet threat, until 1984 when the trend began to reverse itself (Philpott, 1988, p. 35). Reducing funds for naval operations to help fuel the Soviet economy, building fewer but larger ships, and continuing efforts to husband their forces in port until needed are all possible explanations for the drop in Soviet ship-days-out-of-area since 1984 (Philpott, 1988, p. 35). With the introduction of large, sophisticated platforms such as the KIROV,

SOVREMENNNYY, UDALOY, OSCAR, TYPHOON, BACKFIRE bomber, and soon to be introduced aircraft carrier, it is doubtful that the capability of the Soviets to threaten the U.S. at sea has diminished. This case illustrates the inappropriateness of using a simple model to depict the status of the competition. Although manipulating simple models may effect desired appropriations, bottom-line judgement of the competition is what really should be provided to the decision-makers.

This thesis attempts to present net assessment as a method of analysis that can assist both the analyst and decision-maker when dealing with complex issues. Chapter II reviews the process of conducting a net assessment, lists some problems net assessors currently face, and lists Department of Defense agencies which are conducting net assessments. In Chapter III, a limited case study of the United States/Soviet Union "strategic" nuclear balance is performed. This case study highlights some issues important to policy-makers and outlines some existing shortcomings in conducting balance appraisals. Efforts to improve strategic analysis through analytic wargaming is the subject of Chapter IV. And finally, recommendations on policy application are addressed in Chapter V.

II. MECHANICS OF NET ASSESSMENT

A. DEVELOPMENT

Organizational leaders, whether political, military, or commercial, are constantly called upon to decide the direction their establishment will follow. A number of factors go into the making of those decisions. Experience, judgement, and technical competence are among the key internal factors decision-makers routinely call upon (OASG, 1977, p. vii). In today's high tempo environment, however, it seems obvious that no individual possesses the depth in each of these categories to be prepared to deal with the more complex situations that arise. As a result, many attempts have been made to provide the decision-maker with a logical approach to deal with difficult and original concepts. Most of the more successful attempts are not designed to provide the decision-maker with a clear solution to a problem but as an aid to see the "truth" more clearly.

An early attempt to assist the executive in evaluating solutions to operational problems was developed in Britain and the United States during World War II. Operations Analysis came into being when scientists were asked to form solutions to military operational problems (OASG, 1977, p. 5). Basically speaking, Operations Analysis is "the application of scientific knowledge toward the solution of

problems which occur in operational activities (in their real environment). Its special technique is to invent a strategy of control by measuring, comparing, and predicting possible behavior through a scientific model of a situation or activity." (OASG, 1977, p. 4) Some examples of how Operations Analysis was used include: evaluating convoy configuration for maximum submarine protection, evaluating the best technique to protect merchant shipping from aircraft attack, and optimizing the role of radar.¹

Further use of analytical problem solving in the government received little attention until the early 1960s when Secretary of Defense McNamara brought Systems Analysis to the Pentagon. Systems Analysis has been described as,

...an inquiry to aid a decision-maker's choice of a course of action by systematically investigating his proper objectives, comparing quantitatively where possible, the cost, effectiveness, and risks associated with alternative policies; and formulating additional alternatives if those examined are found wanting. (OASG, 1977, p. 16)²

These descriptions of Operations and Systems Analysis are not intended to be all inclusive and the full extent of their possibilities requires further research by the reader. Both methods of analyses have been useful as decision support systems. The primary effort of these techniques,

¹See Naval Operations Analysis, Operations Analysis Study Group, U.S. Naval Academy for more details on Operations Analysis.

²See How Much Is Enough?: Shaping the Defense Program, 1961-1969, Enthoven and Smith, for a description of efforts and accomplishments of the Office of Systems Analysis in the Department of Defense.

however, is in the area of systems acquisition and force structuring. Both of these methods of analysis place little emphasis on the entire range of aspects that make up the condition of competition. Furthermore, they rarely venture into recommending alternatives for developing successful national strategies and policies due to their close association with programming and policy.

In light of this shortcoming, the concept of net assessment unfolded in the early 1970s. It would not be accurate to say that net assessment is a natural progression of Operations and Systems Analysis or that it is a replacement for these systems. Operations and Systems Analysis are still providing valuable input to policy-makers. Net assessment uses some of the basic concepts of Operations and Systems Analysis but goes beyond mere systems acquisition and force structuring.

In 1970, President Nixon's Blue Ribbon Panel on defense organization recommended action to remedy the government's inability to provide an impartial, nonpartisan appraisal of the U.S./Soviet military balance (Collins, 1980, pp. 3-4). As a result, the Department of Defense (DOD) created the Office of Net Assessment (OSD/NA) and assigned a director to the office by way of Department of Defense Directive 5105.39. Under this directive, the Director of Net Assessment was tasked with performing the following functions:

- 1) Develop net assessments of current and projected U.S. and foreign military capabilities by theater, region, function, or mission. In accomplishing these net assessments, the Director may call upon all available intelligence data and all available friendly force data.
- 2) Accomplish or provide for the development of specific net assessments of current and projected U.S. and foreign capabilities, operational tactics, doctrine, and major weapons categories or systems.
- 3) Develop, advise and consult on the net assessment portion of the Secretary's Annual Defense Report, congressional testimony, and foreign government discussions, and provide guidance for the preparation of the Chairman, Joint Chiefs of Staff (CJCS) Posture Statement.
- 4) Provide guidance or staff assistance and representation for the Secretary of Defense in the development of national net assessments by the National Security Council and act as primary focal point for joint efforts with the intelligence community to produce net assessments.
- 5) Coordinate and review net assessment efforts throughout the Department of Defense.
- 6) Provide support for the improvement and development of net assessments within the Department of Defense, including, but not limited to, the maintenance of a library of historical all-source intelligence and friendly force data.
- 7) Provide objective analysis of policy, doctrine, strategy, goals, and objectives, as requested or determined necessary.

At about the same time, the Office of the Under Secretary of Defense for Research and Evaluation began conducting net technical assessments to appraise the Secretary of Defense of technical matters. Because input from each of the military services was perceived as a vital ingredient to a net assessment, the Director of Net Assessment encouraged each Service to establish an office

for net assessments. Minor net assessment activities were set up in the 1) Office of Air Force Assistant Chief of Staff, Studies and Analysis; and 2) Army Assistant Chief of Staff, Military Policy and Strategy Planning. On the other hand the U.S. Navy had already established the Navy Net Assessment Organization in the Office of Chief of Naval Operations, OP-96, Systems Analysis. This organization was conducting net assessments along the same lines as envisioned by the Director of Net Assessment, Office of the Secretary of Defense.

The participants in net assessment continued to develop the process of analysis throughout the remainder of the 1970s and into the early 1980s. The institutions established continued to be productive with more or less influence depending on the political climate. By 1982, Service interest in net assessments had almost entirely dissipated; even the well established Navy Net Assessment Organization was eliminated.

The importance of conducting net assessments was again raised in June, 1986, when the Packard Commission (President Reagan's Blue Ribbon Panel on defense reorganization) advised the Secretary of Defense to provide the President with "a military net assessment of the recommended national military strategy and strategy options." (Packard Commission, 1986, p. 14) Legislation quickly implemented the recommendation with the Goldwater-Nicholas Act of 1986.

That Act stated that the Secretary of Defense and the Chairman, Joint Chiefs of Staff are responsible for "performing net assessments to determine the capabilities of the armed forces of the United States and its allies as compared with those of their potential adversaries." (Goldwater-Nicholas Act, 1986)

Currently, three DOD agencies are performing net assessments:

- 1) Office of the Secretary of Defense/Office of Net Assessment (OSD/NA)--tasked with "the most macro view within the Department of Defense in order to assist the Secretary in his thinking about such questions as: Where have we been?, Where are we now?, Where are we going?" This office interfaces with other Executive Branch offices to prepare net assessments of interest on the national level. (Giessler, 1979, p. 2)
- 2) Office of the Under Secretary of Defense (OUSD) for Acquisition--assigned responsibility for conducting net technical assessments with intent of ascertaining the effectiveness of the U.S. technological/industrial base and to reduce the effect of technological surprise by an opponent.
- 3) Joint Chiefs of Staff (JCS), Force, Structure, Resources, and Assessment Directorate(J-8)--designated to conduct military balance assessments based on policy guidance from the Secretary of Defense and provide strategy options based on those assessments.

Each office seeks to arrive at an independent assessment while simultaneously interacting with the sister offices thus providing a product most beneficial to the nation.

B. TYPES

When making a decision that affects national security, policy-makers intuitively conduct a form of net assessment

on all characteristics of the balance of forces between the U.S. and its competitors. Yet a single net assessment product covering all aspects of the competition would be extremely difficult to produce and overwhelming for the decision-maker to comprehend. As a result, net assessments have been divided into several categories.

1. Balance Assessments

Balance assessments address the question, "How do we stand up to the competition?" with emphasis on military matters. Due to the complexity of assessing global competition, balance assessments are further divided into functional and geographic areas. The U.S./USSR strategic nuclear, NATO-Warsaw Pact, East Asia/Pacific, worldwide maritime, power projection, and military investment balances are examples of these "sub-competitions." These assessments are extremely broad in scope and fairly detailed in their analysis. Balance assessments are updated periodically. Additionally, special balance assessments, such as Command, Control, Communication, and Intelligence (C3I) and Space competition appraisals, are conducted as particular needs arise. Balance assessment methodology "includes static side-by-side comparisons and head-to-head comparisons of major military systems, trends in such comparisons, key asymmetries in the opposing postures, and last but not least some treatment of the qualitative factors to be considered." (Pease, 1983, p. 3)

2. Policy Assessments

Policy assessments address the status of competition in terms of broad political/economic/social/military aspects. They are analogous to methods used by large corporations to appraise the competition and plot strategies. Policy assessments are intended to assist high level decision-makers in recognizing competitive advantage and developing cost imposing strategies.

3. Net Technical Assessments

Net technical assessments attempt to ascertain the effectiveness of the technological/industrial base and reduce the effect of technological surprise by an opponent. Net technical assessments are conducted principally by and for the OUSD/Acquisition.

4. Comparative System Evaluations

Comparative system evaluations compare particular military systems with respect to equipment, organizational, and human factors.

5. Operational Net Assessments

Operational net assessments analyzes the strengths, weaknesses, and vulnerabilities of an opponent's forces to aid in force planning and tactical and doctrinal development.

6. Weapons Comparisons

Weapons comparisons compare particular weapons to determine what effect the significant characteristics may have on battle outcome. (Marshall, 1976a, pp. 1-2)

Threat Assessments are not considered net assessments. A threat assessment is an appraisal of the opponent's intentions and capabilities which does not consider one's own input into the balance. The Intelligence Community normally provides threat assessments. Examples of a threat assessment are the National Intelligence Estimates conducted by the Central Intelligence Agency (CIA).

The Intelligence Community, being primarily concerned with appraising the threat, is generally not tasked with conducting net assessments. However, a joint DOD/Intelligence strategic balance assessment is performed as a result of a written agreement between the Secretary of Defense and the Director of Central Intelligence.

C. PROCESS

To understand the concept of net assessment, one must be familiar with the process. Perhaps the best procedural description is provided by John M. Collins. Collins admits that there is no cookbook approach to conduct a net assessment, but he contends that there are four basic phases to any assessment: compile, certify, combine, and compare. (Collins, 1980, pp. 7-9)

1. Phase One--Compile

In Phase One, information about all the participants in the "competition" is gathered. The information collected must include pertinent facts necessary for the type of assessment being conducted. The analyst faces a double edged sword when assembling this data. First, accurate and reliable material is not always readily available. The analyst must become educated on where to look while at the same time feel comfortable in dealing with the sources. On the other hand, the "age of communication" has made such large quantities of information available that it is becoming increasingly difficult to assimilate everything. It is the analyst's job to separate "the wheat from the chaff" in order to provide the decision-maker with a usable working document.

Perhaps the most basic component of information needed is the static force levels or the so called "bean count." The number of divisions on the European "central front," the equivalent megatonnage (EMT) of the Strategic Rocket Forces, and the weapons capability of the KIROV class guided missile cruiser are typical examples. Additionally, operating characteristics, such as ballistic missile submarine patrolling areas and Tu-95 Bear D reconnaissance patterns must be included.

In addition to static force levels, non-quantifiable information on the competitors must also be accumulated.

This type of data includes such factors as national goals, political objectives, organizational makeup, reliability of allies, leadership capabilities, levels of military training and readiness, population characteristics, and geography (Collins, 1980, p. 8). Although conceptually more difficult than the mere counting of men and equipment, these non-quantifiable factors are invaluable to a net assessment (Pease, 1983, p. 4).

Historical data is an aspect that receives due consideration for two reasons. First, historical data allows one to focus on key factors upon which the occurrence of events hinge. These key factors can then be used to anticipate future developments. Second, most organizations are not capable of conceiving a unique doctrine and immediately implementing novel measures. For example, it may take as long as 12 to 15 years for new naval requirements to be translated into new ships (George, 1985, p. 118). Therefore, examining decisions and actions in the past usually provides an insight into the direction of the future.

The information described above is obtained by the analyst from a number of sources. Information on current and projected U.S. and allied goals and objectives is available from the National Security Council and Staff, the Chairman and Joint Chiefs of Staff, the Joint Staff, the NATO Military Committee, and CINC/Allied war plans.

Statistics on current and projected U.S. and allied military forces are available from the Office of Program Analysis and Evaluation, the Joint Chiefs of Staff, NATO members, the Services, and the Intelligence Community.

The intelligence community provides information about the competition. Members of this community in the U.S. include the CIA, the National Security Agency (NSA), the Defense Intelligence Agency (DIA), and the service intelligence branches. Because there is no single intelligence agency for NATO, each member country is responsible for providing inputs to Allied organizations and commands.

Finally, useful information is also available from open sources and contractors. Some examples of open sources include the International Institute of Strategic Studies' (IISS) The Military Balance, Stockholm International Peace Research Institute's (SIPRI) Yearbook, and Jane's Fighting Ships. Because these sources' access is limited to unclassified material, their input is often incomplete. On the other hand, contractors, such as the RAND Corporation and the Center for Naval Analyses (CNA), have access to classified information (except extremely sensitive material) and have been used in the past to support government assessments.

2. Phase Two: Certify

This step is self-evident in its importance to the net assessment process. If the fundamental data is flawed, the appraisal presented to the executive will reflect the defect--or as the saying goes "garbage in--garbage out." Because a dispassionate evaluation is desired, the net assessor must be aware of the fact that opponents will attempt to provide disinformation and that mirror-imaging may be present in data inputs when concepts are not understood. Inaccurate information is not necessarily limited to coming from the opponent. Improper documentation of forces and erroneous data to support institutional biases are also real possibilities. A heavy burden is placed on the analyst to ensure that the data is as accurate, objective, and as free of bias as possible.

3. Phase Three: Combine

In this phase the net assessment process begins to take shape. "Step Three considers characteristics on each side, first singly, then in combination, to ascertain intrinsic strengths and weaknesses." (Collins, 1980, p. 7) An effective starting point is to establish Measures of Effectiveness (MOEs) for the components of the area being studied. An MOE is defined as a quantitative expression of the extent to which specific mission requirements are attained by the system under study (Taylor, 1984, p. 20). Determining which MOEs to use and what the criteria is for

successful event outcomes are difficult tasks. Presently, there is no exact science for assigning MOEs, but this important step is valuable in arriving at an accurate assessment.

4. Phase Four: Compare

Phase Four is the most important and complex step in the net assessment process. In this phase, all the concepts of a comparative study come into play. Several of the more important aspects are presented.

a. Combining Static and Dynamic Indicators

Once the necessary information has been compiled, certified, and combined, it has to be evaluated as a whole. All component parts must be tied together to provide the decision-maker with the essential characteristic of the competition. The static force levels or "bean counts" of military personnel and equipment of each side are an important first step, but they must be looked at in regard to the national objectives, the actors intentions, non-quantifiable factors (such as leadership, training and geography), and the involvement of allies.

A particularly useful way of looking at the construction of a net assessment is to consider the mathematical equation:

$$\text{assessment} = f(\text{own forces, enemy forces, environment})$$

(Taylor, 1988, p. 8)

Considering only the enemies capabilities or measuring the enemies capabilities in terms of one's own forces are common mistakes committed by analysts. In order to fully understand the balance the analyst must include in the appraisal one's own capabilities as well as the atmosphere in which the competition is taking place. The notion of "scanning the environment" encompasses this concept. (Marshal, 1976a, p. 1)

Simple side-by-side and head-on-head numerical comparisons are insufficient to properly assess the state of military competition. Such comparisons do not take into account the outcome or effect of a confrontation. By anticipating the affects of weapons systems and targeting schemes the analyst can provide the decision-maker with a more comprehensive assessment of the comparison of forces.

b. Using Historical Data

Looking at the past and plotting trends is a vital part of forming the assessment. It is rarely possible to accurately predict the future, but it is possible to evaluate how competitors acted in the past and identify important characteristics of those actions. Previous performance provides a basis to understand the "modus operandi" of interaction and can lead to valuable insight for anticipating future patterns (Cohen, 1983, p. 86). Additionally, an analysis of historical cases can be used to determine the key variables; providing insight to areas for

current research. Comprehension of policies and doctrinal decisions made in the past can lead to a better feel for the present and the future. This is attributed to the fact that change usually does not occur immediately. Change, depending on the scope, may take several years or even a decade.

c. Using Multiple Indicators

A simple look at just one aspect of an opponent will not provide the information necessary to form a constructive assessment. This is especially true in the case of the Soviet Union where their intentions and capabilities are closely guarded. In order to penetrate this "curtain of secrecy," an analyst must utilize every source available. Three aspects that deserve special attention are discussed below.

(1) Content Analysis of Open Literature and Speeches Made by Ranking Officials. Even in tightly controlled governments, a certain amount of information is released to the public. These publications and speeches may serve a number of purposes for the government.

- 1) a medium for propaganda.
- 2) a means of expressing an opinion by influential officials.
- 3) a mode of disseminating accepted policy to a large audience both internal and external.

An analyst must understand the variety of purposes for the dissemination of the information and decide which purpose applies to obtain the most from the information available.

(2) Evaluation of Military Exercises and Force Deployments Conducted by the Opponent. Governments use exercises to provide training for the military and to test the validity of theories concerning the conduct of war. A country can produce misleading information through specially staged exercises. The analyst must be aware of this possibility, however, as a general rule, an organization will fight like it's trained. Deployments, such as the stationing of troops, the deployment of ships out of area, and the use of advisors in foreign countries, are also indicators of interest areas.

(3) Examination of Military Hardware in an Opponent's Inventory. Analysis of the types of ships, tanks, and aircraft an opponent uses leads to a better understanding of their intentions and capabilities.

d. Understanding the Opponent's Assessment

The way in which the opposition assesses the balance is an extremely important aspect of analysis. The goal of net assessment is to give an objective picture of the political-military competition between opponents. A key to obtaining this picture is to understand how the opposition conducts assessments. The deterrence capability of a nation's forces depends on convincing the opponent that

it would be disadvantageous for them to enter into a war. If the enemy does not perceive the possibility of defeat, then there is no deterrence. Thus, understanding how the opposition performs assessments is an essential element in one's own assessment. (Friedberg, 1988 pp. 193-194)

e. Contingency Analysis

Because relying on a limited number of threat scenarios is dangerous for setting policy, analysts must consider all "realistic" scenarios not just the "best" or "worst" cases. Major emphasis is given to preparing the U.S. for strategic surprise while little attention is paid to possible conflict arising from escalating tension. The analyst's role is to explore the full range of conflict possibilities including hostility initiation and likely war outcomes. The decision-maker must be kept aware of the extreme as well as the likely possibilities to reduce the chance of being caught unaware. Simulations and games provide a vehicle to flush out alternative scenarios. Chapter III will examine simulations and games in more detail. The goal of contingency analysis is to determine if one's own forces, either actual or planned, are capable of performing well in various scenarios.

f. Consideration of Allies

Because allies and third parties play an important role in establishing the balance of power, their perception of the status of strategic competition must be

carefully considered for a comprehensive assessment. Allied contributions can be either positive or negative with respect to the United States.

The concepts mentioned here form the basic tools in conducting a net assessment. Just as it may not be necessary to use each and every concept in all cases, neither is the list all inclusive. Future research and continued practice in this field may indicate more appropriate theories. However, the list provided has been developed over time and appears to capture the important issues that lead to a successful assessment. The analyst should learn the lessons from this development and make the best use possible.

D. SUMMARY

Policy-makers have always conducted intuitive appraisals of how their organization compares to its opponents. To assist the policy-maker in coping with large complex problems, a systematic approach to analysis called net assessment was developed. No standard procedure exists for conducting net assessments. There isn't even a universally accepted definition of net assessment. Net assessment is prone to the same difficulties as other forms of analysis and is only as good as its data and analysts. But, the various types of comparisons and organized methods of dealing with key issues seems adequate to provide base-line judgment needed by many decision-makers.

III. STRATEGIC NUCLEAR BALANCE CASE STUDY

A. INTRODUCTION

Of all of the net assessments conducted, one of the most crucial to the condition of national security is the strategic nuclear balance between the United States and the Union of Soviet Socialist Republics. As Andrew Marshall points out:

...our position with respect to that (strategic) balance is a keystone for all of the other balances and has an impact on them. In the case of the Central Front Balance for many years that balance was in large part determined by our strategic superiority and our superiority in the tactical nuclear area. (Marshall, 1976b, p. 6)

In addition to being an assessment of great import, an appraisal of the strategic balance is probably the most difficult to conduct. The large number of variables, the high degree of uncertainty, and the lack of proven methods of analysis related to strategic forces makes this job a perplexing one for the analyst. This chapter discusses several strategic measures of effectiveness and conducts a limited case study of the current state of competition to demonstrate traditional methods of analysis.

B. DEVELOPMENT OF U.S. STRATEGIC NUCLEAR FORCE POSTURES AND POLICIES

To understand the strategic balance, it is best to start with a brief history of the evolution of the U.S. nuclear force postures and policies. In the 1950s, the U.S.

possessed a clear superiority in nuclear weapons and delivery vehicles. With such a significant nuclear advantage, the U.S. adhered to a policy of massive retaliation to deter a wide range of Soviet actions.

As U.S. nuclear superiority eroded in the 1960s, emphasis shifted toward a policy combining the principles of flexible response, damage limitation, and assured destruction. This blend of U.S. contingencies eventually gave way in the latter part of the 1960s to primary reliance on the use of second-strike retaliatory forces and the possibility of Limited Nuclear Options (LNOs) in the 1970s.

Because of continuing Soviet buildup and improvements in nuclear capabilities in the late 1970s and early 1980s, the U.S. implemented policies and actions to improve its capability to compete in a nuclear conflict. Thus, nuclear force modernization became a focus of attention. Efforts concentrated on upgrading offensive and C3 capabilities while devoting additional attention to strategic defense research and arms control negotiations. (Pease, 1983. pp. 7-8)

C. BALANCE ASSESSMENT

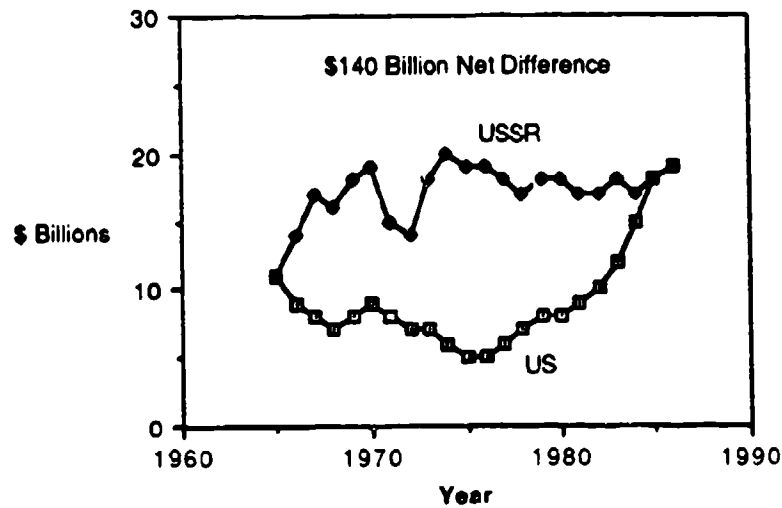
The method most appropriate to address the status of strategic forces is the balance assessment. A balance assessment is the broadest in scope and therefore most useful in addressing the question, "How do we stand relative to the Soviets?" (Pease, 1983, p. 5) Although this

discussion is intended to demonstrate net assessment techniques, this study could be used to determine if the nuclear force modernization steps taken by the U.S. Government have positively altered the balance. Data from several unclassified sources are used to evaluate how the U.S. stands relative to the Soviets.

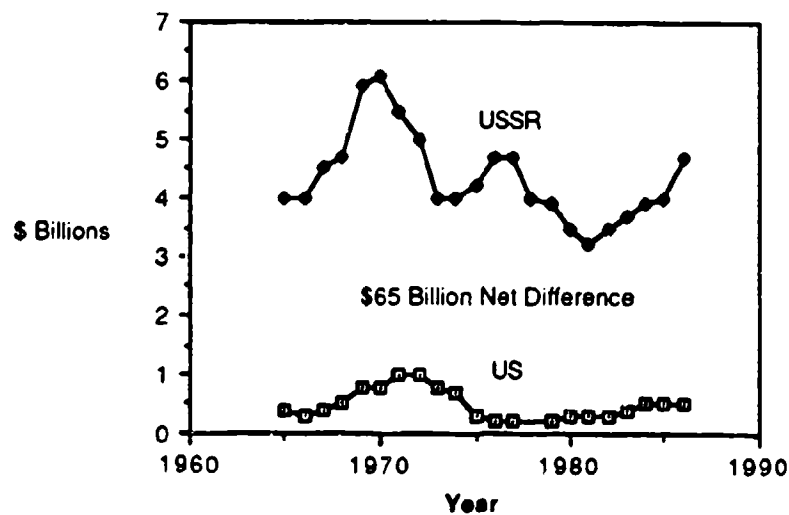
A natural starting point in the comparison is resource allocation. Figure 1 shows the trend in U.S. and Soviet strategic force expenditures since 1965. The U.S.'s current spending for the acquisition of offensive strategic forces is equivalent to the USSR's. This is due to a sharp rise in U.S. spending starting about 1981. However, the Soviet investments in strategic programs over the long term are much higher than the United States', especially in the area of strategic defense.

Figure 1 presents an important picture for two reasons. First, a snapshot in time is not necessarily a good representation of the actual status; trends can be more revealing. Although the U.S. is shown spending about the same as the Soviets in 1986, the cumulative difference of \$140 billion since 1965 allowed the Soviets to exceed U.S. efforts in procurement and modernization. Second, since offensive forces fight against defensive forces, the disparity identified in procurement of defensive systems places the U.S. in a position of greater disadvantage.

OFFENSIVE FORCES



DEFENSIVE FORCES



Source: (Weinberger, 1988, pp. 26-27)

Figure 1. Comparison of U.S./USSR Strategic Force Spending

Comparing procurement expenditures is a fair indicator of the status of the balance, but this measurement does suffer some inadequacies. Among the problems are: the lack of a standard dollar-ruble conversion, insufficient intelligence estimates of Soviet defense spending, and different production standards between the U.S. and the USSR for a given cost. For these reasons, one must look at what hardware the capital investments have provided.

Figure 2 displays U.S./USSR new-system procurement and existing system modification efforts for the past 30 years. In view of the resource allocation discussion above, the figure clearly indicates the Soviets have exceeded U.S. efforts to put new and modified weapons into operation. Although the Soviets have out-performed the U.S. in terms of force modernization, actual and projected deployments by the U.S. since 1981 are indicative of a positive trend in the strategic balance. (Carlucci, 1988, p. 101)

Up to this point of the discussion, all that has been considered is strategic force inputs. Now it is time to compare the on-hand capabilities of the U.S. and Soviet Union. A static side-by-side comparison of strategic nuclear delivery vehicles (SNDVs) as of 1988 is presented in Table 1. The initial unit of measurement is a count of missile launchers and bombers. Counting the number of launchers and bombers is currently the norm for tracking nuclear weapons because of limitations in our "national

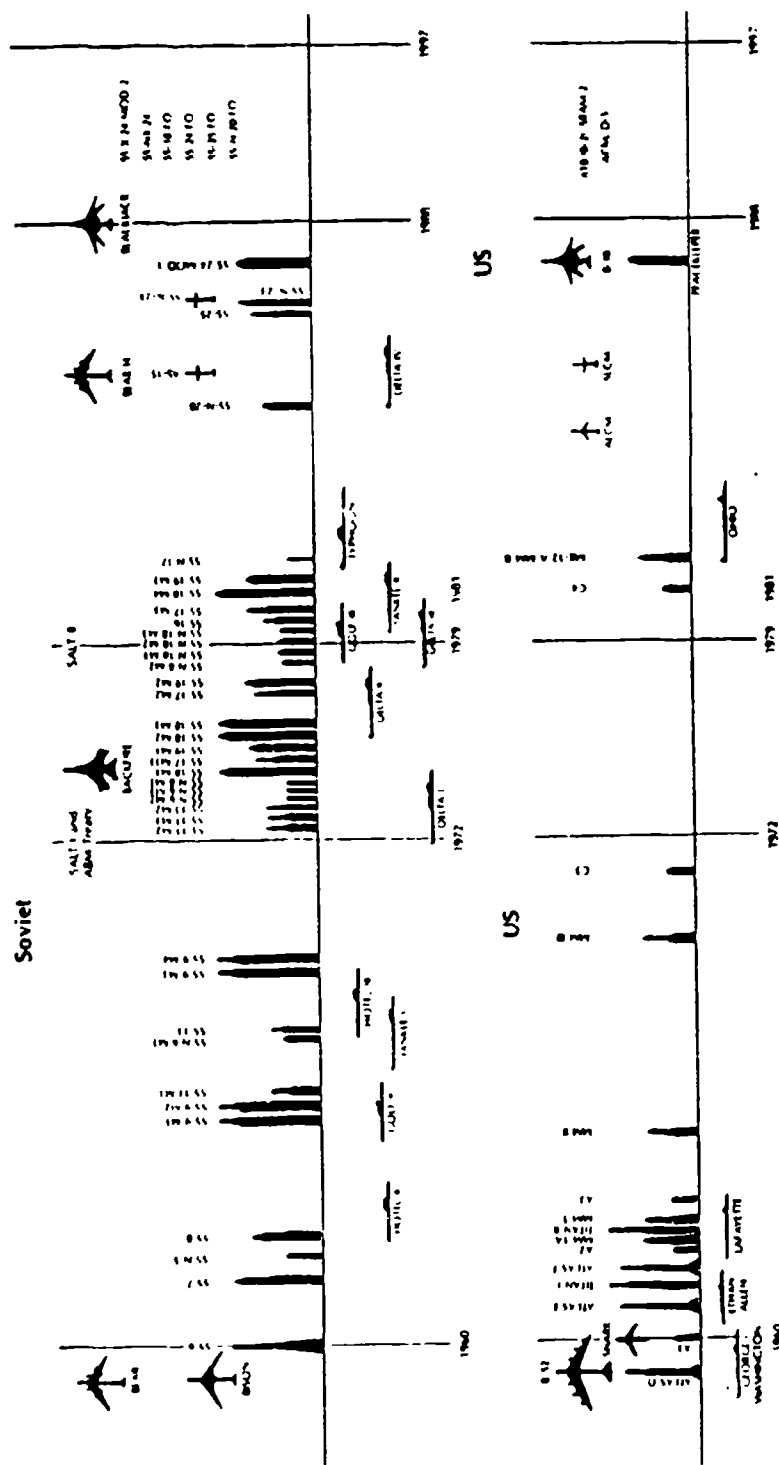


TABLE 1
STRATEGIC NUCLEAR INVENTORIES

| <u>U.S.</u> | | | | <u>USSR</u> | | | |
|-------------------|-------------|-----|------|-------------|------|-----|------|
| ICBMs | | | | | | | |
| | (a) | (b) | (c) | | (a) | (b) | (c) |
| MM II | 450 | 1 | 450 | SS-11 | 420 | 1 | 420 |
| MM III | 511 | 3 | 1533 | SS-13 | 60 | 1 | 60 |
| MX | 39 | 10 | 390 | SS-17 | 138 | 4 | 552 |
| | | | | SS-18 | 308 | 10 | 3080 |
| | | | | SS-19 | 350 | 6 | 2100 |
| | | | | SS-24 | 10 | 10 | 100 |
| | | | | SS-25 | 100 | 1 | 100 |
| ----- | | | | ----- | | | |
| | 1000 | | 2373 | | 1386 | | 6412 |
| SLBMs | | | | | | | |
| C-3 | 256 | 14 | 3584 | SS-N-6 | 256 | 1 | 256 |
| C-4 | 384 | 8 | 3072 | SS-N-8 | 286 | 1 | 286 |
| | | | | SS-N-17 | 12 | 1 | 12 |
| | | | | SS-N-18 | 224 | 7 | 1568 |
| | | | | SS-N-20 | 100 | 9 | 900 |
| | | | | SS-N-23 | 64 | 10 | 640 |
| ----- | | | | ----- | | | |
| | 640 | | 6656 | | 942 | | 3662 |
| BOMBERS | | | | | | | |
| B-1B | 99 | 12 | 1188 | BEAR | 70 | 20 | 1400 |
| | | | | (ALCM) | | | |
| B-52G/H | 105 | 12 | 1260 | BEAR | 100 | 2 | 200 |
| (nonALCM) | | | | (nonALCM) | | | |
| B-52G | 98 | 20 | 1960 | BISON | 5 | 4 | 20 |
| (ALCM) | | | | | | | |
| B-52H | 60 | 20 | 1200 | BACKFIRE | 358 | 2 | 716 |
| (ALCM) | | | | | | | |
| FB-111 | 61 | 6 | 366 | | | | |
| ----- | | | | ----- | | | |
| | 423 | | 5974 | | 533 | | 2336 |
| TOTALS | | | | | | | |
| | U.S. | | | USSR | | | |
| DELIVERY VEHICLES | 2063 | | | 2861 | | | |
| WARHEADS | 15003 | | | 12410 | | | |
| THROW-WEIGHT | 4.2 | | | 10.9 | | | |
| (MILLION POUNDS) | | | | | | | |

Source: (IISS, 1988)

(a) Delivery Vehicles (b) Warheads per Vehicle
(c) Total Warheads

technical means" and no on-site inspection provisions for long range platforms.

An issue that concerns arms control negotiators as well as analysts is how to properly classify various forms of armament. Table 1 exhibits one such area of controversy. Both the United States' FB-111 and the Soviet Union's BACKFIRE bomber are weapon systems that could be considered strategic depending on one's interpretation. Because each platform is capable of in-flight refueling, and therefore has the potential of reaching the opponent's homeland, both are included in the strategic force inventory.

As indicated by the total number of delivery vehicles listed in Table 1, the Soviets apparently have a significant lead in this category. However, this statistic does not consider the number of warheads that can be placed on targets in the opponent's territory. Therefore, the next step of assessing the balance is to calculate the number of warheads in the U.S./USSR inventory. This calculation is accomplished by multiplying the number of delivery vehicles by the maximum number of warheads capable of being carried. Once again uncertainties arise due to the possibility of an opponent deploying more or less than the maximum number estimated, but this method seems sufficient based on current intelligence capabilities. Table 1 computes the number of re-entry vehicles and demonstrates that the U.S. has apparently reversed the balance that existed under the

delivery system category. An explanation for this phenomenon is the expanded use of multiple warheads on missiles and bombers by the U.S.

Although the U.S. appears to have an advantage in the strategic balance due to the use of multiple warheads and bomber loading capabilities, the Soviets possess a significant edge in certain terms such as missile throw-weight. Table 1 displays this Soviet advantage. Should the Soviets decide to take advantage of their superiority in this area by placing more warheads on each missile, the warhead gap and therefore other more dynamic indicators could be changed dramatically.

To better appreciate how the static force inventory affects the strategic balance, observe the trends in this inventory as presented in Table 2. Once again it is apparent that currently the Soviets have a commanding lead in delivery vehicles while the U.S. fares better in the number of warheads. However, the most significant observation from this table is the rapid rate at which the Soviets first approached and then exceeded the U.S. in every category except number of warheads. This rapid procurement capability must be factored into any appraisal of the balance because it demonstrates the Soviets' capacity to significantly alter the path of future trends.

TABLE 2
TRENDS IN STRATEGIC NUCLEAR INVENTORIES

| | <u>1962</u> | | <u>1972</u> | | <u>1982</u> | | <u>1988</u> | |
|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | <u>US</u> | <u>USSR</u> | <u>US</u> | <u>USSR</u> | <u>US</u> | <u>USSR</u> | <u>US</u> | <u>USSR</u> |
| ICBMs | 78 | 40 | 1054 | 1500 | 1053 | 1398 | 1000 | 1386 |
| SLBMs | 144 | 100 | 656 | 500 | 544 | 950 | 640 | 942 |
| Bomb- ers | 1700 | 160 | 500 | 150 | 347 | 356 | 423 | 533 |
| War- heads | 7422 | 460 | 6100 | 2275 | 9700 | 8300 | 15003 | 12410 |

Source: (Pease, 1983, p. 15) and author.

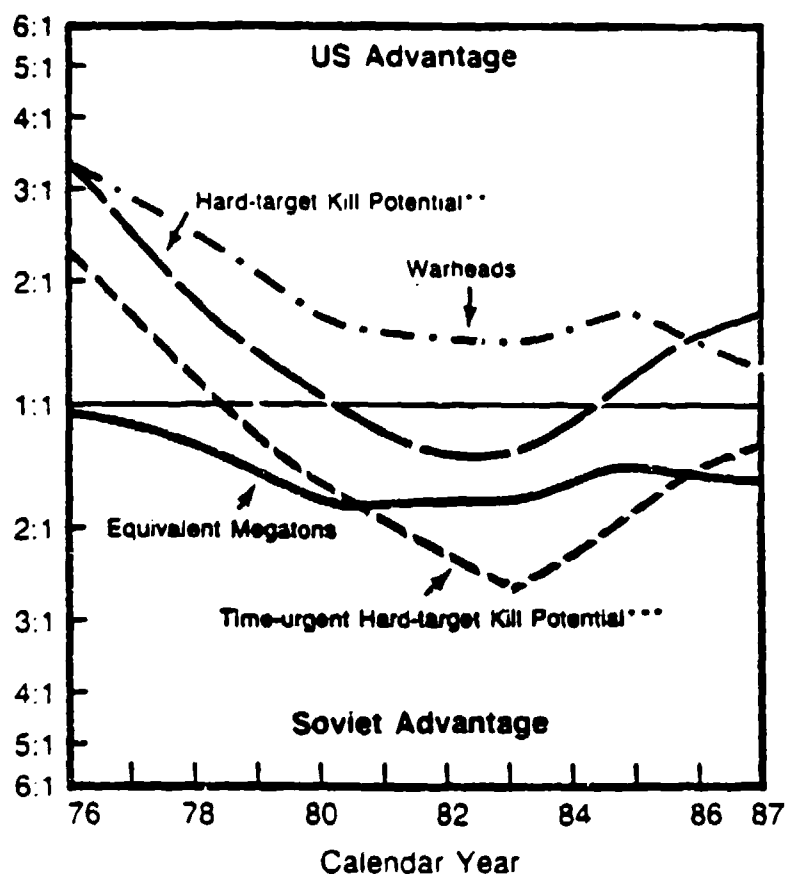
So far all of this discussion has concentrated on the numbers of strategic weapons. In an attempt to capture many of the qualitative features of these weapons, several composite measures are used to standardize potential (Pease, 1983, p. 16). The qualitative features of interest to this study involve: delivery vehicle range and accuracy, warhead yield, and hardened target characteristics. The measures that provide the most insight into the qualitative features include: Equivalent Megatonnage (EMT), Hard Target Kill (HTK) Potential, and Time Urgent Hard Target Kill (TUHTK) Potential. There are obviously other meaningful MOEs, but those mentioned above can be used at the unclassified level to illustrate the points necessary for demonstrating net assessment capabilities. Definitions for EMT, HTK and TUHTK

Potential are listed:

- 1) Equivalent Megatonnage--recognizes the fact that a weapon with a 20 Megaton (MT) yield does not produce 20 times the damage of a 1 MT weapon. Analysis shows that the area subjected to a given blast overpressure is proportional to the two-thirds power of the weapon's yield. In terms of a soft urban-industrial area target, if the target area is large enough, a 20 MT weapon will destroy only a little more than seven times that of a 1 MT weapon. The sum of the individual weapon's EMT of force (is) defined as the force EMT and (is) an indication of the total soft target area which could be covered by a ideal barrage.
- 2) Hard Target Kill Potential--a comparison of the ability of either force to destroy hardened targets. The composition and characteristics of each force are used against a given target set. The number of hardened targets which can be killed is compared.
- 3) Time Urgent Hard Target Kill Potential--a comparison of the ability of either force to destroy hardened targets before the platforms at the target sites are launched or redeploy. (DNA, 1983, pp. 7-8)

Figure 3 provides an illustration of U.S./USSR Strategic Nuclear Force (SNF) competition by utilizing several static indicators in the form of ratios. The values are the result of summing individual weapon characteristics. This format compares the forces in terms of parity or equivalence (Pease, 1983, p. 17). This graph allows a comparison of force weapons strength (warheads), soft target damage capability (EMT), and hard target destruction potential (HTK & TUHTK).

The U.S. has been able to hold on to a slight margin in both warheads and HTK Potential. As previously stated, the



- * Total active inventory (includes FB-111 and BACKFIRE)
- ** Hard-target kill potential represents ability to destroy targets reinforced to withstand some effects of a nuclear blast.
- *** Calculations are based on potential against identically hardened targets.

Source: (Crowe, 1988, p. 43)

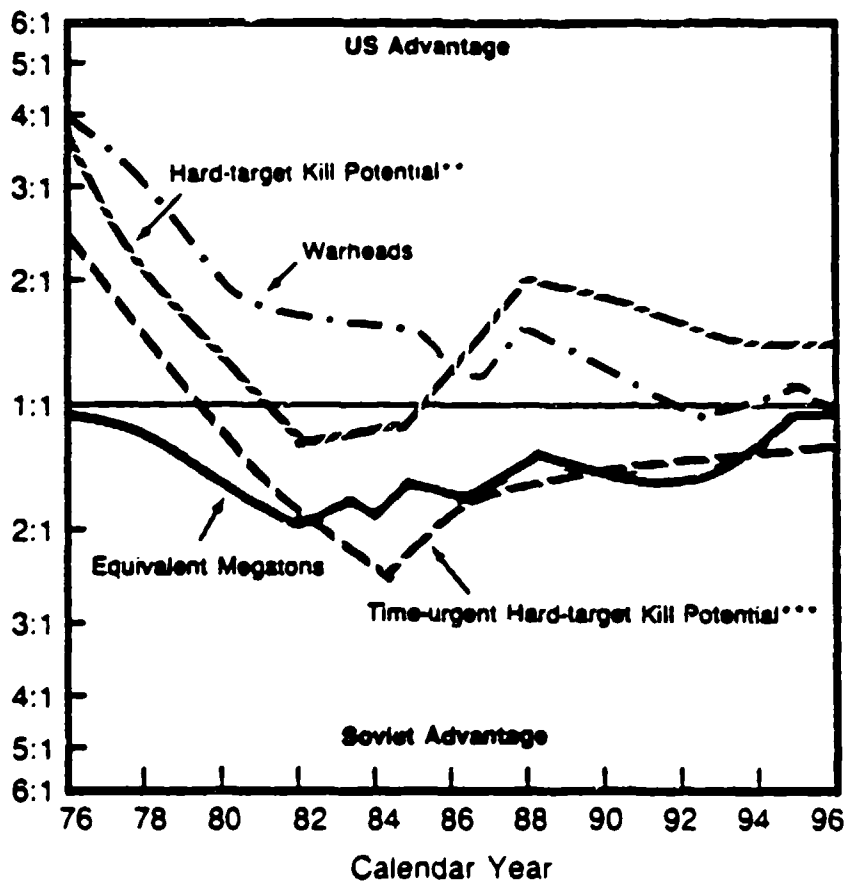
Figure 3. Pre-Attack Static Ratio Comparison

U.S.'s lead in warheads is due to greater use of multiple warheads on SNDVs. The advantage of HTK Potential is due to greater accuracy of U.S. SNDVs.

Because the Soviets maintain higher yield warheads, higher missile throw-weight capacity, and a continuing program of target hardening, they are afforded a margin in EMT and TUHTK Potential.

The trend away from U.S. advantage in the late 1970s of all pre-attack static measures prompted strong action by the Reagan Administration. Efforts to increase warhead payload, improve SNDV accuracy, and improve bomber penetration abilities provided a shift in the trend favorable to the U.S. However, significantly larger Soviet warheads and years of effort on passive defense will probably keep the Soviets ahead in EMT and TUHTK Potential for the foreseeable future.

Figure 4 represents an analyst's prediction of future trends in the same static force measurements. This type of forecasting is based on the assumption that trends will continue, that procurement plans are accepted, and that arms control agreements do not go into effect. Deployment of the MX Peacekeeper, Trident II (D-5), and the B-1B bomber are reasons for the continued swing of favorable statistics towards the U.S. To improve the effectiveness of this



- * Total active inventory (includes FB-111 and BACKFIRE and deployment of 100 PEACEKEEPERS)
- ** Hard-target kill potential represents ability to destroy targets reinforced to withstand some effects of a nuclear blast.
- *** Calculations are based on potential against identically hardened targets.

Source: (Crowe, 1988, p. 44)

Figuer 4. Pre-Attack Static Ratio Comparison
(with Current Soviet Trends)

graph, uncertainty bands should be added to account for the inability to accurately predict the future.

This comparison has so far concentrated on the static capabilities of the competition. No mention has been made concerning how each would fare as a result of some confrontation. These true dynamic force-on-force comparisons are much more difficult to conduct and are usually more politically ticklish than the static side-by-side comparisons. However, these calculations are important to judge if the U.S. can obtain its objectives should deterrence fail.

The list of considerations to be evaluated in preparation for the failure of deterrence is endless. Analysts must consider the effect of a nuclear exchange on the competitors population and industry. Efforts at civil defense and industrial hardening probably will play a role in a nation's ability to obtain war termination objectives.

Additionally, the analyst needs to make estimates as to the strategic force capabilities that will be available to "national command authorities" following the outbreak of hostilities. In effect this analysis is asking "What would the results be if a war were to be fought with this targeting plan and these arsenals of strategic weapons?" (Baugh, 1984, p. 134) Measures such as Expected Surviving ICBMs and Expected Residual EMT are examples of such calculations. However, this analysis must cover a wide

variety of scenarios in addition to the "bolt from the blue attack." For example, the loss of SSBNs to ASW attack, the loss of ICBMs to special forces attack, and the loss of bomber and tanker capability during the conventional phase of a war must be factored into the balance calculations.

Current efforts to analyze opposing strategic forces in a war-time environment use computer generated "arsenal exchange" models. (Pease, 1983, p. 23) These models can deal with strategic inventory exchanges assuming ideal conditions. Although this all out exchange is a very important scenario, it is by no means the only one possible. Several inadequacies of the this type of modeling are:

- 1) modeling nuclear force employment in isolation from other key elements of military operations--i.e., no prior attrition to strategic forces.
- 2) assuming away important operational factors--i.e., C³ connectivity is perfect.
- 3) comparing the forces by defining goals for damage expectancies and then measuring the results in terms of residual weapons, rather than in terms of what effect the nuclear exchanges might have had on the ongoing military campaign.
- 4) modeling too narrow a set of nuclear war scenarios--massive exchanges with two principal variables--alert posture and launch under attack policy. (Pease, 1983, p. 25)

D. CASE STUDY OF SUBMARINE LAUNCHED BALLISTIC MISSILE (SLBM) EQUIVALENT MEGATONNAGE (EMT)

The sea-based leg of the Soviet nuclear forces is of particular importance to the strategic balance. U.S. Naval declaratory policy, such as the Maritime Strategy, is

largely affected by the assessment of this Soviet capability. This limited case will use a static side-by-side measure to examine the net assessment process.

A suitable measurement of capabilities of the strategic submarine force is on-patrol EMT. As CDR James Tritten points out:

Although EMT is but one measure of effectiveness, it is easy to understand, can be constructed from unclassified data, and is useful in determining potential destruction of all type targets. EMT can measure the ability to conduct barrage attacks such as that which might be contemplated against mobile targets. (Tritten, 1983, p. 70)

Table 3 presents the calculations used to arrive at the on-patrol EMT for the U.S. Navy. Statistics on the number of submarines per class, the number of launchers per submarine, the number of warheads per missile, and warhead yield are provided by the International Institute of Strategic Studies' (IISS), The Military Balance, 1988-1989.

Submarine availability used in these calculations is based on operating schedules, maintenance periodicity, and expected missile and launcher reliability. U.S. submarine availability is currently estimated to be 55% and 66% for Poseidon and Ohio class submarines respectively (Tritten, 1983, pp. 68-69). Warhead EMT is calculated taking individual warhead yield to the two-thirds power; total force EMT is calculated by summing the EMT of the individual warheads. Table 3 reflects the U.S. SSBN on-patrol EMT of 647.4.

TABLE 3
U.S. ON-PATROL SLBM EMT

| | <u>SUBS</u> | <u>L/S</u> | <u>W/M</u> | <u>AVAIL</u> | <u>EMT/W</u> | <u>EMT</u> |
|---------------------|-------------|------------|------------|--------------|--------------|------------|
| POSEIDON SUB W/ C-3 | 24 | 16 | 10 | 55% | 0.12 | 247.0 |
| POSEIDON SUB W/ C-4 | 12 | 16 | 8 | 55% | 0.22 | 182.0 |
| OHIO SUB W/ C-4 | 8 | 24 | 8 | 66% | 0.22 | 218.4 |
| | | | | | | ----- |
| TOTAL | | | | | | 647.4 |

KEY:

SUBS -- NUMBER OF SUBMARINES
L/S -- LAUNCHERS PER SUBMARINE
W/M -- WARHEADS PER MISSILE
AVAIL-- SUBMARINE AVAILABILITY
EMT/W-- EMT PER WARHEAD

Source: Author.

CDR Tritten's 1986 calculation of Soviet submarine on-patrol EMT is adequate for comparisons in this study despite some changes to Soviet submarine inventory. He calculated that YANKEES patrolling close-in to the U.S. are capable of 56 EMT and Soviet submarines patrolling home waters are capable of 80.5 EMT: for a total of 136.5 EMT (Tritten, 1986, p. 136).

The large difference between SLBM EMT of the U.S. (647.4 EMT) and the USSR (136.5 EMT) raises many questions and identifies some difficult problems for the analysts. An evaluation of this situation is based on two assumptions:

1) SLBMs make up some or all of Soviet "strategic reserve," and 2) U.S. military planning is based on defense against a Soviet "bolt from the blue."

If Soviet SLBMs make up all of the Soviet strategic reserve, the implications of a "successful" U.S. Maritime Strategy is of great importance. The disparity between U.S. and Soviet on-patrol EMT leads one to believe that the Soviets have more to lose. The possibility that Soviets might use or lose these reserves when threatened by strategic ASW forces must be presented to the policy-maker.

Military and political leadership need to be aware of the possibility that land-based and air-breathing platforms may supplement SLBMs in the strategic reserve. Such a prospect could affect the outcome of war termination negotiations if the U.S. was mislead into believing that the "small" SLBM reserve was all it had to contend with.

The gap between U.S./USSR on-patrol EMT can possibly be explained in terms of Soviet confidence in deterring U.S. actions. Although the U.S. depends on at least 400 EMT for deterrence (Tritten, 1986, p. 120), the Soviets may feel assured with as little as 136 EMT. Such an asymmetry is an important aspect to determining an accurate account of the U.S./USSR strategic balance.

This case study is not intended to answer these questions of force posture but instead to point out that the

net assessment process solicits substantive questions and spotlights the issues affecting policies and programs.

E. SUMMARY

Based on the premise that the objective of the U.S. strategic force is to deter nuclear attack and a wide range of conflict scenarios, the planned strategic force modernization appears adequate. This conclusion is drawn from analysis of trends in static force comparisons. Although current U.S. strategic forces are probably capable of discouraging Soviet leadership from launching a preemptive nuclear strike, only continued U.S. efforts in offensive strategic force modernization and strategic defense implementation will deter the Soviets across a broad spectrum of situations.

The traditional method of evaluating the strategic balance, as outlined in this chapter, is adequate in terms of the simple static indices of weapons. However, the need to include measures of force effectiveness in a dynamic situation is great. A net assessment of the strategic balance is not complete until it addresses likely war outcomes should deterrence fail and the effect that international actors other than the superpowers have on the interaction. An effort to come to grips with these problems of analysis is the subject of Chapter IV.

IV. IMPROVED ANALYSIS METHODS

A. INTRODUCTION

The case study conducted in Chapter III illustrates the importance of measuring the effectiveness of opposing strategic nuclear force postures over a wide range of interactions. The models and calculations used to conduct these measurements became the subject of criticism in the late 1970s. An attempt to make improvements in this area of analysis resulted in the development of a computer-based political-military simulation called RAND Strategy Assessment System (RSAS). This chapter will discuss RSAS's development, capabilities, and possible uses as an analytic tool.

B. DEFINITION

Before continuing, several concepts of analysis need to be explained to ensure a full comprehension of RSAS. A definition of models, simulations, and games, as well as the advantages and disadvantages associated with each, should suffice. This discussion is not intended to be an all inclusive documentation of these analytic tools, nor is it intended to list all the benefits and shortcomings of each category.

1. Models

A model is defined as "an abstract representation of reality which is used for the purpose of prediction and to develop understanding about the real-world process." (USDA Models Review Committee, 1971, p. 1) Models are usually mathematical and may be either manual or automated. They can range in complexity from simple illustrations of a system, such as a ship model, to an intricate arrangement of algorithms and formulas intended to demonstrate the workings of an organization. The advantages of models are best described by Graubard and Builder:

Assumptions are usually explicit or explicable, particularly in the simpler models. Cause and effects, and relationships, are either defined or can be determined. Results can usually be independently reproduced and verified. These characteristics have helped to make computer models the principal analytic tool for the description, evaluation, and communication of strategic force exchange outcomes. (Graubard and Builder, 1982, p. 72)

Several features are available to the analyst through the use of models. Models provide:

- 1) transparency--the capability to make clear to users of the analysis which assumptions, data algorithms, etc., were the key factors determining specific results.
- 2) reproducibility--the capability to duplicate the event to allow an examination of the key factors determining specific results.
- 3) rigor--the state of structure of the analysis, especially explicit listings of assumptions, data algorithms, etc., that lends itself to detailed examination.

Models are not, however, without their drawbacks. It is just not possible to assimilate all variables of a complex

event such as war. Multifarious factors such as individual attitudes, national will, and the "fog of war" are outside the realm of contemporary model making.

2. Simulations

The USDA Models Review Committee describes a simulation as:

...a model which runs completely without human intervention. In this type of model events in the different combat processes are essentially followed in sequence, and decisions are based on predetermined rules which are programmed in to the automated evaluation procedure. (USDA Models Review Committee, 1971, p. 2)

Simulations attempt to depict a real world situation by expanding on mathematical representation. The outcome of a simulation can depend either on a random probability distribution (stochastic) or a fixed outcome table (deterministic). The most important aspect of a simulation is that it can be used to represent a process. As with the simple model, simulations are limited in their ability to capture the uncertainties of human intervention.

3. Games

A game is:

...a model of a situation of competition or conflict in which opposing players decide which course of action to follow on the basis of their knowledge about their own situation and intentions and on their (usually incomplete) information about their opponent's course of action. (USDA Models Review Committee, 1971, p. 3)

Human involvement is the most distinguishing feature of a game. The fact that people are involved brings to light many of the uncertainties that are beyond the

capabilities of plain models and simulations. An example of a game is a wargame "in which individuals simulating decision-makers in real life use their judgment to perform the decision functions in the model." (USDA Models Review Committee, 1971, p. 5) While providing insight into non-quantifiable matters, gaming suffers by

...relinquishing almost all control over the underlying assumptions, relationships, and reproducibility of the results to the individual judgments and caprices of the players. While the experience for the player may be excellent training, it is extremely difficult to extrapolate and apply the results directly to the rigorous assessment of policy, program or operational choices. (Graubard and Buildier, 1982, p. 73)

Although games provide a more accurate picture of how events might transpire, they lack the analytic rigidity to allow in-depth analysis concerning the process of events.

C. DEVELOPMENT

As the nuclear weapons postures of both superpowers evolved, so did the methods of analyzing the strategic forces. In the 1950s, political-military games and the quantification of nuclear weapons effects were the center of analytic attention.

Modeling received greater attention during the 1960s in an attempt to quantify massive strategic nuclear exchanges. Computer modeling, because of memory storage capabilities and rapid calculation rate, also became widely used in analysis and military force programming.

In the 1970s, political and military authorities began to realize that a variety of situations, factors, and operational aspects had to be considered to provide an adequate analysis of opposing nuclear forces. The standard "arsenal exchange" model assuming a massive Soviet attack followed by a massive U.S. retaliation did not consider these other aspects. Dissatisfaction with prevalent computer models and worsening trends in the U.S./USSR strategic balance prompted action to improve analytic techniques. (Marshall, 1982, p. 49)

The recommended course of action, drafted by a 1978 Defense Science Board study, was to develop a wargaming style of analysis. In 1979, the Defense Department sought contractor assistance for the stated recommendation with these objectives:

- 1) To provide more flexible analytic tools that evaluate and compare capabilities of U.S. and Soviet strategic forces in a wide range of scenarios and contingencies including crises, theater of war, and large scale nuclear conflict and its aftermath.
- 2) To allow the strategic nuclear forces to be considered together with other relevant forces, nuclear and conventional.
- 3) To allow a richer set of operational factors to be included in the analysis.
- 4) To include explicitly, in an integral way, those aspects of a large conflict now being treated separately, or not at all (e.g., space, command and control, anti-submarine warfare, tactics, etc.). (Marshall, 1982, p. 49)

Of ten competitive contractors, the RAND Corporation was selected to continue with the design under a project

entitled "Improving Methods of Strategic Analysis." The concept developed by RAND incorporated the best features of analytic models and the best features of political-military games into a computer simulation. Modeling allows a high degree of analytic assessment; gaming captures the uncertainties and qualitative factors of war and human behavior; computers provide the memory storage capability and high calculation rate. The effort by RAND evolved into the RAND Strategy Assessment System (RSAS).

D. RAND STRATEGY ASSESSMENT SYSTEM (RSAS)

RSAS uses five components or agents to interact in a complex political-military simulation. Three of the agents, coded Red, Blue, and Green, represent the Soviet Union, the United States, and non-superpower actors respectively. The Red, Blue, and Green agents are controlled by decision models that portray the national and military command structures of the U.S./NATO and USSR/WTO and third countries. Based on the environment set by a World Situation Data Set, the "national command authorities"¹ of the Red and Blue agents develop objectives and specify strategies to the military command authorities. The

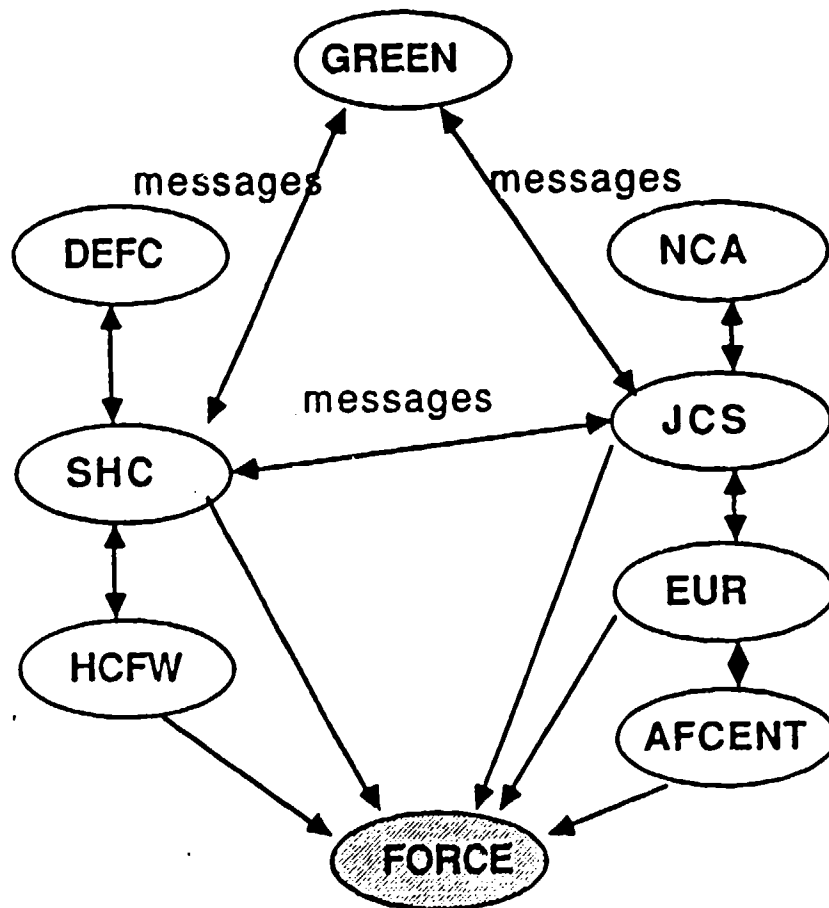
¹Red and Blue political decision models emulate the Defense Council and the National Command Authority respectively. The capability exists to select between two degrees of political climate with one selection being more aggressive than the other (i.e., IVAN 1, IVAN 2, SAM 1, SAM 2).

military command authorities² make decisions and give orders based on analytic war plans designed from prior games and studies. Figure 5 depicts the interaction between command authorities. The Green agent interacts to simulate third country involvement. Any or all of these agents can be replaced by human players.

The output (decision) from the Red, Blue, and Green agents are sent to the fourth component, the Force agent. The Force agent, a simulation model, tracks military forces worldwide and assesses battle outcome. All levels of combat, including conventional, naval, theater-nuclear, and intercontinental nuclear warfare, can be treated. The results are returned to the Red, Blue, and Green agents for further action. The Force agent is also tasked with the referee functions (i.e., time keeping) of a standard wargame.

The fifth agent, the Control agent, provides a means for the analyst to input parameters that will affect the scenario of the game. This capability allows the analyst to affect the game and evaluate the results in a controlled

²Red and Blue military decision models are patterned after the Soviet General Staff (VGK) and U.S./NATO Joint Chiefs of Staff/Military Committee. Lower echelon command organizations (TVDs and CINCs) are also represented.



Source: (Davis and Hall, 1988, p. 27)

Figure 5. Hierarchical Structure of RSAS Agents

fashion. Figure 6 is a graphical representation of the RSAS structure. (Davis, 1987, p. 3)³

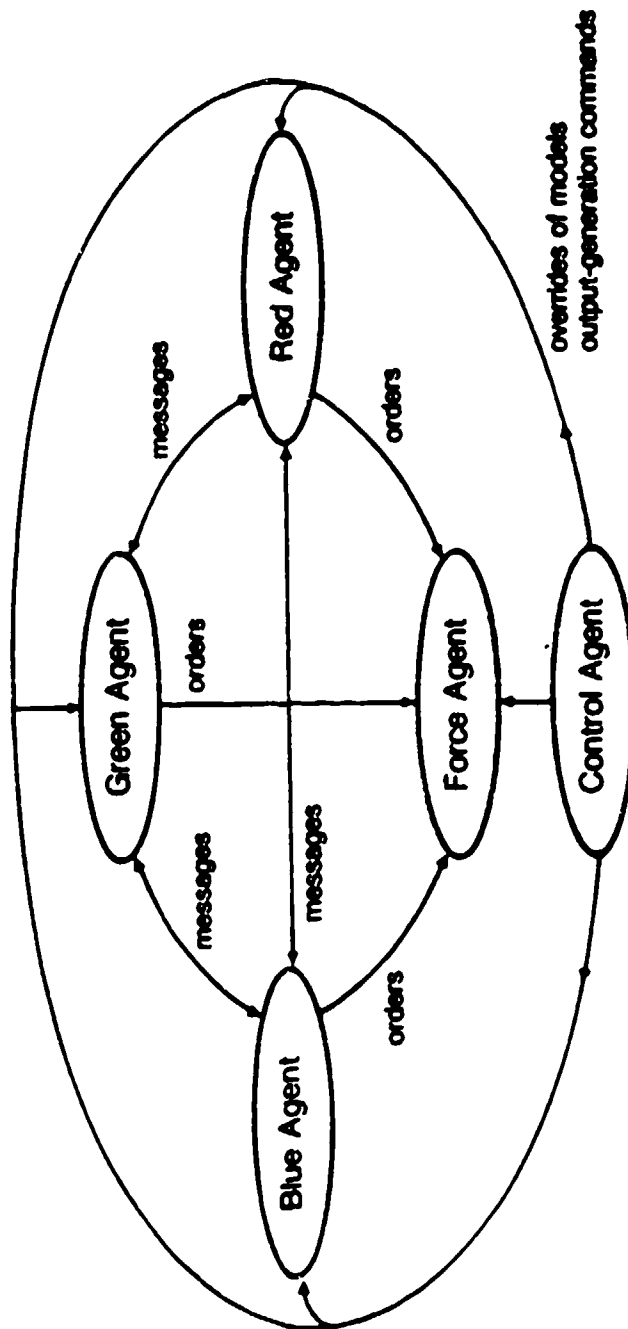
E. RSAS FEATURES

A number of valuable features are available to the analyst through RSAS. Some of the more important attributes include:

- 1) The system can be operated in a fully automatic mode pitting two experts against each other or in a semi-automatic mode allowing humans to play from the position of any agent.
- 2) The models are deterministic (outcomes do not involve chance and events are dependent on the input) enabling repeated plays with variable modification for sensitivity analysis.
- 3) Transparency is possible because all model decisions and simulation results are automatically logged and can be viewed on-screen.
- 4) A game within a game (called "lookahead") can be run by the system to test proposed strategies.
- 5) RAND-ABLE, a novel programming language, provides improved user-computer interface.

RSAS is not an end in itself, but merely a means to improve analysis. It will not provide a solution to a policy question nor will it accurately predict the outcome of conflict. The concept of analytic wargaming on a global scale should not be considered as an input to strategic planning, but rather it should be thought of as a way to

³For a more detailed explanation of RSAS, see The RAND Strategy Assessment System at the Naval Postgraduate School, by Tritten and Channell.



Source: (Davis, 1987, p. 3)

Figure 6. Channels of Communication Among RSAS Agents and Data Sets

evaluate the output of strategic research. As such, RSAS provides the analyst with a number of valuable capabilities.

- 1) The deterministic models and the wide range of combat scenarios available allow the analyst to identify the key variables that affect battle outcome.
- 2) The top down structure of the command authority allows the analyst to focus on integrated strategy-level considerations without becoming concerned about the details of military operations. (Davis, 1987, p. 1)
- 3) Entry into the various levels of the command authority allows the user to address operational-level issues without becoming concerned with strategy-level planning. (Davis, 1987, p. 1)
- 4) The replacement of humans with decision models allows play to occur much more rapidly so as to enable a broad range of scenarios to be run and considered.

Development of RSAS is still in progress and several shortcomings still exist. Of particular interest to this study is the lack of adequate models that represent naval warfare (Tritten and Channell, 1988, p. 4). RAND and OSD/NA should take steps to upgrade RSAS's naval components so as to better model global warfare.

One additional shortcoming noted is the inadequate method of measuring battle outcomes. Determining whether the result is favorable or not in terms of the organization's objectives is not well understood. Because of this defect, identifying key variables that affect outcome is extremely difficult.

F. SUMMARY

Improving strategic assessment through analytic wargaming is a multi-year project that is still evolving.

The goal is not to have an answer machine for decision-makers and analysis. What is expected is a method of analyzing force postures under multi-scenario, multi-variable conditions. The concept of analytic wargaming embodied in RSAS should allow the analyst to conduct numerous runs that reflect various uncertainties present in the real world.

V. FINDINGS AND CONCLUSIONS

Attempting to gather the facts together and form an appraisal of the situation is not a new phenomenon. Decision-makers and analysts have always been doing this intuitively. But such efforts lack structure and can miss the important issues unless the individual(s) conducting the analysis are blessed with exceptional talent or significant experience. Attempts to institutionalize the talent and experience have lead to a number of successful concepts. This thesis has concentrated on the method of analysis known as net assessment.

The development of net assessment, nearly two decades ago, and improvements since have largely been due to Mr. Andrew Marshall. Although building on groundwork laid by other notable individuals such as Robert McNamara, Charles Hitch, and Alain Enthoven, Marshall's concept of analysis provided the structure to ask the questions that need to be asked and present issues to better evaluate intended policy.

Net assessment is not many things. It is not an answer machine to provide the solution to difficult or easy questions. It is not a programming filter that removes institutional biases or political prejudices. Net assessment, as a process, is no better than the men and

women that conduct them or the information that is used in performing them.

Net assessment does, however, have a great deal to offer the strategic planning and management world. The systematic, organized approach to analysis incorporated in the net assessment process provides a path for the analyst and decision-maker to follow.

To make the information more prone to analysis and the analysis more prone to presentation, assessments are broken down into several categories: balance assessments, policy assessments, net technical assessments, comparative assessments, operational assessments, and weapons comparisons. These assessments take the standard static, side-by-side comparisons as one important input and then try to go beyond by examining the qualitative factors (i.e., training, leadership, moral, doctrine, etc.) and the dynamic force-on-force calculations. Qualitative factors and dynamic calculations are no less difficult to evaluate because of net assessment, but must be coped with to make the best appraisal possible. Additionally, net assessments try to come to grip with uncertainties and asymmetries that exist between opponents. By systematically approaching the state of competition, a net assessment can assist a decision-maker face a policy decision with the best information available. Several examples of such policy issues are: does the U.S. need to invest its defense

dollars into a conventional navy or strategic nuclear forces?, are the U.S.'s basic planning assumptions robust enough to absorb certain unexpected circumstances?, has the U.S. thought through the range of scenarios or is it locked into a single scenario?

As with any other process, net assessment continues to evolve. Several areas are worthy of note. First, efforts should continue to improve methods of analysis through the use of analytic wargaming. RSAS as an analytic tool is useful in viewing the broad range of possible scenarios and helpful in identifying the key variables that affect the outcome of likely scenarios. The thrust of development of RSAS, however, should not be limited to strategic and the Central Front issues. Naval models have been found wanting and are in need of upgrading. Analysis of all forms of conflict can benefit from the use of RSAS.

Efforts to link the Intelligence Community directly to the conduct of net assessments should be discontinued. By separating intelligence and net assessment functions, a more accurate picture of the threat containing fewer mirror-images can be obtained. This separation of responsibilities will allow the intelligence officer to concentrate on appraising the enemy and provide the net assessment analyst with the most accurate account of the opponent possible.

Attempts to establish net assessment offices in each of the military services should continue with increased vigor.

As previously stated, a net assessment is not the solution to all the problems, but this method of analysis can present military command authorities with the most un-biased, non-partisan information humanly possible. The appraisal may not be universally accepted or politically tolerable, but the information provided the decision-maker is vital to the organization none the less. This recommendation is not so unusual given the fact that the Chairman, Joint Chiefs of Staff is required to conduct a net assessment on the military balance by the Goldwater-Nicholas Defense Reorganization Act of 1986.

Finally, efforts should continue to ensure that modern day analysis is validated by historical data. A study conducted on the military balance of 1940 showed "that the German forces in a reconstruction of armored divisions equivalent measures were about 5 to 10 percent inferior to the combined French, British, Belgian, and Dutch forces." (Marshall, 1983, p. 13) Clearly, the key variables in determining success of the competitors were not identified. Such a mistake in analysis is unacceptable in future conflicts.

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