DNA-TR-84-84

TLAM/N IN THE NUCLEAR RESERVE FORCE: ALTERNATIVE CONCEPTS

Science Applications International Corporation
P. O. Box 1303
McLean, VA 22102-1303

29 July 1983

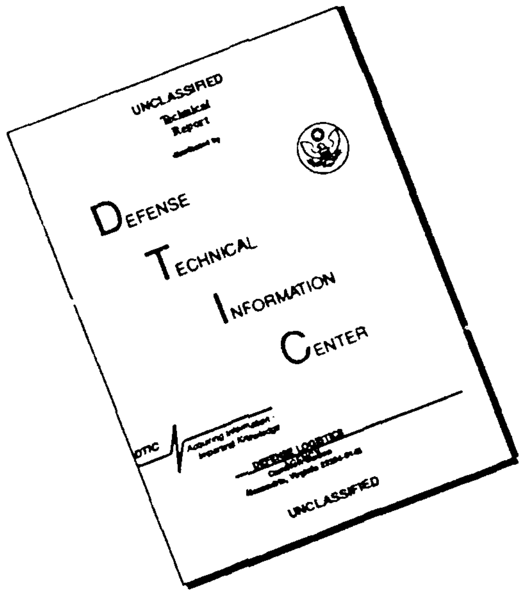
Technical Report

CONTRACT No. DNA 001-82-C-0307

THIS WORK WAS SPONSORED BY THE DEFENSE NUCLEAR AGENCY
UNDER RDT&E RMSS CODES B385082466 V99QAXNL00136 H2590D
AND B385082466 W99QAXOA00024 H2590D.

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

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No 0704 0188 Exp Date Jun 30 1986

1a REPORT SECURITY CLASSIFICATION	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT N/A
2b DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S) DNA-TR-84-84
6a NAME OF PERFORMING ORGANIZATION Science Applications International Corporation / 6b OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION Director Defense Nuclear Agency
6c ADDRESS (City, State, and ZIP Code) P.O. Box 1303 McLean, VA 22102-1303	7b ADDRESS (City, State, and ZIP Code) Washington, DC 20305-1000
8a NAME OF FUNDING/SPONSORING ORGANIZATION / 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DNA 001-82-C-0307
8c ADDRESS (City, State, and ZIP Code)	10 SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO
62715H	V99QAXN	L	DH066335

11 TITLE (Include Security Classification)

TLAM/N IN THE NUCLEAR RESERVE FORCE: ALTERNATIVE CONCEPTS

12 PERSONAL AUTHORS

Watts, K.; Weidman, R.; Bohlin, K.; Kennedy, R.; McPherson, K.; Makins, C.

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Technical Report	FROM 820922 TO 830729	830729	271

16 SUPPLEMENTARY NOTATION

This work was sponsored by the Defense Nuclear Agency under RDT&E RMSS Codes B385082466 V99QAXNLOC136 H2590D and B385082466 W99QAX0A00024 H2590D. a. Review of Advanced Cruise

17 COSATI CODES FIELD	GROUP	SUB-GROUP
16	4.1	
15	6	

18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)

TLAM/N; Attrition; Cruise Missile; Nuclear Reserve Force

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This document summarizes the analytical work done by Science Applications International Corporation in support of an effort to determine the proper role for TLAM/N in the Nuclear Reserve Force. In particular, this document summarizes the evolution of nuclear weapon employment policy and nuclear reserve force concepts, presents the scenarios for strategic context for the NRF, examines TLAM/N employment concepts, and presents a targeting, campaign, and attrition analysis to determine the best match between TLAM/N capabilities and force requirements in both a theater and NRF context.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION
22a NAME OF RESPONSIBLE INDIVIDUAL Betty L. Fox	22b TELEPHONE (Include Area Code) (202) 325-7042 / 22c OFFICE SYMBOL DNA/STTI

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

10. SOURCE OF FUNDING NUMBERS (Continued)

62715H W99QAXO A DH066335

16. SUPPLEMENTARY NOTATIONS (Continued)

Missile Analysis 1 March 80.

b. Activities, Status and Issues of Cruise Missile Survivability Assurance (U) January 82.

c. Cruise Missiles: Status and Issues as They Near Production 28 February 80.

d. DARPA Cruise Missile Task Report 26 March 80.

e. U.S. Nuclear Weapons Policy Toward China: 1985-1995 10 February 81.

f. CINCPAC Nuclear Policy Manual, Volume II--Staff Officer's Handbook 28 February 83.

g. Military Utility of Sea Launched Cruise Missiles 21 December 82.

h. PACOM TNF Improvement Study--Phase II, Volume III: Force Modernization--Force Mix Analysis, Appendix B: Targeting Considerations 30 April 82.

i. Strategic Targeting With Target Building Blocks 1 April 81.

j. SAC Employment Strategy for Protracted War 22 January 82.

k. On Protracted General War: A Study of the Nature of Conflict After a U.S./Soviet Nuclear Exchange, Volume I: Main Report 19 September 80. RD.

l. Concepts for Protracted War 1 December 80.

m. Planning for Cruise Missiles in PACOM 12 December 80.

SUMMARY

GENERAL

The introduction of a fundamentally new weapon system into the arsenal of American nuclear weaponry inevitably creates competing claims to that system. The introduction of the Tomahawk Nuclear Land Attack Missile (TLAM/N) in the mid-1980s is no exception to this rule. Its capabilities (detailed in Appendix A) and the concepts for its use (alluded to throughout the study and detailed in Section 5) raise basic questions about how it might best be used in the context of the situation in which it might be called into use, especially in a post-SIOP world, with all the uncertainties that world encompasses. It was to address questions of TLAM/N utility in relationship to the various demands upon it that this study was undertaken. The purpose of the study are threefold: first, to examine current guidance and procedures regarding the Nuclear Reserve Force (NRF); second, to identify an operating mode for TLAM/N that will allow it to meet the needs of the NRF and of the theater commanders without unduly impinging on the Navy's ability to perform its other missions; and third, to determine if the introduction of TLAM/N into the force requires any changes in NRF guidance and procedures.

PROJECT METHODOLOGY

Figure S-1 provides a picture of the overall project methodology. This methodology is discussed in detail in Section 1 and in subsequent sections as the specific parts of the analysis are presented.

The first step in the methodology was to examine the Nuclear Reserve Force, both in terms of its background and evolution and in terms of its current configuration. Guidelines for its employment were also examined.

The next step was to develop a strategic context for the NRF. This included a review of likely national strategies and their impact on concepts

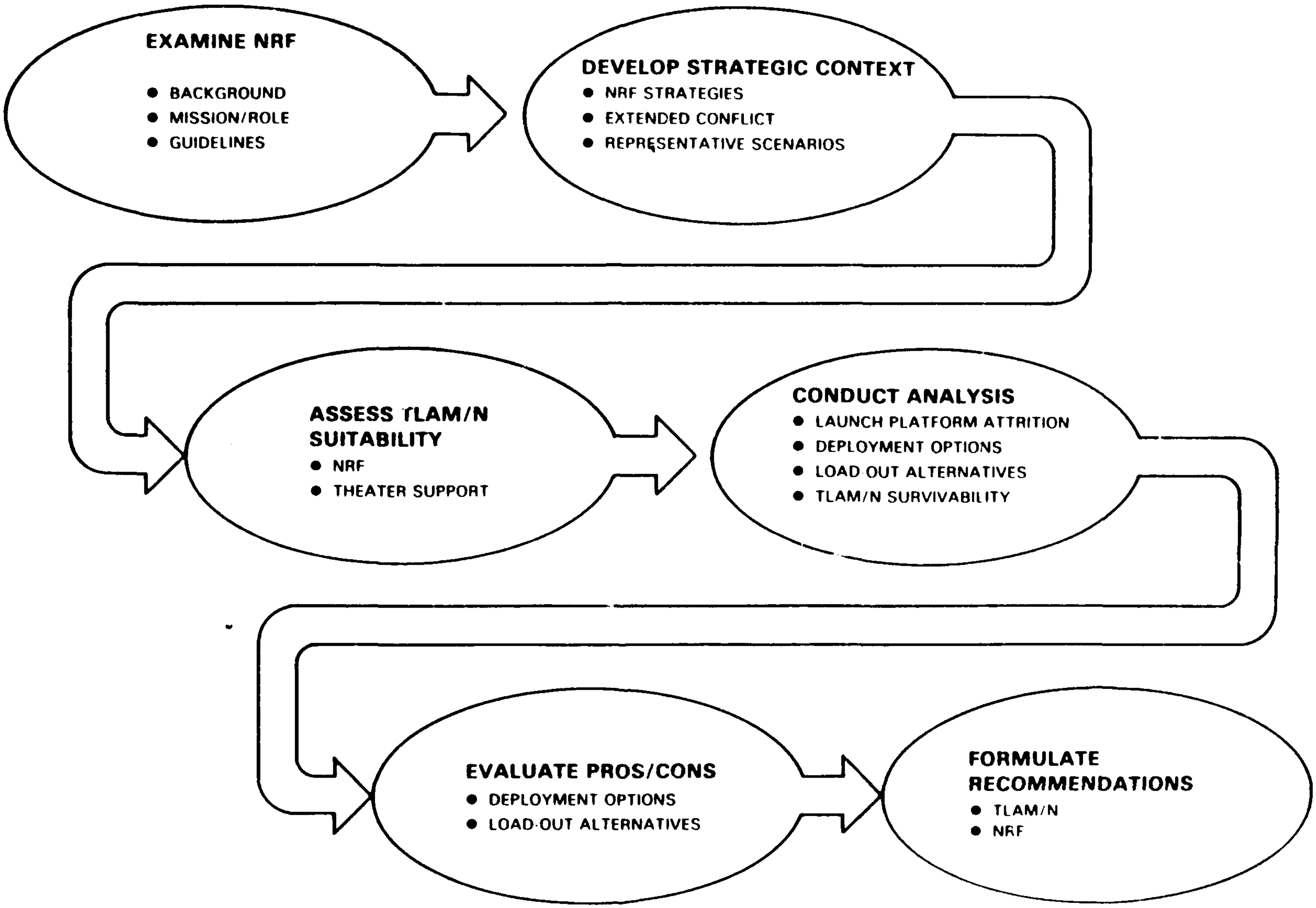


Figure S-1. Project Methodology.

for employment of the NRF. Representative scenarios were constructed to facilitate this analysis.

The third step was to assess TLAM/N suitability for the competing roles in which its use is anticipated--in support of the NRF and in support of theater requirements. This was done through a targeting analysis and perusal of other studies which focused on this issue.

The fourth step was to conduct a campaign and attrition analysis to determine the likely survivability of TLAM/N in a variety of wartime situations based on the three basic scenarios previously developed. A number of deployment options and loadout alternatives were then formulated and evaluated to determine their ability to satisfy the nuclear land-attack requirements of the NRF and the theater commanders, while inflicting the least degradation on Navy capabilities to carry out other missions.

The fifth step was to evaluate the pros and cons of the deployment/loadout options based on the results of the attrition analysis. The focus of this step was to determine the impact of these options on TLAM/N survivability.

The final step in the analysis was to formulate recommendations regarding the most beneficial concepts for deployment and employment of TLAM/N with respect to the mission and role of the NRF.

EVOLUTION OF NUCLEAR WEAPONS EMPLOYMENT POLICY

(b)(1)

1.3(a)(1)

(b)(1)
1.3(a)(1)

NUCLEAR RESERVE FORCE CONCEPTS

(b)(1)
1.3(a)(1)

STRATEGIC CONTEXT FOR THE NUCLEAR RESERVE FORCE

The analysis moves to a discussion of the context into which the NRF must fit, and of the uncertainties that are likely to dominate the post-SIOP world. Planning needs to be pursued in such a way as to meet those uncertainties which fall within the bounds of what might reasonably be predicted. The issue for this stage of the analysis was to define the degree and nature of uncertainty about the strategic environment after an initial major use of nuclear weapons in order to identify whether the needs of that environment suggest a potential role for TLAM/N in nuclear reserve forces as a robust source of both deterrence and wartime capabilities. This section suggests two ways of dealing with the uncertainties--a contingency approach and a capabilities approach--and concludes that the capabilities approach is more likely to be of use in an uncertain post-SIOP world.

The NRF is then assessed in the light of potential U.S. objectives and strategies, through the construction and analysis of the relationship between surviving forces and surviving C^3I capabilities. The analysis suggests that any post-SIOP strategy that can be pursued is a function of these capabilities, and it describes three strategies and the respective models of Soviet behavior on which the success of each is contingent. Because of the difficulty in generalizing about the operational requirements for the NRF--and for TLAM/N as a part of it--in these three different strategies, specific operational contexts, or scenarios, were developed as a basis for analyzing this problem. The primary purpose of these scenarios is to set plausible and analytically interesting starting conditions for NRF operations and to propose, on the basis of those conditions, a strategically reasonable set of actions by both sides leading to a cessation of hostilities. Thus the scenarios reflect a set of postulates or assumptions which affect the objectives, strategies, and operational choices for the belligerent countries and define the forces available to them at the time the NRF is constituted. Broadly speaking, the three scenarios are differentiated by the length of the conventional conflict phase embodied in each--7 days, 30 days, and 90 days--and by the intensity with which conventional conflict is pursued. They thus span a range of possibilities in terms of the exposure of TLAM/N platforms to attrition in the pre-nuclear phase of the war. The section concludes that certain combinations of C^3I and force capabilities are logically linked to certain types of strategies, and that the strategy the U.S. will be able to pursue in a post-SIOP conflict will therefore be scenario dependent.

TLAM/N EMPLOYMENT CONCEPTS

The next stage of the analysis rests on recognition of the fact that the needs of the NRF are not the only influences affecting the role of TLAM/N in the force. There are other potential uses for this system, uses which TLAM/N operational capabilities and characteristics make attractive. These alternative employment concepts are defined in the following fashion:

- "Nuclear Reserve Force Concept," supported by some elements of OSD, JSTPS, and others whose focus is at the national level.

- "Theater Support Concept," espoused by the theater commanders.
- "Naval Force Improvement Concept," formulated by the Navy staff and supported by Navy operational commanders around the world.

(b)(1)
1.3(a)(1)

DE[illegible]

CAMPAIGN AND ATTRITION ANALYSIS

Now begins the investigation of various platform operating modes and weapon loadouts to determine which mode/loadout combination contributes most to the balanced force improvement identified earlier in the analysis. The approach for this section was to perform a campaign analysis using the three scenarios also defined earlier.

In carrying out the campaign analysis, U.S. and Soviet naval forces were first described and paired for campaign analyses and employment in various scenarios. Force levels and fleet distributions were provided for the 1990 timeframe, and a detailed assessment of the relevant threat was developed. The scenarios described earlier provide a framework for estimating the comparative survivability of naval forces in worldwide conflicts of varying durations and against different threat levels. With this objective in mind, conventional naval campaigns were designed to fit the generalized scenarios and expose the platforms to attrition in a plausible series of events. Analysis of the force/threat pairings associated with engagement sequences was conducted and the engagement outcomes assessed. The engagement sequences were not intended to duplicate any scenario. Rather, they were designed to span all the sets of events relevant to each scenario and to provide the components from which the scenario results could be constructed. The main product of this part of the analysis was not a set of stand-alone results but rather data base to support the subsequent analysis.

ANALYSIS OF DEPLOYMENT OPTIONS/LOADOUT PLANS

(b)(1)
1.3(a)(1)

SURVIVABILITY ASSESSMENT

After the deployment modes and loadout plans were developed, they were collated with the platform attrition results from the campaign analysis to provide an estimate of TLAM/N survivability up to the time of NRF constitution. Platform survivability was analyzed, and showed that the attrition of deployed TLAM/N platforms, both surface ship and submarines, was generally low. TLAM/N survival into the post-SIOP phase for the seven loadout alternatives in each of the three scenarios was then assessed. The results of this attrition analysis led to the following conclusions:

- TLAM/N platform attrition is apt to be fairly low, with submarines having a relatively small but important advantage in this respect over surface ships.
- Submarines possess other inherent operational advantages over surface ships which permit them to employ TLAM/N in a hostile environment with less risk and a smaller force presence than is possible with surface combatants.
- The vulnerability of TLAM/N stored ashore to nuclear attack during a homeland-to-homeland exchange argues strongly for those deployment and loadout alternatives which keep all available TLAM/N at sea in surface and subsurface combatants. Core NRF weapons should certainly be deployed afloat.

(b)(1)
1.3(a)(1)

CONCLUSIONS AND RECOMMENDATIONS

The following are the most significant conclusions resulting from the analysis performed during this study.

(b)(1)
1.3(a)(1)

DELETED

Page ix is deleted.
(b)(1)
1.3(a)(1)

In view of these conclusions, the following actions are recommended:

(b)(1)
1.3(a)(1)

DELETED

- Conduct an analysis to estimate the schedule and costs required to modify naval multi-mission platforms to provide effective strategic connectivity.

- Modify launch platforms to provide an on-board targeting capability, as flexibility requirements for the NRF demand an ad hoc targeting capability for TLAM/N.

- Conduct an analysis of tailored missile loadouts for the surface action groups (SAGs), since TLAM/N would have the greatest force multiplier effect when deployed with SAGs.

- Perform additional analysis to better identify the likely NRF target base, given the recognized uncertainties of the post-SIOP environment and extended conflict.

PREFACE

This report is part of the research regarding employment concepts for the Tomahawk Nuclear Land Attack Missile (TLAM/N) being carried out for the Defense Nuclear Agency and OPNAV. The report consists of one volume.

Special recognition is due to Lieutenant Commander Jeffrey H. Albright, U.S. Navy, for his support and assistance throughout this project.

The principal authors of the sections in this volume are as follows: Executive Summary (K. McPherson), Section 1 (K. Watts), Section 2 (K. Watts), Section 3 (K. Watts), Section 4 (C. Makins), Section 5 (K. Watts, R. Weidman), Section 6 (R. Kennedy, K. Bohlin, R. Weidman), Section 7 (R. Kennedy, K. Watts, R. Weidman), Section 8 (R. Kennedy, R. Weidman), Section 9 (K. Watts), Appendix A (R. Weidman), Appendix B (K. Watts), Appendix C (R. Weidman), Appendix D (K. Bohlin). The report was edited by Mr. K. Watts and Dr. K. McPherson.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Concluded)

LIST OF ILLUSTRATIONS

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TABLES (Concluded)

SECTION 1

INTRODUCTION

PURPOSE

The purposes of this study are as follows:

- To examine current guidance and established procedures regarding the Nuclear Reserve Force (NRF).*

- To identify an operating mode, or modes, for the Tomahawk Land Attack Missile/Nuclear (TLAM/N)** that would:

  - enhance the utility of TLAM/N as an element of the NRF
  - provide a TLAM/N capability to support the needs of the theater commander throughout all phases of conflict,
  - allow sufficient flexibility for TLAM/N platforms to perform effectively their other assigned naval missions

- To determine if changes in NRF guidance and procedure are desirable in light of the increasing emphasis on extended conflict and the imminent deployment of TLAM/N.

1.2 HISTORIC CONTEXT

To place current NRF policies and practices in context it is necessary to review U.S. attitudes toward nuclear reserve forces as they have developed over the past several decades. Contrary to the emphasis historically given to the establishment of adequate reserve forces within the national military force structure, planning for and deployment of nuclear reserve forces have been almost totally ignored in the United States throughout most of the post-World War II years. It is only within the last ten

---

* The Nuclear Reserve Force (NRF) was until recently known as the Strategic Reserve Force or, more simply, as the Strategic Reserve. Both terms are used in this report according to the context. For more details, see Section 2.

** A system description of the TLAM/N is provided in Appendix A.

years, and particularly within the past five, that concepts for nuclear reserve forces have begun to receive noticeable attention. Both the earlier lack of attention and the renewed interest now can be readily explained by the trends in the nuclear balance over this same time span.

In the period between the end of World War II and the beginning of the Soviet strategic force buildup in the middle 1960s, there was little doubt about the probable outcome of a strategic nuclear war between the United States and the Soviet Union. U.S. strategic offensive capabilities were vastly and clearly superior to those of the Soviet Union throughout most of this period, and United States doctrine called for the massive employment of these capabilities in response to Soviet provocation. The doctrine of "massive retaliation" assumed, quite simply, that any Soviet attack on the United States or its allies would be met with the full force of American nuclear power. Initially, the primary targeting consideration for the United States was to disrupt the Soviet urban/industrial base--that is, to target cities. As Soviet nuclear capability grew, a second targeting consideration gained prominence, the need to blunt a Soviet attack by getting at its military power base. This was all undertaken with the assumption that any war which occurred would be a result of Soviet aggression, and that the primary mission of the United States nuclear forces was to survive and to render such damage to the Soviet Union that it would be incapable of pursuing a second strike on the United States.

By 1955, however, it was recognized that Soviet capabilities had grown to the point that the United States could no longer substantially disarm the Soviet Union with a massive strike. This led to concern that relying almost solely on land-based aircraft as the delivery mechanism for the massive strike made American nuclear forces unacceptably vulnerable, because of the relative ease with which airbases could be targeted by Soviet nuclear assets. This led in turn to the pursuit of alternative concepts for nuclear strike forces and to the concept of submarine-based nuclear weapons as a potentially more survivable force to ensure an American second-strike capability. The emergence of ICBM technology in the late 1950s provided additional impetus to the move to diversify in order to ensure the survival of the United States' retaliatory strike assets. The recognition that the United States could not disarm the Soviet Union was the first step in the process which would eventually lead to the current interest in nuclear reserve forces.

In the early years of the Soviet strategic force buildup, during the 1960s, it was argued that so long as mutual assured destruction was the guidance by which both superpowers rationalized their strategic force structures, strategic parity between the two nations would not be detrimental to national security. But by the mid-1970s it was clear that Soviet forces were larger than required by deterrence as judged by the criterion of mutual assured destruction. The conclusion that Soviet planners believed that deterrence was best assured by the possession of war-fighting, war-surviving, and war-winning capabilities was inescapable. The extent to which Soviet forces possess these capabilities is impossible to ascertain; what is clear, however, is -that, should the United States undertake a massive strike under such circumstances, it could well disarm itself without rendering the Soviet Union incapable of pursuing a second strike.

This is the context which has led in recent years to an emerging U.S. interest in nuclear reserve forces and protracted nuclear operations.

1.3 PROJECT OVERVIEW

(b)(1)
1,3(a)(1)

DELETED

Page 1-4 is deleted.
(b)(1)
1,3(a)(1) + (2)

DELETED

(b)(1)
1.3(a)(1)

1.4 ANALYTICAL APPROACH

The analytic approach followed in this project is depicted in Figure 1-1. In brief, an extensive review was conducted of the historical evolution of the NRF, as reflected in changes to national nuclear weapons employment policy, especially those of the past decade. Then a detailed examination was made of the Nuclear Reserve Force (NRF) as it is currently configured, looking at such factors as assigned mission, likely target system, command and control considerations, size, composition, and concepts for constituting the force. This examination included investigation of the nuclear weapons employment planning framework for the NRF, and the relationships between strategic nuclear planning--the responsibility of the Joint Strategic Target Planning Staff (JSTPS)--and regional nuclear planning, accomplished by the theater commands.

A strategic context for the NRF was developed, based on SAI's earlier work on extended conflict. This included an extensive review of likely national strategies and their impact on concepts for employment of the NRF, with particular note of the implications for TLAM/N. Three representative scenarios were formulated as a basis for the campaign and attrition analysis performed later in the study. These scenarios reflected conflicts of differing lengths, intensities, and outcomes, which brought into play the full range of alternative strategies.

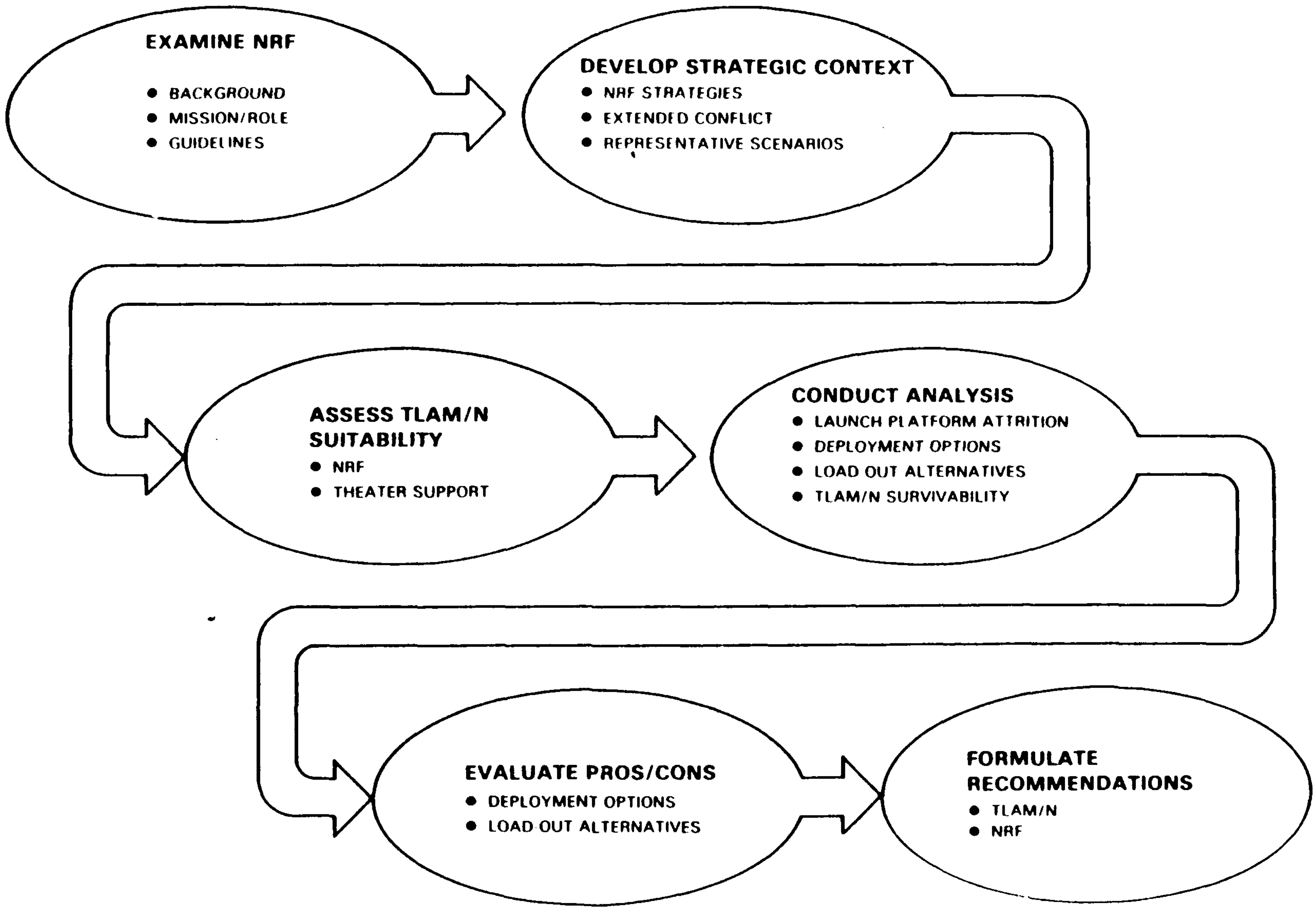


Figure 1-1. Project methodology.

Three current concepts for the employment of TLAM/N were then investigated: NRF, theater support, and distributed force. Competing requirements for TLAM/N as part of the NRF or to provide theater support were analyzed in relationship to the Navy's distributed force concept for TLAM/N deployment. A case was made to use a balanced approach in resolving these conflicts, rather than to optimize one at the expense of the others. A targeting analysis and other studies provided the insights that supported this judgment.

The principal analysis was conducted in three major segments. First, a campaign and attrition analysis was performed to determine the likely survivability of TLAM/N in a wide variety of wartime situations keyed to the three basic scenarios previously developed. Then a number of TLAM/N deployment options and load-out alternatives were formulated and evaluated, to determine their ability to satisfy the nuclear land-attack requirements of the NRF and the theater commanders, while causing the least impact on other Navy missions. Alternatives considered ranged from fully flexible to totally dedicated. Finally, results of the attrition analysis were applied to those deployment/load-out options to determine the impact of TLAM/N survivability. These analyses provided the basis for the study's conclusions and recommendations.

SECTION 2

EVOLUTION OF U.S. NUCLEAR WEAPONS EMPLOYMENT POLICY

2.1 INTRODUCTION

The basic policies that govern the NRF stem from national nuclear weapons employment policy. This baseline policy underwent a fundamental, across-the-board change during the early 1970s. Since that time a number of other major policy revisions have been instituted. As a prerequisite, therefore, to understanding the complexities of the NRF and the potential utilization of TLAM/N, especially in a situation of extended conflict, a clear picture must be obtained of the significant changes which have occurred over the past dozen or so years in policy development and planning for U.S. nuclear forces, both strategic and theater. This section traces this evolution of U.S. national policy with respect to nuclear weapons employment and provides insight into the emerging concepts regarding nuclear reserve forces.

2.2 NATIONAL STRATEGIC TARGETING AND ATTACK POLICY (NSTAP)*

(b)(1)
1.3(a)(1)

* "NSTAP" later changed to "NNTAP" (for "National Nuclear Targeting and Attack Policy.") For simplicity, the term NSTAP is used throughout this report.

Page 2-2 is deleted.
(b)(1)
1.3(a)(1)

(b)(1)
1.3(a)(1)

* The original NUWEP has been considerably modified and expanded to reflect changes in national policy, and two later versions have since been issued. Where it is necessary in this report to differentiate between these various documents, the notation "NUWEP-74," "NUWEP-80," etc., will be used. Where "NUWEP" is used in the broad sense to mean DoD nuclear weapons employment policy, the suffixes will be omitted.

2.3.1 Major Attack Options

(b)(1)
1.3(a)(1)

DELETED

2.3.2 Selected Attack Options

(b)(1)
1.3(a)(1)

DELETED

DELETED (b)(1) 1.3(a)(1)

2.3.3 Limited Nuclear Options

DELETED (b)(1) 1.3(a)(1)

2.3.4 Regional Nuclear Options

DELETED (b)(1) 1.3(a)(1)

2.3.5 LNO/RNO Execution

(b)(1)
1.3(a)(1)

2.3.6 Secure Reserve Force

(b)(1)
1.3(a)(1)

(b)(1)
1.3(a)(1)

DELETED

2.4 NUCLEAR TARGETING POLICY REVIEW

A comprehensive reexamination of NUWEP-74 and its ramifications was initiated in 1977 in accordance with Presidential Directive 18 (PD-18). Commonly referred to as the Sloss Report (for its principal architect, Leon Sloss), the Nuclear Targeting Policy Review (NTPR) was completed in August 1978. The main body of its proposals was formally approved by the National Security Council (NSC) and the President in 1980, although the SECDEF had already directed selected implementation of some measures as early as January 1979.

2.4.1 General

(b)(1)
1.3(a)(1)

DELETED

2.4.2 Building Blocks

DELETED

(b)(1)
1.3(a)(1)

(b)(1)
1.3(a)(1)

DELETED

2.5 PD/NSC-59, "POLICY GUIDANCE FOR THE EMPLOYMENT OF NUCLEAR WEAPONS "

(b)(1)
1.3(a)(1)

DELETED

2.6 REVISED "POLICY GUIDANCE FOR THE EMPLOYMENT OF NUCLEAR WEAPONS

(b)(1)
1.3(a)(1)

DELETED

(b)(1)
1.3(a)(1)

2.7 NSDD-13/NUWEP-82

(b)(1)
1.3(a)(1)

2.8 NUCLEAR RESERVE FORCE (NRF)

(b)(1)

1.3(a)(1)

SECTION 3

NUCLEAR RESERVE FORCE CONCEPTS

3.1 INTRODUCTION

(b)(1)
1.3(a)(1)

DELETED

3.2 CURRENT NRF GUIDELINES

3.2.1 Purpose and Mission

In general, the NRF serves the same objectives as all other elements of U.S. nuclear forces. The primary goal is deterrence, and the NRF makes a particular contribution to deterrence by demonstrating a viable post-attack coercive capability. However, should deterrence fail, then the NRF would be available for employment, as required, for the following objectives:

(b)(1)
1.3(a)(1)

DELETED

To achieve these objectives, the NRF must be capable of effective employment against a broad range of targets on both a planned and an ad hoc basis.

3.2.2 Target System

(b)(1)
1.3(a)(1)

DELETED

3.2.3 Command and Control

(b)(1)
1.3(a)(1) + (2)

DELETED

3.2.4 Composition and Size

(b)(1)
1.3(a)(1)

DELETED

Page 3-3 is deleted.
(b)(1)
1.3(a)(1) + (2)

3.2.5 Constitution

(b)(1)
1.3(a)(1)

DELETED

3.3 ROLE OF THE NRF

3.3.1 General

The concept of the NRF as an expanding force composed of both strategic and theater (or tactical) weapons systems raises some interesting questions regarding its likely use in a post-SIOP scenario, particularly in the event of extended conflict. These issues will be explored in some detail in Sections 4 and 5. As background for that examination and to provide a basis for the later analysis regarding TLAM/N, the role of the NRF and its relationship to other aspects of the nuclear weapons planning and employment process are described below.

3.3.2 Nuclear Weapons Systems

(b)(1)
1.3(a)(1)

DELETED

---

* Sometimes called "central systems," that is ICBMs, SLBMs, and strategic bombers, also known as the "Strategic Triad."

Page 3-5 is deleted.
(b)(1)
1.3(a)(1)

(b)(1)
1.3(a)(1)

DELETED

The inherent characteristics of strategic systems (long range, multiple warheads, large yield) fit them best for strikes against fixed targets. Conversely, tactical--or theater--systems are generally short range, single warhead, and lower yield, thereby providing a more flexible capability to strike either fixed or mobile targets.

3.3.3 Nuclear Weapons Employment Planning

Figure 3-2 illustrates the relationship between the various nuclear phases of conflict and employment options for both strategic and tactical nuclear weapons, showing when the SRF and the NRF will be utilized.

(b)(1)
1.3(a)(1)

DELETED

Pages 3-7 through 3-9 inclusive are deleted. (b)(1)
1.3(a)(1)(2)

(b)(1)
1.3(a)(1)

These basic differences in planning concepts and philosophy for strategic and theater systems have a decided bearing on the potential employment of the NRF.

3.3.4 Target Data Base

(b)(1)
1.3(a)(1), (2), + (4)

(b)(1)
1.3(a)(1)+(2)

DELETED

Figure 3-3 shows the relationships among these target data bases and various employment options: SIOP, theater (under selective release and GNR), and reserve force (SRF and NRF). As indicated in the figure, new targets could be added to the target base in a dynamic conflict situation, either as a result of new intelligence or because of a new threat capability. At the same time, during extended conflict in a post-SIOP world, "additional targets" might develop in areas not currently included in the data base.

3.3.5 Strategic vs. Theater Orientation for Reserve Forces

(b)(1)
1.3(a)(1)

DELETED

Pages 3-12 through 3-15 inclusive are deleted.
(b)(1)
1.3(a)(1)+(2)

SECTION 4

STRATEGIC CONTEXT FOR THE NUCLEAR RESERVE FORCE

4.1 INTRODUCTION

> "In strategy . . . decisions must often be based on direct observation, on uncertain reports arriving hour by hour and day by day, and finally on the actual outcome of battles. It is thus an essential condition of strategic leadership that forces should be held in reserve to the degree of strategic uncertainty." Clausewitz: On War: Book 3, Chapter 13.

The two principles which influenced Clausewitz' definition of the role of a strategic reserve--the importance of the concentration of force and the impact of uncertainty--are also relevant to considering the requirement for nuclear reserve forces in deterrence and operational planning. Historically, U.S. nuclear strategy was at first most concerned with the massive application of force and less with the subsequent uncertainties. Indeed, many of the classical U.S. nuclear strategists discounted the possibility of coherent military operations after an initial nuclear exchange (though it should be noted that the exchange--or, in the early days, unilateral attack --was expected to stretch over a prolonged period of days, if not weeks). They therefore saw little need for military preparations to deal with this possibility. More recently, however, Soviet attainment of nuclear parity and the long-standing concern of Soviet military thinkers with continued military operations after an initial use of nuclear weapons have combined to increase attention in the West to the uncertainties inherent in the situation after a large-scale homeland-to-homeland exchange. The requirements for U.S. deterrent and warfighting capabilities related to that potential phase of a conflict have therefore come to seem of greater interest.

This shift of focus to embrace the principles that concerned Clausewitz is still incomplete. There is as yet no agreement as to the extent to which the United States requires operational capabilities in its nuclear forces to "countervail" Soviet options, including options in an extended conflict phase, either prospectively for deterrence or in the event of nuclear war. Nor is there agreement as to what military strategies for the use of such forces would best achieve the countervailing purpose either in deterrence or in wartime operations. The issue for present purposes is to define the degree and nature of uncertainty about the strategic environment after an initial use of nuclear weapons in such a way as to identify whether the needs of that environment suggest a potential role for TLAM/N in nuclear reserve forces as a robust source of both deterrence and wartime capabilities.

Traditional U.S. nuclear strategic thinking has tended to draw a sharp line between the strategic forces, usually seen as mainly committed to one or more homeland-to-homeland attacks, and the recently named "non-strategic" nuclear forces, primarily concerned with "theater" conflicts, though some of those conflicts may engage areas of the Soviet (and perhaps U.S.) homeland. There are two reasons why this traditional approach creates some difficulty with respect to the consideration of extended conflict. The first is that, *from the point of view of the U.S.* National Command Authorities (NCA), strategic decisions in the aftermath of an initial nuclear attack would still be likely to require judgments about military operations on a world-wide basis. Such decisions would have to encompass at least all areas in which U.S. military forces were previously engaged and, quite possibly, areas untouched by conflict but likely to be of significance after a nuclear war.

The second reason why these traditional distinctions between "strategic" and "non-strategic" nuclear forces cause difficulties for present purposes is that the Soviet concepts of protracted war focus especially on the continued pursuit of goals in the regional theaters of military operations after an initial nuclear exchange, using both nuclear and conventional forces.* A strategy of deterrence based on denying the Soviets any reasonable prospect of military gain must therefore deal with the case in which theater conflicts would be a primary focus of Soviet strategic efforts in an extended conflict after initial homeland attacks. For this purpose, the ability to apply U.S. nuclear forces of all kinds to theater campaigns in a way least likely to provoke Soviet retaliation against the U.S. homeland should be of particular significance.

It follows from these considerations that a useful way to approach the subject of the demands on nuclear reserve forces is to consider the worldwide strategic contexts which the United States might face, including both the homeland and regional theaters, and the strategies, operational concepts, and forces of all kinds available to achieve U.S. objectives in these contexts. It is unlikely that all surviving nuclear forces will be capable of undertaking all operations of interest during this phase of the conflict, because of the limitations of system characteristics or because of unavoidable planning constraints which affect the systems. These latter constraints should not, however, be prematurely introduced into the discussion of a new system like TLAM/N simply on the basis of conventional assumptions which might, if potential benefits were judged significant, be subject to change.

4.2 DEALING WITH UNCERTAINTIES

It may be helpful at the outset to discuss different ways to deal with the uncertainties inherent in the type of planning under discussion here. Two distinct theoretical approaches have been proposed**--a contingency

---

* See, on this subject, the SAI reports "On Protracted General War: A Study of the Nature of Conflict After a U.S./Soviet Nuclear Exchange," DNA Report Number 5481F-1, dated 18 September 1980, and "Further Studies on Protracted General War," dated Decemt 1982, both written under DNA Contract Number 001-82-C-0164. Chapter 2 of the former and Chapters 6 and 7 of the latter contain a survey of Soviet concepts and capabilities relevant to extended conflict.

** See "On Protracted General War," op, cit., Chapter 5.

approach and a capabilities approach. The first of these deals with uncertainty by specifying a range of potential situations in detail and prescribing the optimum method of responding to each. An example is the type of planning done for nuclear power plant emergencies. The second approach, by contrast, assumes that the precise situations that might arise cannot be foreseen in sufficient detail to make the contingency tree approach feasible and that the only useful advance planning to deal with them is the acquisition of generic capabilities that might be helpful in a range of situations. In terms of planning a strategic reserve in the nuclear age, the former approach would correspond to the formulation of preplanned targeting options for dedicated forces and the latter to the identification of a diverse set of force capabilities to be available for flexible tasking as events unfold. Of these two approaches, the first is clearly easier to undertake, but less adaptable to the unforeseen, while the second is more likely to yield the required capabilities in a situation of high uncertainty but much more demanding in terms of forces and C^3I.

(b)(1)
1.3(a)(1)

DELETED

The nature of the uncertainties involved should be carefully defined. Both the number of nuclear weapons and the targets for them are likely in general to be relatively well-established at the start of a war on both sides. Some uncertainties will of course exist--weapons system reliability and performance are unlikely to be precisely as expected and target characteristics are unlikely to be exactly as estimated. Nevertheless, in both areas the quantities involved are finite and the changes in them calculable. The most important uncertainties are likely to concern the strategic impact of different modes of application of nuclear force and the information available to both sides at any given time about the status of both targets (attacked and not yet attacked alike) and forces. Thus, it is in the areas of intelligence and assessment and in the practical conclusions to be drawn therefrom that the greatest uncertainties are likely to lie and the need to cope with them is likely to be the most acute. It is for this reason that the capabilities approach is likely to be more useful. Of course, if prewar estimates of behavior prove accurate, the ease of execution of options derived from anticipated contingencies could confer great advantages on the NCA in an extreme situation.

4.3 THE NUCLEAR RESERVE FORCE IN THE LIGHT OF POTENTIAL U.S. OBJECTIVES AND STRATEGIES

The range of potential U.S. objectives, even in the nuclear phase of a war, is a broad one. While some of these objectives may be rated as considerably less plausible than others, there are at least a substantial number of them that must be taken into consideration in examining alternative strategies and corresponding force requirements.

Broadly speaking, U.S. objectives, as seen from the NCA's point of view, would be likely to fall into one of three categories: objectives relating to the course of the war itself, objectives relating to the termination of the war, and objectives relating to the post-war situation. In the first category, a primary objective would be likely to be the avoidance of further attacks, and especially nuclear attacks, on the U.S. homeland and, at least in some degree, on allied territories. In the second category would be objectives of at least two different kinds. First would be military objectives that would dispose the Soviets to accept the futility of continuing the war. Examples would be the creation of favorable military situations in theaters of operations, the destruction or disruption of key enemy military supply and support facilities, or the disruption or destruction of the enemy's national command structure. Second would be objectives related to the creation of situations which would make an early Soviet decision to end the war more likely or easier. Examples might be the achievement of pauses in the fighting, or in nuclear attacks, designed to permit time for decision and discussion free from the pressures--and ambiguities as to enemy interactions--created by continuing nuclear attacks. In the third category might be the protection of access to key areas of the world, the maintenance of some nuclear capability for the purposes of post-war deterrence, or the achievement of a stringent nuclear arms limitation regime.

These three categories of objective can obviously either overlap or conflict with one another in terms of the strategies and operations they suggest. For present purposes, however, the need is to consider the range of possibilities and to assess their implications for the Nuclear Reserve Force requirements and associated C^3I and, therefore, for the potential role of TLAM/N as a part of that force. An initial approach to the relationship between potential objectives and capabilities is to identify a range of capabilities and identify, in the light of a set of alternative strategies and operational contexts (or scenarios), the type of objectives that each would plausibly permit the NCA to pursue. The following three subsections discuss, in turn, alternative capabilities, strategies, and operational contexts as the basis for the subsequent analysis.

4.3.1 The Definition of Alternative NRF Capabilities

In defining differing levels of NRF capabilities (or, more generally, surviving or reconstitutable nuclear force capabilities executable over a defined period of time), weapons systems and C^3I capabilities need to be considered separately. For the sake of simplicity, it is convenient initially to distinguish between three levels of capability--good, moderate, poor--in each category.

In terms of weapons systems, consideration of the three levels focuses on the potential contribution of different numbers of TLAM/N as part of the mix of U.S. nuclear weapons and delivery systems surviving after an initial large-scale nuclear exchange. The "poor" level means the survival of less than 1,000 weapon and delivery systems.* The "moderate" level means 1,000-3,000 surviving weapon and delivery systems, and the "good" level 3,000+ surviving weapon and delivery systems. These three levels reflect a range of situations in which the NCA would be faced with quite different strategic choices.

Several dimensions of C^3I capabilities are relevant to the consideration of objectives and strategies. Perhaps the most important of these for present purposes is the degree to which the NCA remains capable of effective control and direction of nuclear force operations, particularly of attacks on the Soviet homeland. The potential irreconcilability of certain U.S. objectives suggests that the NCA would wish to have all relevant U.S. military and political actions coordinated at the highest possible level, ideally by the NCA. Even if a high degree of centralized control were not possible in terms of the planning and execution of nuclear attack options, some NCA guidelines as to what weapons could be executed by subordinate levels of command during specific intervals of time and against specific categories (functional or geographic) of targets would be desirable. Without some such control over at least those surviving nuclear forces capable of striking Soviet homeland targets, attempts to terminate hostilities would run a high risk of being undercut by local initiatives in one or more theaters of operations. It is important to note that the C^3 links between the NCA and the

---

* Very short range weapons (i.e. less than 150 km) and naval ASW, ASuW and AAW systems will not be included here since their inclusion would do little more than unnecessarily complicate an analysis which is mainly concerned with middle to longer range land attack systems. They could easily be introduced if necessary at a later stage. However, all bombs should be included, as should all surface-to-surface missiles with longer range.

theater need to be two-way for fully effective operations, particularly in support of NCA decisions about nuclear operations designed to support military objectives in the theater. This point is especially relevant to the discussion below about alternative strategies.

Against this background, the three levels of two-way NCA-to-theaters C^3I capabilities that are used initially to define alternative cases are as follows. "Good" signifies a continuing ability on the part of the NCA to exercise command and control over surviving nuclear forces and to execute them within a reasonable period of time (less than 48 hours) against targets both in the Soviet homeland and in regional theaters, allowing, for example, fusion of national-level and theater-level intelligence and strike-planning against targets of high priority to the theater commanders. "Moderate" signifies a limited ability on the part of the NCA to direct the course of nuclear force operations over time intervals of 3-7 days, principally by means of authorizing theater commanders to execute nuclear strikes within specific time and geographic guidelines on the basis of only limited information about the military situations in the theaters. "Poor" signifies essentially no ability on the part of the NCA to direct the course of the nuclear battle, except over long periods of time (1 week+) and in the most general terms. Within each of these categories there is obviously scope for varying a range of other dimensions related to C^3I, such as levels of target acquisition and engagement capability, retargetability of weapons delivery systems, and so on.

There are therefore, in the approach taken here, nine primary cases of interest which can be represented in the matrix shown in Figure 4-1. These nine cases do not incorporate variables concerning Soviet capabilities (e.g. what surviving Soviet C^3I capabilities over theater operations might be). This is an additional dimension which needs to be taken into account in the analysis.

		U.S. C^3I CAPABILITIES (NCA-TO-THEATERS, TWO-WAY)		
		GOOD (1-2 DAYS)	MODERATE (3-7 DAYS)	POOR (1 WEEK +)
U.S. NRF CAPABILITIES (SURVIVING/ RECONSTITUTABLE U.S. NUCLEAR STRIKE SYSTEMS)	GOOD (>3000)			
	MODERATE (1000-3000)			
	POOR (<1000)			

Figure 4-1. Representative NRF and C^3I capabilities.

Of the nine cases, the "poor-poor" case and the "good-good" case are probably of least interest for present purposes, since the former is not a good basis for future planning (important though it may be to understand its significance) and the latter is an ideal about which it is premature to think even for the 1990 time-frame of this study (desirable though it would be as an outcome of current improvement programs). The good C^3I/poor NRF case also seems of lesser interest because it is inherently somewhat implausible that a good C^3I capability would exist after an attack that destroyed most residual weapons. These three cases are shown as shaded in Figure 4-1. The remaining six cases are the most important for present purposes, since they represent the most plausible, or at least attainable, cases during the period in which TLAM/N is being introduced into the force.

4.3.2 Alternative U.S. Strategies*

Each of these different levels of U.S. NRF capabilities is compatible with a number of different strategies for the conduct of military operations. As used here, the term strategy is carefully distinguished from both tactics and the operational level of warfare, long familiar in the Soviet literature as "operational art" and embodied in U.S. Army doctrine in FM 100-5 as revised in August 1982. The definitions from FM 100-5, which are consistent with those used in this report, are worth reproducing here.

> Military strategy, operational art, and tactics are the broad divisions of activity in preparing for and conducting war.
>
> Military strategy is the art and science of employing the armed forces of a nation to secure the objectives of national policy by application of force or the threat of force. Military strategy sets the fundamental conditions for operations. . . .
>
> Operational art is the intermediate level of war between military strategy and tactics. The operational level of war makes use of available military resources to attain strategic goals within a theater of war. Most simply, it is the theory and practice of large unit. . . operations, the use of battles and their results to attain a major military goal. . . .
>
> Tactics are the specific techniques smaller units use to win battles and engagements.**

In this section, the primary focus is on types of military strategies. Many aspects of operational art and tactics will be discussed in subsequent sections.

---

* This section draws heavily on a corresponding section of the SAI report 'Extended Conflict and C3 Architectures' dated 22 November 1982 and prepared for the Defense Communications Agency under contract DCA110-79-C-0036.

** FM 100-5, Operations, August 1982.

A strategy is in effect a concept of leverage over the enemy, for example, the general plan by which one hopes to induce the enemy to cease hostilities on conditions favorable to oneself while minimizing the risk of additional damage to one's own homeland. The goal of minimizing damage to oneself has always been a preoccupation of strategy. There are, in theory, several ways in which it can be achieved, including the exercise of restraint and the adoption of an offensive damage limiting approach. But the advent of an assured intercontinental nuclear second strike capability in Soviet hands has resulted in an important change in the conditions under which the United States might have to pursue such a goal. These new Soviet capabilities elevate damage limitation to a central position in the concerns of strategists. Some argue that it is the overriding goal of the U.S. leadership and induces them to abandon all their other goals. In one variant of this view, the only practical option in the face of a continued Soviet nuclear threat is to seek an immediate end to hostilities, if necessary by capitulation in the face of a resolute adversary. Without accepting this latter view, a central role must be attributed to this goal in the determination of what alternative strategies and military operations might realistically be undertaken by the United States in a wartime situation.

Three "pure" types of strategies relevant to extended conflict can be suggested:

- Counter-society coercion
- Counter-military coercion
- Theater dominant.

As their names imply, counter-society coercion and counter-military coercion strategies are designed to operate on the enemy's will. A theater dominant strategy is aimed at achieving a direct military solution to actual or potential theater conflicts. The different concepts of leverage over the enemy embodied in the three strategies have significant implications for the forces and C^3I required to support them. Before discussing each type of strategy in more detail, two general comments should be made. First, hybrid strategies, consisting of a combination of pure types, are possible. Second, all strategies can be pursued in a relatively restrained or an unrestrained manner. The degree of restraint adopted or desired is a key variable which has significant operational implications for nuclear reserve forces. Different levels of restraint are featured in the scenarios outlined later in this Section.

The following sections describe the concept and primary characteristics of the three pure types of strategies and the model of Soviet behavior on which the success of each is contingent.

4.3.2.1 <u>Counter-Society* Coercion Strategy</u>. Counter-society strategy has been a classic feature of Western (though not Eastern) strategic thought in the nuclear age. Indeed, it is the only strategy which has ever been used in nuclear war, and counter-society operations continue to have a central, though increasingly contested, role in Western thinking about deterrence. The fundamental concept of a counter-society coercion strategy is to break the Soviets' will to continue the war by threatening the destruction of and, if necessary, progressively destroying elements of Soviet society unless the war is ended. (The massive attack of societal targets is a reflection less of a strategy than of an abdication of strategy.) This strategy is most plausible in two contexts: first as an end to an extended conflict in which extensive damage was done to both sides' military forces, theater conflicts were going badly for the United States, and the United States had no other strategy it

* The term "counter-society" is used here in place of the more familiar "counter-value" since the latter can misleadingly imply that non-military targets represent the only things of value to the enemy. In fact, both non-military and military targets represent values. A central issue for strategy is what the relative priority of those values is for a given enemy at a given time.

could hope to pursue effectively and faced only the alternative of surrender; second, in a situation in which the Soviets employed such a strategy. It is the type of strategy consistent with the "poor" C^3 case. Even if pursued in a highly restrained manner, this type of strategy carries a very high risk of provoking an escalation of Soviet attacks on the United States. Thus its credibility is substantially lower in an age of nuclear parity than it was in the age of overwhelming U.S. strategic superiority.

This type of strategy assumes that certain non-military aspects of Soviet society have high enough value to the Soviet leadership that they would prefer to avoid additional damage to themselves, rather than to engage in a further coercion campaign against the United States, even at the cost of accepting frustration of their objectives in the war. Such a model of Soviet behavior might apply to two situations. First is a situation in which the Soviets believe that they hold the upper (but not decisive) hand in important theater conflicts and are willing to rely on consolidating their advantage by political means after the end of the war, rather than running the risk of further homeland damage during the wars. Second is a situation in which they are so fearful of loss of societal cohesion that they are prepared to abandon their other goals in the war.

4.3.2.2 Counter-Military Coercion Strategy. This type of strategy reflects the application of classical Clausewitzian principles. As Clausewitz wrote, "to disarm him (the enemy) must always be the aim of warfare" (On War, Book 1, Chapter 1). In the nuclear age there are two variants of this type of strategy--counter-nuclear and general counter-military.

A counter-nuclear coercion strategy operates on the enemy's will to continue either the homeland conflict or any theater conflicts. It is based on the premise that the enemy believes that nuclear weapons are militarily decisive and that, consequently, superiority in nuclear forces represents a dominance which even local conventional superiority cannot offset. It follows that the threat to destroy those forces or to render them unusable (e.g. by disrupting their control systems) and, if necessary, the execution of that threat would significantly affect the enemy's will. Expanded homeland attacks are deterred under this strategy by retention, at a minimum, of a strong counter-society capability and an avoidance of attacks on (or heavy collateral damage to) societal targets. This strategy is most appropriate in two situations. First is a situation in which the Soviets are evidently pursuing a similar strategy. Second is a situation in which the United States is able, while retaining a viable reserve, to bring the Soviets' surviving nuclear forces rapidly (i.e. over a period of weeks at the longest) to a level so low that they pose no significant threat to the United States. Near-to-mid term technology offers little prospect that such a U.S. capability can be achieved against SSBNs, mobile ICBMs, or bombers with tactical warning. Disruption of Soviet C^3I sufficient to disable these forces would substitute for the rapid destruction of the forces themselves, but at a high risk of provoking the Soviets to escalate the homeland attacks.

This strategy is not, *prima facie*, a particularly attractive one for the United States in present circumstances, in which the Soviets have an assured second strike capability. However, it has featured repeatedly in Western strategic thought, most recently in the ideas of Paul Nitze on possible Soviet coercive strategies against the United States. It assumes that the Soviets, in calculating the correlation of forces, attribute such weight to nuclear forces that, if facing a declining trend or if placed at a substantial disadvantage in surviving (or surviving and usable) nuclear forces, would prefer to settle for terms favorable to the United States rather than to escalate to a counter-military or counter-society coercion strategy.

A general counter-military coercion strategy operates on the enemy's will to continue either the homeland or theater conflicts by the progressive destruction of Soviet nuclear and conventional military power on a world-wide basis if necessary. Expanded homeland attacks are deterred under this strategy by the retention of a strong counter-society capability and avoidance of attacks on such targets. This type of strategy is most appropriate in situations in which the Soviets are aiming to achieve the total defeat of the United States world-wide or are pursuing a similar strategy themselves. However, if pursued strenuously this strategy has the prospect of being hard to distinguish from a counter-society strategy, and involves a high risk of provoking the Soviets to escalate their attacks against the United States.

This type of strategy assumes that a deteriorating correlation of military forces would lead the Soviets to settle for terms favorable to the United States, rather than to escalate to expanded homeland-to-homeland attacks.

4.3.2.3 Theater Dominant Strategy. This type of strategy has been poorly addressed by classical Western strategic thinking, which has tended to ignore the theaters once a homeland exchange has been introduced. It is much more prominent in the Soviet strategic literature. This strategy aims at a direct military resolution of any nonhomeland conflicts, with the expectation that this would also terminate the homelands conflict. All available military forces, including long range nuclear forces, would be used in regional theaters to achieve satisfactory outcomes in those theaters, subject to the restraint options selected. "Horizontal escalation," including attacks on theater-related military targets in previously non-belligerent theaters, is at any time a possible tactic consistent with this type of strategy, provided the motive is to influence the military balance in those theaters directly rather than to achieve indirect results by means of coercion of the enemy's will (in which case the strategy would be counter-military coercion).

Many of the targets of interest in a theater dominant strategy would, therefore, be the same as those of interest in a counter-military coercion strategy. The critical differences between the two are in the targets which are not of interest in a theater dominant strategy and in the concept of leverage over the enemy in accordance with which military operations are planned and conducted. Under a theater dominant strategy, attacks are made only on operational military targets which have a bearing on the military situation in a region. Thus, no attacks are made on societal targets, national leadership, war supporting industry, or intercontinental nuclear forces and C^3I. Although this last set of targets could be used offensively, attacks on them would be inconsistent with the fundamental concept of the strategy, which is to minimize Soviet attacks on the United States by the limitation of U.S. attacks on the enemy homeland. Expanded homeland attacks are deterred by the retention, at a minimum, of a strong counter-society capability and avoidance of attacks on (or heavy collateral damage to) such targets. This type of strategy is most appropriate if the origins of the conflict and the basic U.S. objectives are theater-related.*

An important feature of this strategy is that it attempts to exploit to Soviet disadvantage a geographic asymmetry between the United States and the Soviet Union which in other ways (e.g. ease of resupply of the theaters) tends inherently to favor the Soviets. Since the major regional theaters of interest border on Soviet territory and not on U.S. territory, the Soviet homeland has many more theater-related military targets than the U.S. homeland. By combining a willingness to threaten and, if necessary, attack these (with restraint if possible) with the continual threat of larger and less restrained attacks on the Soviets' central military and societal assets, the United States has a form of psychological leverage on the Soviets which could exercise a valuable deterrent function and, in a conflict, could place the decision for further escalation during the war on the Soviets.

---

* One special case of a theater dominant strategy needs to be mentioned: domination of the homeland theater by direct military means (i.e. rendering the enemy incapable of pursuing the homeland war by disarming him of relevant weapons). The technical infeasibility of achieving this in present or likely future conditions, however, means that operations of this kind can most usefully be seen as concerned with coercion rather than with the actual achievement of "theater-dominance."

This type of strategy assumes that, even if confronted with frustration of their objectives in one or more theaters and despite possibly repeated U.S. nuclear attacks on military targets in the Soviet Union directly related to theater operations, the Soviets prefer to settle on terms favorable to the United States (e.g. stalemate or restoration of status quo ante) in the theaters of conflict rather than to escalate to expanded homeland-to-homeland nuclear attacks.

4.3.2.4 Hybrid Strategies. With the changing fortunes of war, strategies will almost inevitably change. Hybrid strategies, in which one pure type of strategy is pursued either in combination with another or in succession to it, must therefore be considered. One feature of many hybrid strategies is the tit-for-tat exchange, or condign response. A case can be made that a distinct strategy of condign response exists. Certainly tit-for-tat strikes are prominent in Western strategic thought and this concept underlies deterrence strategies such as that of "countervailing." However, at least in terms of warfighting and arguably in terms of deterrence, condign response misses the critical concept of using military operations to achieve political or military objectives, which is the essence of any strategy. In this sense, tit-for-tat is more an abdication of strategy, than a strategy. By contrast, it is an important element of operational art in the nuclear context. Accordingly, condign response is not treated here as a distinct type of strategy, though the plausibility of such exchanges as a feature of the operational level of warfare is recognized, as are the potential demands they impose on forces and C^3I systems.

4.3.2.5 Strategies, the NRF and TLAM/N. The identification of alternative strategies which the U.S. NCA might choose to pursue in an extended conflict helps define the operational requirements which might be placed on the Nuclear Reserve Force. No single strategy can be selected beforehand as the only one of which planning should take account, although below certain minimum levels of surviving force and C^3I capability, not only would options for restraint under several of the types of strategies be foreclosed, but some of the strategies themselves (e.g. the theater dominant strategy) might well be unrealistic. However, the range of possible strategies can be used to identify generic capabilities in the forces and C^3I which would be valuable for operations to support different strategies and, in particular, to assess those operations for which TLAM-N is well suited and those deployment and operational modes which prove most suitable for these purposes.

Two requirements for nuclear reserve forces are immediately apparent from the discussion of the different strategies. The first and most obvious is the requirement to retain the capability to threaten, and if necessary attack, a range of societal targets in the Soviet Union. This capability is needed for deterrent purposes for at least as long as the Soviets retain a similar capability against the United States. As has been suggested above, there are different ways in which this threat can be made, ranging from a single massive counter-societal attack to a phased series of "restrained" counter-societal attacks designed to increase the pressure on the Soviets. While the ultimate execution of any such attacks may seem highly improbable, and planning on this basis is increasingly the object of both informed and popular criticism, the threat of counter-society attacks can arguably be said to be more credible if options other than a single large attack are manifestly available.

(b)(1)
1.3(a)(1)

DELETED

(b)(1)
1.3(a)(1)

In both these roles, the particular characteristics of TLAM/N, especially on nuclear-powered submarines, provide some important advantages. Endurance, invisibility, and capability for discriminate and accurate targeting are all be characteristics that enhance the threat of restrained attacks, whether counter-societal or, in the post-war case, counter-military. Some of these same characteristics are also inherent in SLBMs. However, the lack of accuracy and the MIRVed nature of existing and prospective SLBMs make them less suitable than TLAM/N for certain of the tasks implied by these two NRF roles.

Beyond these roles, however, it becomes harder to generalize about the operational requirements for the NRF, and for TLAM/N as a part of it, in the different strategies. For the purpose of analyzing this problem, it is necessary to consider more specific operational contexts. These will be discussed in Section 6.

4.4 AN ANALYTICAL APPROACH TO NRF SCENARIOS

Scenarios, or operational contexts, are indispensable to the analysis of issues connected with the NRF. Their primary purposes are to set plausible and analytically interesting starting conditions for NRF operations and to propose a strategically reasonable set of actions by both sides on the basis of those conditions and leading to a cessation of hostilities. Thus the scenarios reflect a set of postulates or assumptions which affect the objectives, strategies and operational choices for all the belligerent countries and define the forces available to them at the time the NRF is constituted. One particularly important feature of the scenarios or operational contexts is that they provide an analytical framework for ensuring that the postulates and assumptions concerning the actions of both sides are mutually compatible and that the set of scenarios chosen spans the cases that are of interest for analytical purposes.

Section 4.3.1 suggested an initial set of postulates about alternate levels of NRF capabilities which it would be desirable to take as a basis for analysis. However, as was noted in that section, those postulates in themselves are not sufficient to define the set of operational contexts needed for analysis. These contexts need to be further defined in terms of the surviving Soviet capabilities corresponding to the different levels of U.S. NRF capability, the nature of the nuclear exchanges that have taken place, and other relevant aspects of the war up to the constitution of the NRF, including its geographic scope and intensity. Without this further definition, not only would analysis be impossible, but the plausibility of the chosen cases would be suspect. For the purposes of this study, the operational contexts of interest are all taken to involve worldwide U.S./Soviet conflict. This is not to say that limited war scenarios are not of interest in connection with TLAM/N. However, the most stressing case for TLAM/N is worldwide conflict, conceivably originating in a limited war in one theater, but spreading to engulf U.S. naval assets around the globe.

For the purposes of this analysis, the pre-NRF phase of war is broken into three periods of interest. First is the prewar period. The only importance of this period is the definition of the forces and other capabilities available at the start of the war. Second is the period of conventional fighting. Here too, many potentially complicating details are ignored and the focus maintained on the demands on (and losses of) TLAM/N platforms and C^3I imposed by the conventional engagements and on the objectives and strategies of the two sides. The major relevant variables here are the length and intensity of the conventional phase, especially as it affects TLAM/N availability and potential TLAM/N targets. Third is the pre-NRF nuclear phase, including both limited and large scale nuclear operations.* Here again, the precise details are largely subsumed by the postulated alternate levels of NRF capability. But the scale, scope and intensity of initial nuclear hostilities are obviously of great potential importance.

In terms of the pre-war period, this study focuses on forces projected to be available to the two sides in 1990, as are described in more detail below. In terms of the initial period of conventional hostilities, three different scenarios are used, derived from the three proposed canonical scenarios for protracted war analyses in the SAI study "On Protracted General War: A Study of the Nature of Conflict after a U.S./Soviet Nuclear Exchange"**. For present purposes, however, these three scenarios are generalized somewhat so as to highlight the fact that they reflect conventional conflict phases of distinctly different lengths--7 days, 30 days, and 90 days--and intensity. They thus span a range of possibilities in terms of the exposure of TLAM/N platforms to attrition in the pre-nuclear phase of the war.

In terms of the initial nuclear phase of the war, up to the time at which the NRF is constituted, all three scenarios involve Soviet first use, in two cases in preemption of an intended U.S. attack. In all three cases, a major SIOP option and a corresponding large-scale Soviet attack are assumed to

---

* Variants which involve limited initial homeland attacks need not, however, be analyzed and spelled out for present purposes, since it is a fundamental assumption of this study that the NRF is constituted at some point and, therefore, that one or more SIOP options are executed. (The third of the scenarios used in this study exemplifies this point.) Thus it is sufficient to consider the cumulative results of a sequence of attacks which start with a limited homeland attack and end with the execution of a major attack option in terms of their impact on the availability of forces and C^3I and the existence of targets of interest for NRF weapons at the time at which the NRF is constituted.

** "On Protracted General War", Op. cit.

have been executed, both on a world-wide basis. It is important to note the range of potential variants of these assumptions. In the first place, the scale of initial exchanges both in the homelands and in the theaters obviously has some bearing on the targets which would be suitable for TLAM/N. For example, the initial exchanges might include either small- or large-scale attacks in all the regional theaters or, alternatively, might be concentrated only in a single theater (e.g. Europe). Likewise, the initial homeland attacks might be confined primarily to nuclear threat targets or consist of more extensive counter-military attacks, with greater or lesser inclusion of national C^3 assets. Depending on which of these cases occurs, the strategies and strike options of relevance in the protracted phase of the war would be quite different. The three scenarios used here are designed to illustrate this point.

In terms of the phase of the war after the NRF is constituted, the three scenarios are designed to explore a range of different possibilities, both in terms of the strategies of the two sides and in terms of their military operations. All three assume this phase of the war lasts between 2 and 4 weeks. The primary reason for this is that prior analysis has suggested that more extended scenarios become increasingly implausible and that consideration of the capabilities relevant to operations in the first days or weeks of a nuclear war is in any case the most immediate requirement. Were the United States to possess such capabilities, it would be likely also, _ipso facto_, to have some capabilities relevant to a more extended war.

One important consideration in all scenarios of this kind is the set of assumptions used concerning counter-C^3I attacks by both sides, affecting both land- and space-based C^3I systems. In the methodology used here, with the nine primary cases for analysis being defined in part by postulating three alternative levels of surviving C^3I capabilities at the time of constitution of the NRF, detailed specification of the events leading up to this situation are largely unnecessary. However, in subsequent analyses focused more on the

C^3I issues associated with TLAM/N, this aspect of the scenarios will need to be addressed in more detail.

It is useful to outline the three scenarios. The force postures and operational concepts associated with the scenarios are developed in detail in Section 6.

4.5 SCENARIO 1: 7-DAY CONVENTIONAL PHASE

This scenario, which is derived from Scenario 1 in the earlier SAI study, is a classic European war scenario in which both the United States and the Soviet Union act as their declaratory postures would dictate. The Warsaw Pact, in a situation of growing tension along the East-West division in Central Europe, launches a massive conventional attack at the tail end of an exercise. The Warsaw Pact offensive is relatively successful and, on D+7, NATO decides to execute a number of battlefield and interdiction selective employment plans (SEPs) against WP tactical forces in an attempt to prevent their breakthrough and also strikes a limited number of key military targets in the Western Military Districts of the Soviet Union. This decision triggers a massive Soviet nuclear preemptive attack on D+7, involving a counter-military attack on both the continental United States and NATO targets in Europe. Nuclear hostilities also develop rapidly in the sea areas associated with the European theater. However, no hostilities develop outside the European theater and its sea environs, and no other theaters are affected by the Soviet attack. The United States, having seen the initial NATO attack partially degraded by the Soviet preemption, responds immediately on D+8 with a large counter-military attack on the Soviet Union and on WP nuclear and conventional force targets in the non-Soviet Warsaw Pact. (In the base case, the United States executes a delayed response to the Soviet attacks; in a variant, the United States could be assumed to launch under attack and therefore both execute a more effective response and retain a larger number of weapons for post-SIOP operations.) From this point, a de facto ceasefire holds in terms of attacks on homeland targets until much later in the war. By

D+15, facing renewed Soviet forward movement in Europe, the United States makes a further series of nuclear strikes in the European theater. These are unsuccessful in stopping the WP advance but do draw a Soviet response on D+19 against war-supporting industry throughout Western Europe. Faced with total defeat in Europe, the United States decides on D+20 to try to destroy the Soviet military position in other key theaters (Far East/Pacific, Sino-Soviet border, Latin America) and at sea by means of a series of nuclear attacks against key military targets. The Soviets, who have little option to change the upshot in Latin America or on the Sino-Soviet border except at high potential cost, confine themselves to a response in kind against U.S. forces and facilities in the Far East/Pacific region (on D+23). At this point, hostilities cease and a protracted lull starts.*

4.6 SCENARIO 2: 30-DAY CONVENTIONAL PHASE

(b)(1)
1.3(a)(1)

DELETED

* For reasons explained in more detail in the earlier study ("On Protracted General War", Op. cit., pp 36ff), the term "protracted lull" is preferred to "termination" since it covers a wider range of possible ways in which hostilities might come to an end.

Page 4-25 is deleted.
(b)(1)
1.3(a)(1),(4) + (5)

DELETED

(b)(1)
1.3(a)(1)

4.7 SCENARIO 3: 90-DAY CONVENTIONAL PHASE

This scenario is an example of the controlled, limited mutual coercion type of scenario described in the earlier SAI report. It is an adaptation of the theater war variant of this type of scenario presented there.* In this scenario, a major Warsaw Pact attack in Europe (similar to that described in scenario 1 above) fails in its objectives of bringing about the elimination of the U.S. military presence in Europe and the dissolution of NATO. The initial conventional campaign plays out more slowly than had been expected before the war, but after almost 3 months neither side is able to break the conventional deadlock in West Germany or willing to concede terms to the other. During that time, naval engagements gradually develop outside the European/North Atlantic area and continue on a sporadic basis when one side or the other perceives its power threatened. During the conventional phase of the war, the hardline faction in Moscow, which argues that the moment has come to deal a decisive blow to U.S. imperialism, gains in influence and finally persuades the leadership as a whole to resort to nuclear weapons on D+90. However, the initial Soviet strike is a limited one, against a small set of targets of high coercive value (e.g. power stations) in the CONUS only. (Soviet confidence in their ability to pre-empt a NATO nuclear attack in Europe is high enough that they do not feel compelled to "use or lose" their nuclear weapons there and prefer to put some intense psychological pressure on Western Europe by attacking only the United States and to leave Western European industry relatively unscathed, if possible.) The U.S. responds on D+91 with a limited attack of comparable scale on Soviet power projection force targets in Europe and the Asia-Pacific region. This response convinces the Soviet hardliners of the futility of limited measures. As a result, in

* "On Protracted General War", Op. cit., Section 3.3.3, p. 29.

D+93 the Soviets launch a large, worldwide strike against U.S. and allied nuclear threat targets of all kinds, but excluding national C^3I, which is left out in the hopes that it will facilitate a U.S. decision to terminate the war. The United States and NATO launch condign responses under attack. At this point, a lull in nuclear hostilities on land ensues, while the two sides attempt to negotiate an end to the conflict and race to muster their conventional forces to prevent the other from gaining any decisive advantage in Europe. Naval hostilities continue sporadically, with nuclear weapons of all kinds being used. With negotiations deadlocked and evidence of both sides' surviving military forces coming under acute strain, especially in Europe, a final nuclear exchange occurs on D+120, limited on both sides by the relative scarcity of weapons. This exchange reflects a U.S. attempt to destroy Soviet military capabilities in the Asia-Pacific region, including those along the Sino-Soviet border, and a Soviet attempt to sever the United States from the Asia-Pacific theater by attacking all undamaged U.S. military facilities between the West Coast and the Philippines. Following this exchange, hostilities in all theaters gradually wane. (This scenario also could have a counter-society branch added to it.)

4.8 SCOPE OF THE SCENARIOS

The extent to which these three scenarios are representative of all the scenarios of interest for an analysis of this subject can be tested in a number of ways. In the first place, earlier SAI work* establishes the general representativeness of the three types of scenario from which the three described above are derived. That study covers both the initial conflict types, the initial types of homeland attacks, and the characteristics of the protracted conflict phase. Secondly, Figure 4-2 shows how the scenarios span the range of possible cases created by alternative initial conflict durations, alternative types of nuclear strikes against the regional theaters and homelands up to the constitution of the NRF, and alternative U.S. strategies

* Ibid.

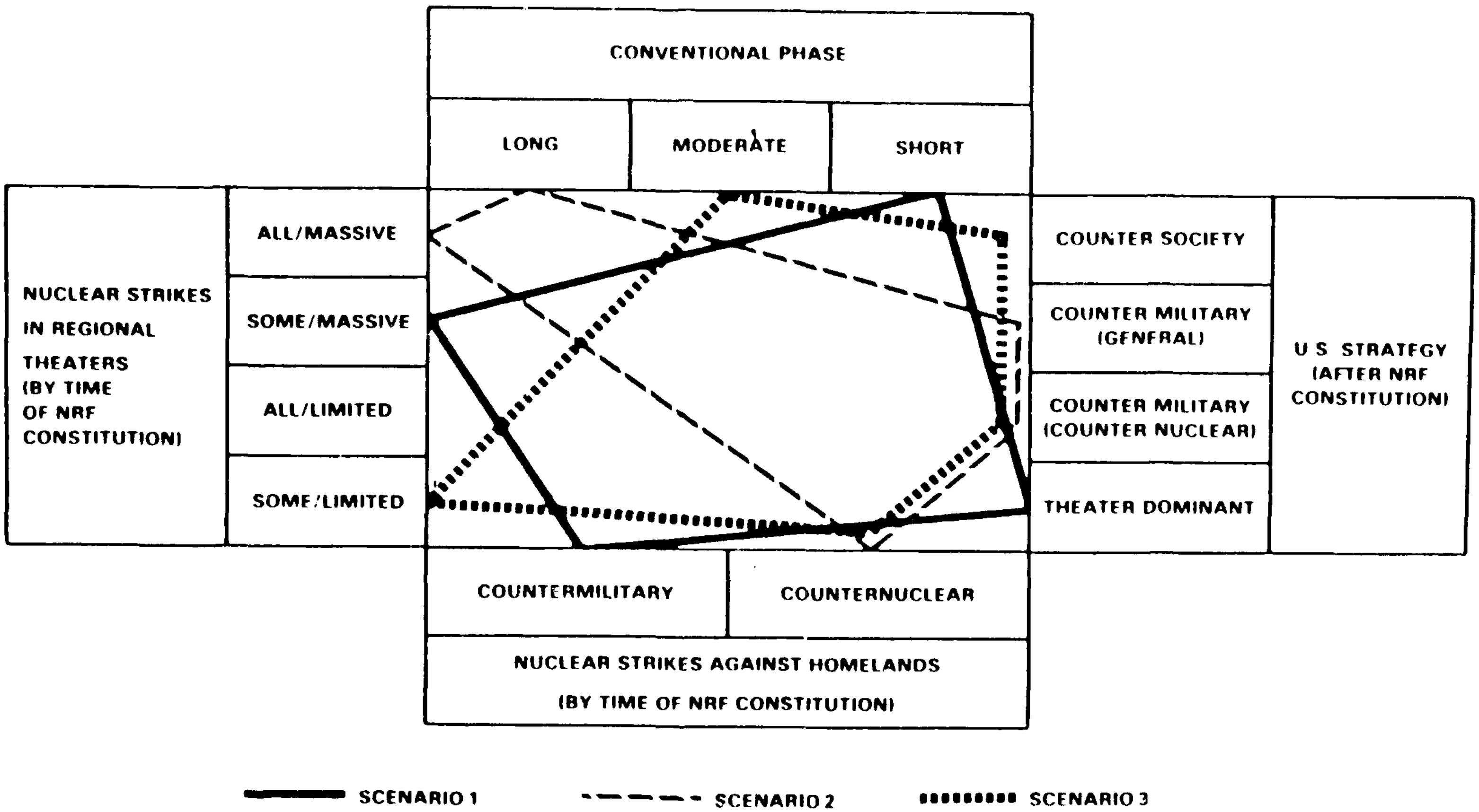


Figure 4-2. Characteristics of the three scenarios.

following the constitution of the NRF.* Thirdly, Figure 4-3 shows how the three scenarios fit into the matrix of primary cases identified in Section 4.3.1 above. In all these ways the scenarios can be seen to span the range of cases of interest.

4.9 INTERRELATIONSHIPS BETWEEN NRF SCENARIOS, STRATEGIES, AND CAPABILITIES

Inspection of Figures 4-2 and 4-3 suggest some obvious ways in which alternative strategies and different levels of NRF and associated C^3I capabilities relate to different scenarios. For example, cases involving poor surviving NRF capabilities and moderate NCA-theater C^3I are logically linked to scenarios like Scenario 2, in which the nuclear operations before the constitution of the NRF involve a counter-nuclear homeland exchange with relatively large-scale nuclear operations in one or more theaters. In this case, the NCA would in all probability be looking for a strategy which involves a high pay-off for subsequent nuclear operations in view of the relative scarcity of surviving nuclear forces. This suggests a need for well-planned and coordinated attacks against limited target sets of high value, which might well be relatively hard. This would probably be true whatever strategy the United States pursued. However, the choice of strategy obviously affects the locations of the targets of interest and the target acquisition and strike planning requirements. As a result, different NRF deployment concepts for TLAM/N and other weapon systems could be more or less well suited to undertaking the operations in question. However, the limitation on the U.S. Nuclear Reserve Force (close to the minimum needed for the basic reserved counter-society and post-war deterrence capabilities) would very likely make a theater dominant strategy seem beyond reach. Indeed, the worse the NCA-to-theater C^3I and the fewer the number of surviving weapons, the stronger would be the case for trying a counter-society strategy, as Scenario 2 suggests.

---

* Additional strategy/scenario combinations are discussed in the SAI report "Extended Conflict and C3 Architectures," Op. cit.

		U.S. C^3I CAPABILITIES (NCA-TO-THEATERS, TWO-WAY)		
		GOOD (1-2 DAYS)	MODERATE (3-7 DAYS)	POOR (1 WEEK +)
U.S. NRF CAPABILITIES (SURVIVING/ RECONSTITUTABLE U.S. NUCLEAR STRIKE SYSTEMS)	GOOD (>3000)			1
	MODERATE (1-3000)	3		
	POOR (<1000)		2	

Figure 4-3. Levels of C^3I and NRF capabilities in the three scenarios.

Other cases of moderate NCA-to-theaters C^3I capabilities--i.e. those with moderate or good NRF capabilities--would be increasingly logically linked to a theater-dominant strategy as the level of NRF capabilities increased. This is because of the inherent appeal of strategies which minimize the risk of large, indiscriminate retaliation against the U.S. homeland (or indeed allied territory) and because the C^3I regime makes a strong focus on theater operations logical.

Cases involving good NRF capabilities and poor NCA-theater C^3I are logically linked to scenarios like Scenario 1, involving a massive counter-military homeland exchange and comparatively limited theater nuclear operations--at least by the United States--possibly in only one theater. In this case, U.S. strategy is largely in the hands of the theater commanders, acting under only very general NCA guidance, and the most logical, though certainly not the only plausible, strategy in many ways is a theater dominant strategy in which the theater commanders seek to use the relatively plentiful NRF weapons to achieve a strong military position in their theaters, even if these have not been involved in large scale nuclear operations at an earlier stage. For this purpose, mobile as well as fixed targets would very likely be involved and some targets (e.g. aircraft on airfields) might be time-sensitive.

In cases of good NCA-to-theaters C^3I capabilities, the choice of strategy is obviously limited only by the level of surviving NRF capabilities. If these capabilities are also good, then the NCA has a broad range of strategic choices. If they are poor, then the NCA is looking for high pay-off options for the use of a small number of weapons not required for the "bedrock" counter-society and post-war deterrence missions. Unlike Scenario 2, in which the scarcity of weapons creates some incentive for resort to a counter-society strategy the situation in Scenario 3 combines a large number of weapons with a greater intelligence gathering and option planning capability at the NCA level, thus suggesting greater opportunity for devising and executing an effective counter-military coercion strategy. Thus the combination, in Scenario 3, of a counter-nuclear and general counter-military strategy is a logical outgrowth of the U.S. capabilities existing in that scenario.

These considerations suggest that certain combinations of C^3I and force capabilities are inherently (though not necessarily uniquely) related or predisposed to certain types of strategy. Figure 4-4 shows the matrix of primary cases developed earlier overlaid by these inherent relationships or predispositions. The figure shows that the closer the United States comes to the "good-good" case, the greater is its freedom of strategic choice. The closer it comes to the 'poor-poor' case, the closer it is to having only a counter-society coercion option. In the other corners of the matrix, the more stringent the combination of poor NCA-to-theater C^3I and weapon affluence, the greater the incentive to pursue a theater-dominant strategy, since the degree of national target acquisition and option planning for an effective counter-military coercion strategy would not exist. By contrast, the more stringent the combination of good NCA-to-theater C^3I and weapon indigence, the greater the opportunity to pursue a counter-military coercion strategy and the less the capability to pursue the (in many ways more attractive) theater-dominant strategy.

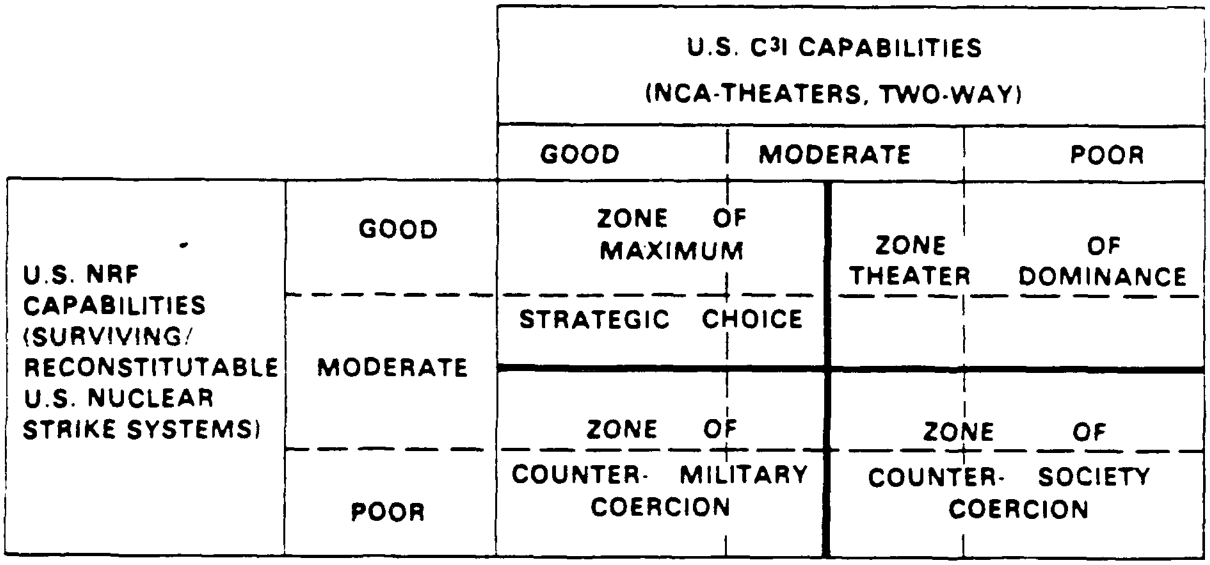


Figure 4-4. The strategy/C3I/NRF capability nexus.

4.10 NRF TARGETS AND TLAM/N

It remains, in this part of the study, to review briefly the suitability of TLAM/N for use against the different classes of targets associated with the various strategies that might govern the use of the NRF. It is apparent from the earlier discussion that the target classes of interest for each strategy are somewhat different. To analyze this issue further, the following illustrative list of target classes is useful:*

1. Urban-Industrial
2. Leadership
3. Intercontinental Nuclear Forces/C^3
4. Theater Nuclear/Biological/Chemical Forces/C^3
5. Air Forces
6. Ground Forces
7. Naval Forces

For a pure counter-society coercion strategy the target classes of interest are:

1. Urban-Industrial
2. Leadership

For a pure counter-nuclear coercion strategy, the target classes of interest are:

2. Leadership
3. Intercontinental Nuclear
4. Theater Nuclear/Biological/Chemical (if the strategy were to extend to non-homeland related nuclear forces)

---

* Obviously, each of these classes can be subdivided into smaller sets. This has been done elsewhere. See "Extended Conflict and C^3 Architectures", op. cit., Section 2.5, p. 15. For present purposes, the essential points can be made on the basis of the aggregated classes.

For a general counter-military coercion strategy, all target classes are potentially of interest (including urban-industrial, which contains war supporting industry). However, this is not to say that all classes would necessarily be attacked in any given case. Moreover, in general, battlefield and tactical targets, which are of the greatest interest to a theater dominant strategy, are likely to be of lower priority in a general counter-military coercion strategy because of their relatively low coercive value.

For a pure theater dominant strategy, the classes of interest are:

4. Theater Nuclear/Biological/Chemical

5. Air Forces (in support of actual or potential theaters of conflict)

6. Ground Forces (in support of actual or potential theaters of conflict)

7. Naval Forces

The target classes of interest to each strategy point to where the focus of attention would be in terms of targeting requirements for the NRF under that strategy. However, because a strategy could change during the course of a war, the targeting requirements would inevitably be greater than would be required just to pursue any pure type of strategy.

While there are targets in all the classes to which the distinctive characteristics of TLAM/N are well matched, the requirements of some of the types of strategies are more compatible with the system than those of others. For example, the success of the counter-nuclear coercion strategy is heavily dependent on an ability to target intercontinental nuclear forces and national C^3 nodes, many of which are likely to be either out of range of TLAM/N or mobile. The same is true of a general counter-military coercion strategy, though to a lesser extent, since other military targets, many of which would be more suitable for attack by TLAM/N, is of higher importance than in the counter-nuclear coercion strategy. By contrast, the theater dominant strategy tends to focus on military targets on the Soviet periphery, and therefore generally well within TLAM/N range. (Scenario 1 above provides a good example of this.) Even though many of these are relatively mobile tactical targets, there are inevitably a number of priority fixed targets suitable for TLAM/N, not least because of their hardness and the likely importance of minimizing collateral damage under such a strategy. The vulnerability to nuclear and non-nuclear attack of theater-nuclear assets with characteristics comparable to TLAM/N makes the latter an especially suitable substitute in campaigns oriented towards theater-dominant goals. This last point is well illustrated by Scenario 2 above, in which the Soviets attacked NATO's LRTNF before they were dispersed. In any such case, the survivability of the TLAM/N make it an attractive system.

A related point about survivability is illustrated by Scenario 3 above, in which naval hostilities, non-nuclear and nuclear, continue for a period of weeks after the SIOP phase during a lull in the ground battle, with a final nuclear exchange in the Far East. From the NCA's point of view, the ability to threaten Soviet military targets in the Far East would, in this type of scenario, be an important potential lever over the Soviet will to continue the conflict. It would therefore be important that the nuclear weapons that would back up such a threat, of which TLAM/N would be an important component, not be seen by the enemy as subject to relatively rapid attrition during an extended naval conflict. For this purpose, submarine platforms would have an obvious advantage, especially if they were, in one way or another, essentially dedicated at that stage of the war to the land-attack mission.

A final point concerns the issue of restraint, which has been referred to earlier. All the types of strategy could, and in all likelihood would, be pursued with some degree of restraint in order to minimize the risks of undesirable consequences for the United States and of undercutting efforts to terminate the war. The three scenarios described above all embody some forms of restraint, whether geographical (as in Scenario 1) or in terms of limitations on the size and scope of nuclear attacks. To the extent that the distinctive characteristics of TLAM/N can be combined with the selection of targets to indicate the desired level of restraint in the prosecution of a given strategy, this would obviously be a significant advantage from the point of view of the NCA and theater commander alike.

SECTION 5

TLAM/N EMPLOYMENT CONCEPTS

5.1 INTRODUCTION

A principal purpose of this study is to analyze the utility of TLAM/N with respect to the NRF and to examine alternative methods of operating the TLAM/N weapon system for an NRF role. NRF utilization must be studied in a broad-based context which includes the operational capabilities and characteristics of TLAM/N and other potential uses for this system. In assessing the balance between these other uses and the NRF, it is helpful to examine the various concepts for employment which have evolved as this weapon system has developed.

5.2 ALTERNATIVE EMPLOYMENT CONCEPTS

From the earliest days of Tomahawk weapon system development, three differing concepts of employment for the TLAM/N began to evolve, each driven by different operational requirements and each with its own advocates. These three concepts can be characterized as follows:

- "Nuclear Reserve Force Concept" supported by some elements of OSD, JSTPS, and others whose point of focus is at the national level.
- "Naval Force Improvement Concept," formulated by the Navy staff and supported by Navy operational commanders around the world.
- "Theater Support Concept," sponsored by the theater commanders.

The TLAM/N possesses unique employment capabilities that would help remedy existing deficiencies of interest to each of these advocacy groups. A closer look at each of these concepts, in turn, will provide an improved basis for understanding the issues involved.

5.2.1 Nuclear Reserve Force Concept

TLAM/N weapon system development began in 1972 as technology breakthrough and national interests came together to make the development feasible. The Harpoon antiship cruise missile work produced renewed interest in cruise missile systems (earlier abandoned when ballistic missiles showed distinct performance advantages over early cruise missile systems, such as the Navy's Regulus). Advanced research studies revealed three areas in which technology breakthrough made improved cruise missiles viable:

- Miniaturized turbofan engines with associated low specific fuel consumption, which could propel small airframes to a relatively long range.
- Small nuclear warheads, which could provide a small airframe with a high nuclear yield payload.
- Advanced microprocessor equipment, which permitted autonomous inflight inertial guidance system updates and resulted in very high accuracies dependent, not on the time of flight, but on the time since the last inertial platform update.

These technology advances made it feasible to develop a long-range, high-yield, accurate cruise missile. Moreover, this cruise missile could be sized for launch from existing naval submarines and surface ships and, because of its size and corresponding low observables, have high penetrability against Soviet defensive systems.

The technical feasibility of TLAM/N development. however, sparked a vigorous debate at the national level regarding the desirability of acquiring such a system as part of the national strategic nuclear force. Some, among them Dr. Henry Kissinger, were interested in developing TLAM/N principally as a bargaining chip in SALT negotiations.* Others claimed that since a whole

---

* Betts, Richard K., ed., "Cruise Missiles Technology, Strategy, Politics," The Brookings Institution, Washington, D.C., 1981, pg. 278.

family of Tomahawk missiles, both nuclear and conventionally armed, were being developed for employment against surface ships as well as against land targets, and since all Tomahawk missiles would use a common airframe and launch systems, it would not be possible to verify which of these missiles was a TLAM/N, a fact which would make arms limitations agreements more difficult. Opponents of a continuing build-up in strategic weapons argued that the TLAM/N could contribute to third world proliferation.* Other TLAM/N opponents were concerned about the creation of a "fourth leg" of the TRIAD, pointing out that cruise missiles did not have the penetrability of the existing TRIAD systems. By the late seventies, with SALT II negotiations underway and a desire at the national level to reduce strategic nuclear weapons, TLAM/N faded from interest as a strategic weapon.

Even as interest to include TLAM/N in the SIOP waned, however, the use of TLAM/N in selective release scenarios continued to be studied, and the use of TLAM/N in limited nuclear options, such as selected strikes or condign responses, received serious consideration. It has a number of important advantages in this role. For one thing, the missile system has a unitary warhead vice MIRV, and the launch of a single cruise missile would therefore be less escalatory than the launch of one ballistic missile. Secondly, the launch platform would not be stationed on U.S. soil, nor would it be subject to Allied basing constraints, and preparations for launch could be carried out covertly. The flexibility provided by these capabilities was of growing interest to the theater commanders and provided an impetus for the development of theater concepts. However, though the use of TLAM/N in selective release options would provide expanded employment alternatives at the national level, the deployment of TLAM/N based upon this mission alone did not sufficiently justify the resource allocation required, and the concept was dropped. The present interest in extended conflict and in expanding the Nuclear Reserve Force has caused a reassessment of the role of TLAM/N at the national level.

---

* Tsipis, Kosta, "Cruise Missiles," Scientific American, Feb. 1977, Vol. 236, No. 2.

5.2.2 Naval Force Improvement Concept

A long history of naval warfare has convinced the Navy of the utility of flexibility in coping with uncertainties. This approach recognizes that the specific situations that might arise cannot be foreseen in detail and that advance planning must be supported by the acquisition of generic capabilities that would be useful in a range of situations. The Navy has therefore concentrated on developing a diverse set of force capabilities to be available for flexible tasking in light of developments. In view of the history of budget constraints, this diverse set of capabilities is best obtained by procuring weapons delivery platforms that have a multi-mission capability.

This desire to maintain multi-mission platforms caused the Navy to be concerned about the original emphasis on TLAM/N as a member of the "strategic force." However, as the weapon system evolved, emphasis on TLAM/N as a potential SIOP weapon diminished (as described above), and the Navy staff showed increasing interest in the additional capabilities that Tomahawk missiles would add to both submarine and surface ships.* The Service's basic concept of multi-mission platforms and a distributed force capability seemed especially applicable to Tomahawk. Because missile development was expanded to include an anti-ship version and a land attack version, with both conventional and nuclear warheads, and since all these Tomahawk missiles would use the same airframe and launcher system, a one-time platform modification would permit the addition of all three new capabilities, a highly cost-effective measure. The introduction of land attack Tomahawk missiles would provide a distributed power projection capability to a fleet whose current capability is centered around a limited number of aircraft carriers. Soviet emphasis on targeting aircraft carriers and ballistic missile submarines would consequently have to be broadened to include all TLAM/N equipped combatants, with a corresponding increase in the survivability of the CVA and SSBN. Finally,

---

* Coker, James W., The Superwarriors, Weybright and Talley, New York; 1975, pp. 205-206.

with Soviet Naval Aviation (SNA) presenting an increasing threat to the U.S. surface fleet, the addition of TLAM/N would provide the unified and fleet commanders with an organic capability to strike Soviet airfields in the event of regional or limited wars in which strategic nuclear weapons had not yet been released. This Navy concept for TLAM/N is well documented in the CNO's "Concept for Nuclear Land Attack Tomahawk" dated 20 November 1978.

5.2.3 Theater Support Concept

As would be anticipated, the unified commander concept is an amalgam of national strategies and service capabilities. The unified commander must translate national strategies into specific theater objectives and then determine how best to utilize his limited assets to fulfill those objectives. By the early seventies, the theater commanders were faced with a dilemma. If the new balance of strategic forces against those of the Soviet Union resulted in strategic forces being reserved for use only in a global conflict involving potential or actual homeland-to-homeland exchange, how could the theater forces fulfill their more limited objectives in a regional conflict? By the mid-seventies, however, new theater nuclear options were developed which emphasized the utility of theater nuclear weapons. The TLAM/N is such a system, planned for distributed force deployment on naval ships and submarines under the operational control of the unified commander. The TLAM/N will provide a long-range capability to attack land-based facilities only partially accessible to the limited assets of naval and Air Force tactical aircraft. It will be especially useful against heavily defended targets which would cause high attrition to manned aircraft and personnel. The launch platforms are mobile and not easily targeted, thereby increasing their survivability. The utility of TLAM/N to the unified commander is well illustrated by the PACOM Theater Nuclear Force Improvement Study (TNFIS), which provides a detailed analysis of the potential utility of TLAM/N in the Pacific Command.*

* PACOM Theater Nuclear Force Improvement Study, Phase II, draft final report in 5 volumes, submitted to DNA 30 April 1982 under contract number 001-81-C-0033.

(b)(1)
1.3(a)(1)+(2)

DELETED

5.3 ASSESSMENT OF ALTERNATIVE EMPLOYMENT CONCEPTS FOR TLAM/N

5.3.1 Characteristics of the Alternatives

These various employment concepts for TLAM/N can be characterized as follows:

- Nuclear Reserve Force
  - Responsive to NCA tasking
  - Guaranteed availability post-SIOP
  - Reserved for post-SIOP use
  - Survivability, endurance, flexibiilty essential features
  - Broad target coverage important

- Naval Force Enhancement
  - Remain under fleet CINC OPCON but support theater CINC, NCA
  - Minimum interference with other missions
  - Distributed force capability for flexibility, survivability
  - Deployment on multi-mission platforms

(b)(1)
1.3(a)(1)+(2)

DELETED

(b)(1)
1.3(a)(1)

5.3.2 NRF Role

(b)(1)
1.3(a)(1) + (2)

DELETED

(b)(1)
1.3(a)(1) & (2)

DELETED

5.3.3 Theater Support Role

(b)(1)
1.3(a)(1) & (2)

DELETED

(b)(1)

1.3(a)(1)+(2)

* See the SAI study on this subject, op. cit, "Reducing Soviet Attack Incentives: Nuclear Operations Under Ambiguous Warning", Contract Number DNA 001-82-C-0168, 29 July 1983.

(b)(1)
1.3(a)(1) + (2)

DELETED

5.4 CONCLUSIONS

(b)(1)
1.3(a)(1)

DELETED

---

* Extracted from PACOM TNFIS, Phase II, Volume III, Op. cit.

** Ibid.

Pages 5-11 through 5-13 inclusive are deleted.
(b)(1)
1.3(a)(1),(2), +(4)

(b)(1)
1.3(a)(1) + (2)

DELETED

For the purposes of this study, this balanced approach was used as the basis for the remaining analysis. The question of the specific numbers of weapons to be allocated for NRF and theater use was left open until the analysis had been completed, so that recommendations could be based on the results of the investigation. This balanced approach is represented graphically in Figure 5-4.

Page 5-15 is deleted.
(b)(1)
1.3(a)(1)

SECTION 6

CAMPAIGN AND ATTRITION ANALYSIS

6.1 INTRODUCTION

Sections 2 through 4 discussed the evolution of NRF concepts and strategies and examined assigned missions for the NRF, as well as its likely target bases, constitution, composition and size. Section 5 discussed the specific role for TLAM/N in the NRF. The remainder of this study will investigate various platform operating modes and weapon loadouts to determine which mode/loadout combinations contribute most to the balanced force improvement being sought. One problem of significance that needs to be examined is the survivability of TLAM/N through the pre-SIOP phase; if the missile systems are not survivable through the major attack phase, they cannot be candidates for NRF improvement. The study approach was to perform a campaign analysis using the three scenarios defined in Section 4. Because these three postulated scenarios lead to the employment of the three major post-SIOP strategies, the full range of NCA options were covered. This campaign analysis resulted in estimated platform attrition, which was then combined with employment options and weapon loadouts to provide estimates of TLAM/N survival for the post-attack phase. This section will discuss the campaign and attrition analysis.

6.2 FORCE AND SCENARIO DEVELOPMENT

This subsection describes how U.S. and Soviet naval forces were developed and paired for campaign analyses and how they were employed in scenarios.

6.2.1 Battle Force/SSN Development

Determining the number, composition and distribution of U.S. Naval forces was an essential part of the analysis, and the output was used throughout. Unclassified sources* were used to project force levels and fleet distribution. Allocation of ship types to battle forces and the two fleets was made by SAI analysts based on existing patterns or published force/platform rationale. Force data are shown for 1985 and 1990, though only the latter were used in the analysis.

Table 6-1 shows postulated force levels and distribution for both years of all the surface combatants available for battle force assignment. Tables 6-2 (for 1985) and 6-3 (for 1990) display illustrative single-carrier battle group and two-carrier battle force combinations based on the first table. Also shown is the availability of these forces as postulated by SAI analysts. These estimates, as well as what forces constitute "limited surge" or "full surge" capabilities, are unofficial but considered reasonable formulations for the present purposes. A nominal 15% not-ready factor is applied to all U.S. naval combatants, principally to account for ships in major overhaul. Table 6-4 organizes battle groups/forces into the combinations used in the analysis:

- 2 CV battle force
- 2 CV battle force plus battleship surface action group
- 3 CV battle force
- 4 CV battle force

Table 6-5 shows assumed deployment, employment, and relative threat levels and sources for all SSNs. Direct support submarines, 2 per CVBG/BB SAG, were examined as part of the battle forces. Independent SSNs were distributed by theater and subregion. Conventional war at sea missions are listed for each force entry. The following assumptions were used to construct this table.

- SSN force level of 95 was based on current SSN authorizations and requests which would produce an estimated 39 SSN 688s in FY90; 39 SSN 637 class; 13 THRESHER class; and 4 SKIPJACK class commissioned after 1960.

---

* See list of unclassified sources on p. 6-53.

Table 6-1. Postulated combatant distribution by major force element.

Force Element	Year/Type Combatant															
	1985								1990							
	CG 47	CGN	CG	DDG 2/37	DDG 993	DD 963	FF/FFG	SSN	CG 47	CGN	CG	DDG 2/37	DDG 993	DD 963	FF/FFG	SSN
CVBF-2 CV/CVN (6-'85, 7-'90)	6	9	14	16	-	26		24	14	9	8			28		[illegible]
CVBG-1 CV (e.g., CORAL SEA)			2	3		2		2	1		2	2		3		2
LANT/PAC	3/3	5/4	9/7	10/9		16/12		14/12	12/10	5/4	6/4	2/0		17/14		16/14
Distribution BBSAG--1BB (1-'85; 4-'90)			2	2		2		2	4		8	16				4-6
Amphibious Forces				10	4		8					10	4		8	
UNREP Groups (1D)				10			30					10			30	
Convoys							~60								~60	

Table 6-2. Illustrative 1985 CVBG/CVBF composition and readiness.

Status (Surge Capability)	Fleet/Composition													
	LANT							PAC						
	CV/ CVN	CG 47	CGN	CG	DDG 2/37	DD 963	SSN	CV/ CVN	CG 47	CGN	CG	DDG 2/37	DD 953	SSN
Regular Overhaul RFS >30 days	CV		1	1	2	3	2	CV	1		2	2	2	[illegible]
(Full Surge)	CVN							CV						
Repair Availability RFS ~15 days		1	2	2	2	4	4		1	2	2	2	4	4
Limited Repair Availability RFS ~4 days	CV							CVN						
(Limited Surge) RFS or Deployed	CVN							CV						
		1	1	3	2	4	4		1	2	2	2	4	4
RFS or Deployed	CV							CVN						
RFS or Deployed	CV (C.S.)	1		1	2	3	2	CV (MW)			1	3	2	2
Deployed Indian Ocean	CV		1	2	2	2	2							

Notes: Brackets indicate 2-carrier BF to illustrate surface combatant composition
RFS - Ready for sea
C.S. - Coral Sea
MW - Midway

Table 6-3. Illustrative 1990 CVBG/CVBF composition and readiness.

Status (Surge Capability)	Fleet/Composition: LANT CV/CVN	LANT CG 47	LANT CGN	LANT CG	LANT DDG 2/37	LANT DD 963	LANT SSN	Fleet/Composition: PAC CV/CVN	PAC CG 47	PAC CGN	PAC CG	PAC DDG 2/37	PAC DD 963	PAC SSN
Regular Overhaul RFS >30 days	CVN	1		1	3	2		CV	1	1			2	2
(Full Surge) Repair Availability RFS ~10 days	CV	2	1	2		4	4	CVN	2	1	1		4	4
Limited Repair Availability RFS ~4 days	CV													
(Limited Surge) RFS or Deployed	CVN	2	1	2		4	4	CV	2	1	1		4	4
RFS or Deployed	CV							CVN						
RFS or Deployed	CVN	2	2	1		4	4	CV	1				2	2
RFS or Deployed	CV							CV (MW)	1		2		2	2
Deployed - Indian Ocean	CVN	1	1		2	2	2							

Notes: Brackets indicate 2-carrier BF to illustrate surface combatant composition
RFS - Ready for sea
MW - Midway

Table 6-4. Notional battle force composition: 1985/1990.

Notional Battle Forces	Ship Types								
	CV/CVN	BB	CG 47	CGN	CG	DDG 2/37	DD 963	SSN	AOE/R
<u>1985</u>									
CVBG	1			1	1	2	2	2	1
CVBF	2		1	1	3	2	4	4	2
BBSAG		1			2	2	2	2	1 AO 1 AE
CVBF + BBSAG	2	1	1	1	5	4	6	5	4
CVBF	3		1	2	4	3	6	6	3
CVBF	4		2	3	5	4	8	8	4
<u>1990</u>									
CVBG	1		1	1	1		2	2	1
CVBF	2		2	1	1		4	4	2
BBSAG		1	1		2	4		1	1 AO 1 AE
CVBF + BBSAG	2	1	3	1	3	4	4	5	4
CVBF	3		2	2	2		6	6	3
CVBF	4		4	2	3		8	8	4

Table 6-5. Assumed SSN deployment, mission, threat.

Area	No. SSN	War at Sea Mission		Threat	
		Primary	Secondary/Alternate	Primary Source	Rel. Leve
LANTCOM					
WLANT	5	Area ASW		SSN	Lo
MIDLANT/NORLANT	10	Area ASW		SSN	Lo
GIUK Gap/Norwegian Sea	9	Choke Point/Barrier Ops.	Bastion Purging	South - SSN	Lo
			Land Attack	North - SSN, Air ASW, FF/DDG	Mod-Hi
EMED	4	Area ASW & Anti-Surface		SSN,FF/DDG	Lo-Mod
		Combatant Patrols		+ Possible Air ASW	Mod
Deployed Battle Forces (7 CVBG, 1 BBSAG)	16	Direct Support	Land Attack	Concentrated SSN/SS	Lo-Mod
Not RFS/Deployed (15%)	7				
TOTAL LANT	51				
PACOM					
EPAC	3	Area ASW		SSN	Lo
MIDPAC (Hawaii area)	2	Area ASW		SSN	Lo
NEPAC	6	Area ASW		SSN	Lo
NORPAC	8	Choke Point/Barrier Ops	Bastion Purging	SSN, Air ASW	Mod
			Land Attack	(Close-in) + ASW helos, FF	Mod-Hi
SEASIA	2	Choke Point/Barrier Ops		SSN	Lo
Deployed Battle Forces (6 CVBG, 2 BBSAG)	16	Direct Support	Land Attack	Concentrated SSN/SS	Lo-Mod
Not RFS/Deployed (15%)	7				
TOTAL PAC	44				

- The split between LANT (51) and PAC (44) was arbitrary except that the PACOM number was derived from the SSN assignments used in the PACOM TNF Improvement Study, Phase II.

- PACOM deployment pattern is the same as used in the TNFIS, Phase II. LANTCOM deployment pattern and missions are designed to roughly parallel the approach used in PACOM.

- Threat sources and relative levels are subjective judgments of the analysts drawing upon other studies and analyses.

6.2.2 TLAM/N Capable Platforms

Table 6-6 displays the current plan for converting delivery platforms to TLAM/N capability. Only 8 surface combatants will be TLAM/N capable by end FY 1985; 23 submarine conversions are planned by that date. (Tube-launched missiles require only a modification to the submarine fire control system.) By 1990, ship/submarine numbers are 45 and 69 respectively.

6.2.3 Soviet Threat Development

Detailed threat development is displayed in Tables 6-7 through 6-13 included. Tables 6-7, 6-8, and 6-9 are extracts of the 1990 SNA, submarine, and surface combatant threat from the current DIPP. Tables 6-10 through 6-13 allocate 75% of submarine and surface threat units to LANTCOM and PACOM theaters and recions. The 75% readiness figure is adapted from an earlier SAI-BDM study,* based on a D-day of M+20. Sub-theater allocations are based on a defense-in-depth tactic and tactical objectives that will be discussed later. They are also influenced by threat distribution patterns in other naval analyses. PACOM allocations, for example, are adapted from deployments used in the PACOM TNF Improvement Study and current PACOM war gaming projects. The threat is greater, though, principally because longer warning time is allowed. In the Atlantic, more anti-SLOC SSNs are allocated to interdict NATO

---

*SAI, PACOM TNF Improvement Study, Phase II , Vol. III, Appendix A, dated 3 April 1982; page A-2-25, Ships/submarines: 24 hours-25%, 8 days-60%, 30 days-80%.

Table 6-6. TLAM/N launch platform capability.
Source: JCMPO Requirements/Analysis Document
Vol. Ib, 1 April 1983,

Platform	Launcher				FY (Cumulative)										
	Type	No.	Capacity Each	Capacity Per Ship	83	84	85	86	87	88	89	90	91	92	Objective
Surface															
DD 963	ABL	2	4	8	1	2	4	7	7	7	7	7	7	7	7
DD 963	VLS	1	61	61					2	4	11	13	17	20	24
DDG 51	VLS	1	90	90							1	1	4	9	20
CG 47	VLS	2	61	122				1	3	6	9	13	15	18	22
CGN 38	ABL	5	4	20			2	3	4	4	4	4	4	4	4
CGN 9,36,37	ABL	2	4	8			1	1	3	3	3	3	3	3	3
BB	ABL	8	4	32	1	1	1	2	3	4	4	4	4	4	4
Submarine															
SSN 637	Horizontal		(26	8)*			2	7	13	20	25	30	31	34	39
SSN 688	Horizontal				7	14	20	26	28	30	29	31	31	31	31
SSN 688	VLS + Horizontal	1	12 (26	12 8)*			1	4	6	8	8	8	8	8	8

*26 is total weapon capacity; 8 is notional Tomahawk missile loadout

Pages 6-10 through 6-16 inclusive are deleted.
(b)(1)
1.3(a)(4)

reinforcement and for SSBN defense north of the GIUK line. In all theaters, SSGNs are employed in the anti-carrier warfare (ACW) mission, and diesel submarines are used mainly in barrier situations.

6.2.4 Force-Threat Matrix Development

6.2.4.1 <u>General</u>. The scenarios described in Section 4 provide a framework for estimating the comparative survivability of naval forces in worldwide conflicts of varying durations and against different threat levels. The output of most interest is the proportion of surviving TLAM/N-capable submarine and surface platforms. With this limited objective in mind (as opposed to force level or war planning), relatively simple conventional naval campaigns were designed to fit the generalized scenarios and expose the platforms to attrition in a reasonably plausible series of events. The same naval force dispositions and deployment patterns, with minor variations, are used in all three scenarios (7-day, 30-day, 90-day). U.S. battle forces are initially or subsequently deployed in two postures: (1) defensive--transiting or holding--in areas where Soviet force is not concentrated; and (2) offensive, in areas of more concentrated Soviet threat. This technique produces force-threat pairs that can be assembled in various combinations but are notional and simplified for purposes of gross comparisons. The highest threat end of the spectrum is less apt to be encountered in practice as forces would not be deployed in these areas until the threat had been diluted to provide a reasonable probability of mission success.

6.2.4.2 <u>Force Generation Assumptions</u>. The worldwide superpower conflict represented in all three scenarios involves vital national interests, and the use of nuclear weapons is contemplated by both sides. This kind of conflict is considered to be preceded by a period of rising tensions and increasing military preparations, including partial or total mobilization. Naval surge deployments are among the earlier actions that would be ordered in these circumstances. D-day is assumed to be no earlier than M+20 for either side.

All available U.S. Navy combatants (approximately 85%) and 75% of Soviet Navy combatants are deployed by D-day. The unit of maneuver and analysis on the U.S. side (except for independent SSNs) is the carrier battle force (CVBF), which may include 2, 3, or 4 carrier battle groups (CVBGs) and a battleship surface action group (BB SAG). Assumed CVBG readiness status is summarized below (RFS = Ready for sea).

	LANT	PAC
Major Overhaul; RFS > 30 days	1 CVBG	1 CVBG
Repair Availability; RFS ~15 days	1 CVBG	1 CVBG
Limited Availability; RFS ~4 days	1 CVBG	1 CVBG
RFS or Deployed	5 CVBG	4 CVBG
Total	8 CVBG	7 CVBG

6.2.4.3 Assumed U.S. Tactical Objectives. At the commencement of hostilities, the U.S. is deploying its battle forces into forward areas (but not yet into the highest threat environments), with the following tactical objectives.

- Provide barrier between Soviet bases/forces and U.S./allied SLOCs.
- Assist in defense of adjacent land areas.
- Attrit Soviet threat with favorable or acceptable ratio compared to U.S. losses.
- Be situated to move rapidly into land attack or support positions as required.

6.2.4.4 Assumed Soviet Objectives and Tactics. The Soviet Navy has five broad tactical objectives, listed below in rough priority order.

- Protect Soviet homeland from seabased conventional or nuclear strikes

- Protect seabased strategic forces and employ if directed
- Interdict military SLOCs to Europe (support the land battle)
- Destroy or neutralize enemy offensive naval capability
- Maintain egress/ingress through chokepoints for Soviet naval units.

The fundamental Soviet naval tactic is defense in depth. Surface combatants remain in or near home seas. Submarine and surface units operate in ACW (anti-carrier warfare) groups supported by SNA in these waters to interdict any CVBF closing for strikes. ASW is also more intensive in home-waters; barrier and patrol SS/SSNs and surface combatants are augmented by fixed wing aircraft and, close-in, by ASW helicopters. U.S. battle forces may be attacked anywhere by Soviet SSGNs/SSNs and, when in range, by SNA. ACW submarines will be fewer and more dispersed as range from home port increases. SNA are less likely to attack repeatedly or as intensively at longer ranges. These assumptions are summarized in several operational principles.

- Battle forces in threatening positions at D-day will be attacked with all available ACW forces.
- Battle forces at long range or not in threatening position will be subjected to submarine attack by available units and may be attacked by SNA at the outset of hostilities to deter forward movement or to dilute offensive capabilities. Assets will not be expended recklessly but will be conserved for more threatening situations.
- When battle forces advance, remaining ACW units will retreat and regroup with other forces reserved for this purpose. SNA and submarine attacks will intensify as range to Soviet territory decreases.
- Regardless of the intensity of conventional SNA attacks, some minimum number of aircraft must be preserved in the event resort to nuclear weapons is directed.

6.2.4.5 1990 Notional Force-Threat Matrix. In the matrix displayed in Table 6-14, the tactical objectives and principles outlined above have been applied to notional U.S. battle forces and Soviet threat forces to generate representative theater threats to various battle force sizes. "Higher" and "lower" threats generally oppose "offensively" deployed and "defensively" deployed battle forces respectively. Other assumptions used to distribute forces or apply them in the engagement/campaign analysis are listed below. As noted earlier, only the 1990 case is analyzed in any depth; there are too few TLAM/N platforms available in 1985 for the predicted results of engagement analysis to have a meaningful bearing on NRF options.

- SNA
  - Low threat/single raids. Number of A/C shown is raid size.
  - High threat/multiple raids. Number of A/C shown is notional base loading, which must be adjusted for availability, reliability, etc.
  - High threat raids continue until SNA reaches 50% of its initial level. Analysis continues to the 25% level, the assumed "nuclear withhold" minimum force.
  - Friendly landbased air (LBA) is treated as a variable, that is, it may or may not be able to intercept enemy bombers and take attrition prior to their reaching CVBF defenses. When LBA attrition is assumed, the level used is 10% of attacking bombers destroyed.
- Surface Combatants
  - Number of ships shown are in ACW groups in the general area of CVBF operations. Fifty percent are in missile range and targeting envelope at H-Hour; the remainder are neutralized before firing.
  - Rules of engagement (ROE) in all cases. U.S. enforces a keepout zone of 50nm.

Page 6-21 is deleted.
(b)(1)
1.3(a)(1) + (4)

- Submarines

  - Numbers of submarines shown on the force-threat matrix are all those assigned an ACW mission and deployed in the general area of CVBF operations. Table 6-15 indicates those actually in contact at D-day and D+1, determined by the following criteria.

  - SSGN
    - -- 50% are within range with sufficient data for missile launch at H-hour
    - -- 25% are able to fire by D+1
    - -- 25% do not make contact or have erroneous targeting data
    - -- SSGNs attempt to close for torpedo attack after missile launch

  - SSN
    - -- Same contact ratio (50%-25%-25%) used for SSN torpedo attacks

  - SS
    - -- Submarines indicated employ barrier tactics in straits, subject to intensive ASW. CVBF encounters on ~ D+3.

(b)(1)
1.3(a)(4)

Page 6-23 is deleted.
(b)(1)
1.3(a)(1)+(4)

(b)(1)
1.3(a)(1)+(4)

6.2.5 Descriptions of Conventional Naval Warfare Scenarios

6.2.5.1 General. As described in Section 4, the 7- and 90-day scenarios originate in NATO Europe and subsequently spread to the Pacific. U.S. battle forces are withdrawn from the Indian Ocean in these cases and operate with their respective fleets. The 30-day scenario is a Southwest Asia conventional campaign and other theaters are not engaged until nuclear use.

All three scenarios begin with conventional war at sea engagements and conclude, for analytical purposes, when battle forces have undergone a nuclear attack. In some cases/theaters, forces surviving initial engagements move into higher threat areas, sometimes combining residual units of two battle forces for the move forward. The force-threat pair that most closely resembles the new engaged forces is used for that campaign, and estimated results are derived by interpolation. Another situation requiring interpolation is the submarine-only threat, arising when the SNA range is extreme, when the Soviets concentrate air attacks on only one of two possible forces, or when the SNA bases have been interdicted. Engagements or campaigns where friendly landbased aircraft (LBA) are assumed to intercept bomber raids are indicated on the scenario tables.

6.2.5.2 7-Day Scenario. Operations from D-day to D+6 commence with U.S. battle force deployments and threats for the short conventional phase NATO conflict as shown in Table 6-16. (Independent SSN operations are discussed later). The five LANT CVBGs that were ready for sea or deployed at M-day are formed into a 2-carrier battle force (2 CVBF) in the Western Mediterranean or Tyrrhenian Sea, and a 3 CVBF is located between the North Atlantic SLOCs and Soviet threat axes. A 2-CVBG consisting of the units that had been in availability status, plus a battleship surface action group (BB SAG), are enroute at D-day to reinforce the forward CVBF for possible operations in the Norwegian Sea. These forces are all attacked on D-day by the threat forces indicated in the table. Landbased interceptors are committed to other urgent tasks and cannot assist.

The four PACOM RFS/deployed CVBGs have formed a CVBF southeast of Japan to contribute to that nation's defense and to take advantage of land-based early warning and interceptor contributions to force survivability. The later-deploying 2 CVBF/BB SAG is in mid-Pacific enroute to join the 4 CVBF for possible strike operations. A second BB SAG (not shown) is operating under LBA cover in Southwest Asian waters and is not attacked by Soviet forces at D+20.

Operations from D+7 to D+20, proceed as residual forces from the two LANT CVBFs are merged into one CVBF whose size and composition is expected to approximate a 4 CVBF. The combined force is about to enter the Norwegian Sea at D+7 to support a land campaign in Norway. The U.S. and its allies decide to initiate nuclear operations, and all naval forces receive selective release authority for employment of ASW and AAW nuclear weapons. The Soviets pre-empt in the European theater at D+7 with all available (residual) forces. The MED 2-carrier battle force, which had remained in the Western Mediterranean, was successful in preventing additional surface combatants or submarines from penetrating the Straits of Gibraltar or Sicily. By D+7, coordination had been

Table 6-16. 7-Day Scenario - battle force deployments vs. threats.

Theater Force	D-Day to D+6		D+7 to D+20	
	Location	Threat	Location	Threat
LANT 3 CVBF	NORLANT	Higher (0)*	—4 CVBF NORLANT	NUC @ D+7 Residual LANT SNA (10%), plus NUC, withhold SSGNs.
2 CVBF + BB SAG	WLANT Enroute NORLANT	Lower (0)	Surviving U.S. forces available for TLAM/N. Transit to LPs: no significant air or surface threat, only residual SSNs.	
MED 2 CVBF	WMED	Lower (0)	WMED	Nuc @ D+7, Higher (10%); Residual SNA, no surface or subs
PAC 4 CVBF	SE of Japan	No Conflict	BFs join SE of Japan at D+10. 6 D/S SSNs detached to proceed to TLAM/N LPs.	
2 CVBF + BB SAG	MIDPAC Enroute NWPAC			NUC @ D+20 by SSGN/SSN only "4 CVBF (PAC) Higher" and "2 CVBF Higher"

*Number in parentheses following threat level is assumed attrition of SNA by friendly LBA.

established with LBA, and SNA raids were intercepted first by landbased interceptors. Battle forces surviving nuclear attacks would then be in TLAM/N range of many EUCOM/SIOP targets. They should encounter no significant air opposition in further transit because the U.S. counter-military attack on D+8 neutralizes all SNA bases; submarine resistance, however, will be extensive if battle forces move into the Barents Sea or Eastern Mediterranean.

PACOM battle forces are both just southeast of Japan at D+10 and operate independently while coordinating defenses and preparing to assist in the defense of Japan if required. Six of the 12 direct support SSNs are detached at D+15 to proceed to TLAM/N launch points. U.S. nuclear strikes on D+20 neutralize all SNA bases, among other targets, so the D+21 Soviet response against the CVBFs is carried out only by submarines. Soviet surface combatants are destroyed by surprise SSM and aircraft attacks on D+20.

6.2.5.3 30-Day Scenario. Operations from D-day to D+30 begin with battle force deployments and threats for the 30-day conventional phase conflict as shown in Table 6-17. The U.S. surge-deploys naval forces during a Southwest Asia crisis and by D-day has deployed battle forces, independent submarines, and support forces in the Indian Ocean and to defend the SLOCs from CONUS. The Soviets do not make a heavy naval commitment to the Indian Ocean, seeing it as an area where the natural correlation of forces is unfavorable. A 2-carrier battle force and a battleship SAG are maintained in the Arabian Sea/NW Indian Ocean mainly to support the land battle as required. The tacit agreement to confine the sea war to this area breaks down on D+25 when Soviet submarines begin attacks on a rapidly growing seaborne resupply and reinforcement pipeline. Local and area ASW begins immediately, but major Naval forces are not engaged. The U.S. is planning more drastic measures when the Soviets pre-empt, including an SNA nuclear raid on the Indian Ocean battle forces. The two SNA raids (conventional and nuclear) violate neutral airspace to avoid U.S. LBA interceptors.

Table 6-17. 30-Day Scenario - battle force deployments vs. threats.

Theater Force	D-Day to D+30		D+31 to D+34		(Nuclear Attack)	
	Location	Threat	Location	Threat	Location	Threat
LANT 3 CVBF	MID/ELANT	No Conflict	MIDLANT	Lower (0)	MIDLANT	All residual LANT SNA (10%), + Nuc. W/H
2 CVBF + BB SAG	CARIB/SOLANT		Enroute to join 3 CVBF	Lower (0)	Enroute	SSGNs subs only: residual + nuc W/H SSGNs
MED 2 CVBF	CENT. MED.	No Conflict	WMED	Lower (0)	WMED	Residual SNA (10%) No surface/subs.
SW Asia 2 CVBF + BB SAG	NW Indian Ocean	Lower (0)* Nuc @ D+30	No Significant Action			
PAC 2 CVBF + BB SAG	SE Asia	No Conflict	Enroute to join 2 CVBF	Lower (0)	~4 CVBF Phil. Sea	Residual PAC SNA (10%), + Nuc. withhold SSGNs.
2 CVBF	Phil. Sea		Phil. Sea	Lower (0)		

*Number in parentheses following threat level is assumed attrition of SNA by friendly LBA.

Operations from D+31 to D+35 assume that the war at sea does not spread at once to other theaters: the Soviets are considering nuclear attacks on the battle forces, and the U.S. is urgently consolidating CVBFs at a rendezvous out of the higher threat areas. The Mediterranean 2-carrier CVBF, which had been supporting ASW operations in the central MED, is moved to a more defensible position in the western MED. Soviet nuclear war at sea is initiated on D+35, and all U.S. naval forces are authorized to employ ASW and AAW nuclear weapons. After the initial coordinated Soviet nuclear strikes, battle forces concentrate on surviving submarine warfare and any further SNA raids. Direct support SSNs are retained in the battle forces, but independent SSNs are available to participate in the U.S. D+40 coordinated attack.

6.2.5.4 90-Day Scenario. In the D-Day to D+5 period, battleforce deployments and threats for the longer NATO war scenario are as shown in Table 6-18. The first 5 days of this conflict are similar to the 7-day scenario. Then, as land warfare continues, naval forces are ordered to conduct offensive strikes or assist land campaigns from forward locations. The war at first does not spread to the Pacific, although both sides have surge-deployed naval forces.

Operations from D+6 to D+20 begin as NORLANT CVBFs and the BB SAG move into the eastern Norwegian Sea higher threat area and conduct strike operations for about 7 days. (Aircraft attrition from strike operations is not addressed but would have a secondary effect on TLAM/N surface platform attrition.) The Sixth Fleet 2-carrier battle force remains in the western Mediterranean awaiting reinforcement to move east. War at sea begins in PACOM at D+15, when the 2-CVBG/BB SAG patrolling the SE Asian SLOC is challenged by a Soviet ACW group which will not accept the U.S. declared "keep out zone." The battle force is operating under both seabased and landbased air protection.

Table 6-18. 90-Day Scenario - battle force deployments vs. threats.

Theater Force	D-Day to D+5		D+6 to D+20		D+21 to D+93	
	Location	Threat	Location	Threat	Location	Threat
LANT 3 CVBF	NORLANT	Lower (0)*	~4 CVBF	Higher (10%) (Residuals*)	NORLANT ~2 CVBF	Nuc @ D+93: W/H SSGNs only
2 CVBF + BB SAG	WLANT Enroute to join 3 CVBF	Lower (0)				
MED 2 CVBF + BB SAG	WMED	Lower (0)			EMED 3 CVBF*	(> D+30) Higher (10%). Nuc @ D+93: W/H SSGNs only.
PAC 4 CVBF	SE of Japan	No Conflict			SE of Japan	(D+25 & D+40) Lower (10%). Nuc @ D+93: Both Battleforces, SSGNs only
2 CVBF BB SAG	MIDPAC Enroute to SEAsia		SEAsia	(D+15) Lower (10%)		

*No. in parentheses following threat level is assumed attrition of SNA by friendly LBA.

*Deduct Soviet losses in previous single raids from "4CVBF Higher" threat for LANT.

*Reinforced to full 3 CVBF strength

**Split residual PAC SNA 2/3 - 1/3 for nuclear raid.

The D+21 to D+93 time period begins as the northern CVBF withdraws from the Norwegian Sea after operations which debilitate the naval forces of both sides. A 2-CVBF is maintained in NORLANT for SLOC defense. The Sixth Fleet is reinforced, making up a full 3-carrier battle force from residual NORLANT ships and initial MED battle forces. When ready (no earlier than D+30) this force, supported by independent SSNs and LBA, moves into the eastern Mediterranean to achieve sea control, reopen the Suez SLOC, and support the land battle if required.* The 3-CVBF is opposed by reconstituted SNA and unreinforced submarine forces which have suffered some losses in earlier actions. Several less intense engagements take place in the Pacific, with neither side wanting to expand the scale of the conflict. On D+93 the U.S.S.R. conducts nuclear attacks on U.S. naval forces using only "nuclear withhold" submarines; U.S. nuclear strikes against Soviet power projection force targets had destroyed remaining SNA capability. After the D+93 attacks, surviving battle forces, as well as SSNs, can be ordered forward to employ NSNF against the theater or NRF targets with minimal threat expected from Soviet naval forces.

6.3 ANALYSIS OF SCENARIOS

6.3.1 Introduction

The assessment of employment options and loadout plans is based on estimates of the numbers of TLAM/N platforms and weapons that would survive various contingencies so as to be available when required by the NRF. The

*The Mediterranean as a maritime theater has been the subject of much study and analysis because of the proximity of the threat, lack of sea room, and charged political-military environment. It has generally been concluded that (1) no more than 2 CVBGs are likely to be in the MED at NATO/WP D-Day; (2) the best place to be at D-day is in the Western Mediterranean or Tyrrhenian Sea; and (3) at least a 3 CVBF is needed to move into the eastern MED against the undiluted threat. In the 7- and 30-day scenarios, the 2 CVBF allocated to the MED stays in the Western MED where it is already in NSNF range of many theater targets. In the 90-day campaign, a 3 CVBF is moved into the Eastern MED to provide a higher threat case.

survival estimates were derived from the results of engagement sequences arranged to represent each of the scenarios described in the preceding section. Individual engagements were analyzed using quantitative models designed for that purpose. This section describes the models, the engagement sequences, and the scenario analyses.

Each of the engagement models portrays the interactions of naval forces with various threats--surface and submarine-launched cruise missiles, air to surface missiles, and submarine attacks with torpedoes. The analysis uses expected-value models to estimate average results at each of several points in an engagement. It then rounds off the losses to whole numbers to avoid the methodological difficulties of carrying out a campaign analysis involving fractions of surviving forces.

The following description of the analysis and its results is arranged in the order in which the work was carried out:

- Selecting the sequence of engagements to be analyzed based on the notional 1990 force/threat combinations.
- Assessing the outcomes of each engagement in the sequence.
- Summarizing the results for each sequence of engagements in such a way as to incorporate the cumulative effects of combat damage from one engagement to the next.
- Interpreting the results of the engagement sequences in terms that are meaningful to each of the scenarios.
- Summarizing the scenario results relevant to the overall numbers of TLAM/N platforms lost and surviving.

6.3.2 Selecting the Engagement Sequences

A set of ten engagement sequences was constructed, corresponding to each combination of US force composition (2 CVBF, 2 CVBF with BB SAG, etc.) and threat level (lower, higher) as defined in Table 6-14.

Each engagement event represents an attack with conventional weapons against a U.S. battle group. Attacks with nuclear weapons are envisioned as single events occurring at the end of each of the scenarios (as defined in Tables 6-16, 6-17, and 6-18).

In general, the engagement sequences begin with an SSM attack launched by submarines, coordinated, in the higher threat cases, with attacks from surface anticarrier groups. This opening event is followed by an attack by SNA armed with ASMs and accompanied by jamming aircraft. The third event involves a torpedo attack made by one or more SSNs which attempt to penetrate the ASW defenses.

The events following these first three vary depending on assumptions regarding the threat. In the lower threat cases, no further SNA attacks occur, but additional submarines are assumed to attack with missiles or torpedoes or both (in sequential events).

In the higher threat cases, SNA attacks are repeated until the number of surviving aircraft falls to some pre-selected fraction of the starting force. At that point, it is assumed that conventional SNA attacks would cease and any future anti-carrier strikes would be made with nuclear weapons. The minimum permissible number of survivors was varied; for the analysis it was either 25% or 50% of the initial force levels.

In the higher threat cases, the SNA attacks were augmented by missiles fired from SSGNs, which then attempt to attack the battle force with torpedoes.

The events assumed for each of the engagement sequences are summarized in Table 6-19.

Pages 6-34 through 6-38 inclusive are deleted.
(b)(1)
1.3(a)(1)+(4)

6.3.3 Assessing the Engagement Outcomes

There are three basic types of attacks--SSMs fired by surface ships or submarines, ASMs launched by SNA, and torpedoes delivered by SSNs or SSGNs. These types of attacks differ according to the number of weapons fired, the targets against which they are directed, and the capabilities of the defenses to defeat them. The attacks are alike in the sense that each requires the enemy to penetrate a layered defense in order to succeed. The attacking platforms must survive to their launch positions and the weapons must overcome successive defenses and countermeasures, guide successfully, and hit their intended targets.

The methodology used to analyze each type of attack is discussed separately in the next sections.

6.3.3.1 SSM Attacks. The outcomes of SSM attacks are assessed in the following steps:

1. Add up all the missiles that are available for attacking the battle force from all elements of the attacking force.
2. Reduce the number of missiles fired by an estimate of launch reliability and round the result to an integer value.
3. Calculate the number of SAMs that are fired against the incoming SSMs.
4. Calculate the number of SSMs that are destroyed by the area defenses.
5. Determine the number of SSMs that survive the area SAMs and convert this value to a whole number.
6. Assign each of the penetrating SSMs to a ship type in the defending force.
7. Calculate the effectiveness of the point defense and soft kill systems for each ship type under attack.
8. Estimate the damage of each SSM hit on the force in terms of whether or not the ship attacked is sunk, afloat but out of action, or still operational.

Details for each of these steps are given in Appendix B. Typical results for two different SSM raids are shown, for illustration, in Table 6-20.

6.3.3.2 ASM Attacks. From an analysis standpoint, ASM attacks resemble SSM attacks but with an outer air battle occurring at the beginning of the engagement. The outcome of this battle determines the number of ASMs that are launched at the carriers and the accompanying ships. From there on, the ASMs are engaged, successively, by area SAMs, point defenses, and EW systems, just as the SSMs are, although the performance numbers governing the outcomes of these interactions differ between missile types. Steps 2-8 in the SSM analysis sequence just described apply to ASMs as well. For SNA attacks, the first step actually consists of the following 5 steps:

1. Calculate the raid size, consisting of the total number of Backfires, Badgers, jammers, etc., that reach the task force outer defense. This calculation includes the effects of land-based aircraft that manage to intercept the SNA before they arrive at the task force.

2. Calculate the number of combat air patrol (CAP) and deck launched interceptor (DLI) aircraft that engage the attacking aircraft before they are able to launch their ASMs.

3. Determine the number of AAMs launched by the intercepting aircraft against both jammers and ASM-aircraft.

4. Calculate the number of SNA killed in the raid. All these are assumed to occur before ASMs are launched, and no credit is taken for the ability of AAMs to destroy ASMs in flight.

5. Calculate the number of reliable ASMs that are launched and enter the task force area SAM defense zone. This (usually fractional) value is converted to an integer for use in the remainder of the engagement analysis.

An expanded discussion of these steps is contained in Appendix B. The procedure is illustrated in the results shown in Table 6-21 for two representative SNA raids.

Pages 6-41 and 6-42 are deleted. (b)(1) 1.3(a)(4)

6.3.3.3 Torpedo Attacks. Submarines, both SS/SSN and SSGN, may elect to attack the battle forces with torpedoes. It is assumed that, in order to do so, they must pass through the layered ASW defenses and take up a firing position at relatively short range from their targets (at least within 10,000 yards). They proceed to make a single attack with a salvo of 4 torpedoes and then attempt an escape. There are four possible outcomes for each submarine engaged in a torpedo attack:

1. The submarine makes a successful attack on some ship in the force and escapes
2. The submarine makes a successful attack but is sunk in a counterattack trying to escape.
3. The submarine is sunk before making a successful attack on the battle force.
4. The submarine is attacked and is forced to abort its approach in the battle force but manages to escape.

The following steps are followed in assessing the effects of torpedo attacks:

1. Define the composition of submarines making up the attack. It may be any mix chosen from among 11 different submarine types.
2. Calculate the probabilities that each approaching submarine is detected, attacked, and either sunk or driven off as it passes through 4 ASW defense zones--SSN (direct support) patrol area, S-3 sonobuoy field, TACTASS coverage area with S-3 backup, and a LAMPS/SH-3 defensive zone.
3. Determine which of the ships in the force are selected as targets by a surviving submarine.
4. Estimate the torpedo hits on the force and the resulting damage to the targets.
5. Calculate the chances that each submarine escapes the counterattacking ASW forces.

More details are shown in Appendix B. Results are of the form illustrated in Table 6-22.

6.3.3.4 Nuclear Attacks. The analysis of attacks on the battle force with nuclear weapons differs from that for conventional attacks in two respects: susceptibility to point defenses and warhead lethality.

Both SSMs and ASMs must penetrate the same defense in depth regardless of warhead type down to the point at which they enter the point defense zones for the targets they have acquired. At this point, it is assumed that even a successful intercept would not prevent the warhead from detonating within lethal range of its intended target. For analysis purposes, therefore, all these missiles (SSMs or ASMs) with nuclear warheads that have survived the outer and area defenses are assumed to hit. For torpedo attacks, there is no difference.

Any hit with a nuclear weapon (SSM, ASM, or torpedo) is assumed to produce a target kill. Whether or not it would produce collateral damage in nearby ships is a function of warhead size and intership spacing. For this analysis, it was assumed that ship dispositions prevented multiple kills; a hit on one ship was sufficient to sink it but no others.

6.3.4 Summarizing the Engagement Sequences

Each engagement sequence leads to a series of attacks resulting in damage to both the attackers and the defenders. There are 10 basic sequences plus some others that represent the cases in which land-based interceptors extract some attrition to the SNA. These sequences are summarized in Table 6-23.

The result of these multiple attacks is expressed in two forms:

- The number of CV/CVNs that are sunk or out of action.
- Total hits on the force, including those on CV/CVNs.

Pages 6-45 and 6-46 are deleted.
(b)(1)
1.3(a)(1) + (4)

Initially, the analysis calculated the number of hits on each ship type in the force and the corresponding numbers that were sunk and, additionally, put out of action (but not sunk). These are the numbers reported in Table 6-23 for the CV/CVN class, with the categories of "sunk" and "out of action" combined. By aggregating hits on all ship types, it was possible to redistribute the hits based upon different target weighting schemes than those originally assumed. (Appendix B may be referred to for a discussion of how target weights are applied.)

Any changes in the distribution introduced "after the fact" tend to distort the results somewhat, since a hit on, for example, a CG-47 may degrade overall force effectiveness to deal with succeeding attacks more than would a hit on another ship, such as a DD-963. The errors introduced, however, tend to be small until the size of the force is attrited severely. For example, sinking the last CG-47 in the force would have a much more serious effect on AAW performance than would the sinking of a DD-963.

While it is safe to ignore the changes in task force performance caused by a redistribution of hits among different escort types, the same is not true for hits on the carriers. The presence of operational CV/CVNs is one of the dominant factors in the model inputs. For that reason, carriers are treated differently and reported separately in Table 6-23.

6.3.5 Interpreting the Results

The engagement sequences were not intended to duplicate any scenario. Rather, they were designed to span all of the sets of events relevant to each scenario and to provide the components from which the scenario results could be constructed.

For example, the events taking place in the Atlantic for the 7-day scenario begin with a 3-carrier CVBF operating against a high threat in the northern Atlantic, with 2 additional carriers deployed with a BB SAG to join up. While enroute, these forces are subject to attack by the lower threat force. In both of these cases, the scenario assumes that there are no land-based aircraft to intercept SNA attacks. About D+7 the carriers from these groups join and are subject to a combined SNA, SSGN attack using nuclear weapons.

Attrition to both battle forces for the period D-Day to D+6 are extracted from the appropriate engagement sequences: 3 CVBF opposed by the higher threat and a 2 CVBF/BBSAG opposed by the lower threat for the first 6 days. The survivors are then subject to nuclear attacks from the surviving SNA and the withheld SSGNs. Nuclear attack results were calculated from the outcome of engagements with about 30 SNA (80% of the survivors at this point), in which weapons targeted against a ship were assumed to sink it or place it out of action.

Results in terms of losses for all of the scenarios were constructed in an analagous way. The results are displayed in Table 6-24.

6.3.6 Summarizing the Scenarios

The main point of the engagement analysis is to determine the number of TLAM/N platforms that survive through a series of conventional attacks culminating in a nuclear strike by remaining Red forces. A secondary focus is the number of residual carriers and non-TLAM ships that also survive to this point.

These results are exhibited in Table 6-25.

Pages 6-49 through 6-52 inclusive are deleted.
(b)(1)
1.3(a)(1) + (4)

SOURCES

1. Moore, Captain John, RN, ed., Jane's Fighting Ships, 1982-83, Franklin Watts, Inc., New York, 1982.

2. Polmar, Norman, The Ships and Aircraft of the U.S. Fleet, Twelfth Edition, Naval Institute Press, Annapolis, 1981.

3. Baker, Captain Brent, USN, "Counting the 600-Ship Navy", Proceedings, U.S. Naval Institute, May 1982, pp. 209-210.

4. Polmar, Norman, "The U.S. Navy: A New Destroyer Class," Proceedings, U.S. Naval Institute, August 1982, pp. 122-124.

5. Alden, Commander John D., USN, "Tomorrow's Fleet," Proceedings, U.S. Naval Institute, January 1983, pp. 109-121.

6. Secretary of Defense, Annual Report to the Congress for FY 1984, February 1, 1983.

SECTION 7

ANALYSIS OF DEPLOYMENT OPTIONS/LOADOUT PLANS

7.1 INTRODUCTION

Following the campaign analysis, eight different deployment options and seven separate loadout plans were developed and analyzed. In this section each of these deployment options is discussed and the loadout plans applicable to these various options are described. Section 8 describes the results of the attrition analysis as it applies to these various TLAM/N options so as to provide a measure of potential TLAM/N survivability at the time of NRF constitution.

Originally, five different deployment options were selected for analysis, but as the study revealed additional methods for maximizing the effectiveness of the TLAM/N inventory, this number was expanded to eight to allow investigation of the additional options. The options can be grouped into two basic categories: those options wherein TLAM/N missiles are deployed in multi-mission combatants and rely on various schemes to preserve an NRF inventory objective, and those options in which TLAM/N reserved for the NRF are not carried on multi-mission platforms and some other method is used to guarantee their availability.

7.2 MULTI-MISSION PLATFORM OPTIONS

7.2.1 Contingency Withhold Options

DELETED

(b)(1)
1.3(a)(1)

(b)(1)
1, 3(a)(1)

This type of withhold places a major constraint on the flexibility of the fleet and theater commanders. It limits peacetime deployments of major force elements at crucial times, precisely when and where a show of strength might be required. In conventional and theater nuclear warfare, this option limits opposed CVBG operations by holding out of action a significant portion of the available theater forces. As a result, a larger residual threat survives into the post-SIOP period. When these TLAM/N platforms are eventually brought forward to fulfill their role as part of the NRF, they have to proceed to their forward launch points in the face of this greater residual threat.

There may be other valid reasons why naval forces should be withheld from high threat areas during the course of a world-wide conventional and nuclear conflict. The attrition analysis reveals substantial differences in estimated losses in high and low threat areas, as shown in Table 7-1. However, the use of a contingency withhold for the sole purpose of preserving TLAM/N for later utilization as part of the NRF is not considered a viable concept.

7.2.2 Platform Withhold Option

7.2.2.1 Surface Ship Withholds. In this option, individual platforms or classes of surface ships carrying TLAM/N dedicated to the NRF are withheld from forward areas to provide additional protection for their weapons. There are two variations of this option. One is to withdraw all the TLAM/N platforms, or selected classes, from a battle force operating in a high risk region. The second is to substitute platforms of a lesser capability for

Table 7-1. Estimated attrition in high/low threat areas.

- Zero SNA attrition from friendly LBA
- Conventional engagement only

Battle Force Composition		Estimated Attrition			
		Lower Threat		Higher Threat	
No. CV/CVN	No. TLAM/N Surface Ships	CV/CVN	TLAM Ship	CV/CVN	TLAM Ship
2	6	1	1	2	6
2 (+ BBSAG)	7	0	0	2	3
3	9	1	2	1	4
4 (LANT)	12	1	0	2	4
4 (PAC)	12	1	1	2	3

the TLAM/N ships withheld. Table 7-2 shows some battle force combatant withhold alternatives, including substitution of similar but less capable units. Not all ships of a TLAM/N platform class are withdrawn because not all will have converted to TLAM/N by end FY90. The number removed is proportionate to the percentage of the TLAM/N platform class that will have been converted by end FY90. Scheduling and operations permitting, it is possible to increase the number of yet-to-be-converted platforms in the most threatened battle forces, putting the converted ships and submarines in the less threatened battle forces. This applies particularly to BB SAGs, which are not designed to operate in high risk areas without CVBG or landbased air cover. This kind of exchange between forward and rear areas becomes progressively more

Table 7-2. Platform withhold alternatives (1990) - 2 carrier battle force.

Alternatives	Battle Force Composition								
	CVN	CV	CG 47	CGN	CG	DDG 2/37/993	DD 963	FFG 7	SSN
Baseline (no withhold)	1	1	2	1	1	-	4	-	4
No TLAM/N Platforms	1	1	1	-	2	2	2	2	1
SSN withhold only	1	1	2	1	1	-	4	-	1
CG 47 withhold only	1	1	1	1	1	2	4	-	4
DD 963 withhold only	1	1	2	1	1	-	-	2	4

difficult in the 1990s as more ships and submarines convert to TLAM/N and DDG-51s are introduced. Eventually, virtually every combatant except the carrier becomes TLAM/N capable, and the only escorts without TLAM/N are frigates and 4 DDG-963s (KIDD class destroyers). Such a withhold from a carrier force heading into action is clearly inappropriate.

There are other reasons why platform withhold is an undesirable option. In the first place, commanders are loath to risk in-combat forces whose defenses have been deliberately degraded. A more logical decision is to remove the entire force to a less dangerous location. Secondly, moving TLAM/N platforms to an area where Soviet forces are not normally concentrated but where they still operate, or can reach, does not eliminate the possibility of loss or damage--especially if these platforms are separated from the integrated defenses of the entire battle force. Finally, drawing upon the results of the campaign analysis, survivability of TLAM/N surface combatants in their normal postures is high enough (~80%) that reducing overall battle force capability to achieve further improvement is not warranted.

Other important effects of this option might show up, not in changes to CVBG survivability, but elsewhere. For example, DD-963s with VLS could be withheld from their normal missions of defending CVBGs and SAGs from submarine attack. If this were done, it seems likely that other ASW-capable forces--such as SSNs, frigates, or older DDGs--might be diverted from their roles in barriers, convoy escort groups, or other wartime functions to replace the DD-963s. The price paid for this substitution is that some patrol areas are left uncovered. The major effects of the withhold might then show up in more enemy forces passing through check points, increased shipping losses, etc. These and similar effects are not covered in the scenarios and are beyond the scope and resources of this analysis.

7.2.2.2 <u>SSN Withholds</u>. The SSN has a high probability of survival (P_S) in wartime. The estimated values applied in this analysis are as indicated in Table 7-3 (by mission areas).

To the extent these P_S estimates and assumptions about SSN allocation are correct, it is apparent that SSN withholds (to reduce their own attrition) are from missions involving enemy ASW forces: attacks on Red surface forces and area ASW, where the targets are Red SSNs. The impact of not attacking Red surface forces (mainly ACW groups) is highly scenario dependent but, in general, forces reliance on carrier or shorebased air, or surface and submarine launched missiles.

Removing SSNs from area ASW could have more serious consequences since these operations are focused in areas where the presence of Soviet submarines is considered likely. Failure to intercept these enemy submarines places an additional burden on air ASW and close-in task forces or convoy protection. The P_S for units in these forces is reduced by an amount

Table 7-3. SSN survivability.

(b)(1)
1.3(a)(1) + (4)

DELETED

equivalent to the cumulative effects in their altered ASW situation. Along the lines discussed for surface combatants, the resources necessary to calculate all these secondary effect engagement and campaign results are not within the scope of this analysis. But, more importantly, the high P_s for SSNs, even on these two missions, plus the tactical value of the missions, combine to make the withhold of independent SSNs an undesirable approach to preserving TLAM/N weapons for the NRF.

7.2.3 NCA Withhold Option

DELETED

(b)(1)
1.3(a)(1)

DELETED

(b)(1)
1.3(a)(1)

7.2.4 No Withhold Option

(b)(1)
1.3(a)(1)

DELETED

7.2.5 NCA Expenditure Control Option

(b)(1)
1.3(a)(1)

DELETED

7.3 NON-MULTI-MISSION PLATFORM OPTIONS

7.3.1 Weapon Withhold Option

(b)(1)
1.3(a)(1)

DELETED

There are several reasons besides NRF availability why limiting TLAM/N loadout in this manner might be considered:

- (U) Protect from loss during conventional or nuclear attack.
- (U) Use missile spaces for torpedoes, other Tomahawk variants, or ASW/AAW munitions.
- (U) Increase centralization of assets until need arises to indicate area and platform of choice.
- (U) Comply with a provision of some future arms control agreement.

Whatever the reasons might be, the main concerns are not the number loaded or withheld, but weapon survivability and the feasibility of rearming when desired.

TLAM/N not in combatant shipfills could be stored in one or a combination of the following storage alternatives.

- CONUS ammunition depots

(b)(3)

DELETED

- Deployed AEs or T-AEs (but not AOEs integral to battle forces)
- MSC-operated and forward-sited commercial type vessels.

(b)(3)

DELETED

---

* JCMPO, "Requirements/Analysis Document," Vol. Ib, Navy Cruise Missile Systems, 1 April 1983

(b)(3)

(b)(1)
1.3(a)(1)

Even if safe and secure storage can be provided for TLAM/N not loaded aboard combatants, the weapons still must be resupplied to surviving TLAM/N platforms when required, specifically, when the NRF is constituted. The method of operation now contemplated loads the combatant out prior to overseas deployment. Rearming at sea or at overseas locations is not planned as a matter of routine, and there are major technical obstacles to TLAM/N replenishment at sea. The critical problems will arise from the lack of transportation resources and facilities in a trans- or post-SIOP environment, and the priorities associated with these shortages.

There may be no urgency to rearm naval combatants with TLAM/N for NRF missions if other NRF weapons can handle any immediate military or deterrent requirements. In this event, ships and submarines can move to the storage site, or suitable sea transport can take the missiles to the platforms. Deployed combat units should be able to rearm in rear areas with little risk to themselves or impact on their current tasks. Even in a time-urgent situation where TLAM/N is needed to prosecute the extended conflict, sea movement will still be the mode employed if the missiles are stored in forward locations.

If rearming were time urgent and TLAM/N storage sites were located in CONUS or Hawaii, air transportation would be the desired mode, although aircraft and aircrew losses are certain to be extensive during a nuclear conflict, reducing further the already critically short airlift capability. Tables 7-4 and 7-5 provide an illustration of airlift capabilities to transport TLAM/N. In a rearming situation, TLAM/N platforms which have expended their missiles will be directed to rearm at a forward port facility, usually available within one day's steaming for a combatant vessel. If transport aircraft could immediately airlift the needed weapons, the launch platforms could be back on station at their launch points within 3 days. Large numbers of aircraft will not be required. One to three aircraft sorties, depending on type, could fully replenish a single launch platform. However, given the direct and collateral damage and general chaos that will exist in the trans-SIOP and post-SIOP world, the ready availability of aircraft, airfields, maintenance parts, and suitable port facilities is unlikely.

7.3.2 Dedicated Platform Option

This option would involve dedication of specific Navy combatants to the role of TLAM/N launch platforms. There is precedent for this idea in both the strategic and tactical forces. The strategic forces include the SSBN platforms, whose primary mission is to provide one leg of the Triad. Tactical force dedication is exemplified by the use in WWII of the Inshore Fire Support ships carrying rapid-fire rocket launchers and by the current fleet of minesweepers. Dedication of naval platforms to a TLAM/N firing mission does not imply the dedication of missile assets to a specific role. The missiles could

Pages 7-12 and 7-13 are deleted.
(b)(1)
1.3(a)(1)+(2)

be part of the theater nuclear forces, could be earmarked for use with the NRF, or could be a combination--pre-SIOP, theater use; post-SIOP, NRF. Since submarines have an inherent survivability that is greater than that of surface ships, the use of a submarine as a dedicated launch platform maximizes the survivability and endurance of TLAM/N weapons for theater use and for the NRF. With this in mind, the SSN was investigated as a dedicated TLAM/N platform, in effect becoming an SSGN. This concept of dedicating a portion of the SSN force to land attack is based on the fact that the Navy will soon be getting the capability to augment existing land attack assets from comparatively low-risk platforms. Fragmenting missions among all platforms--or assigning many concurrent missions to single platforms--may not be the best approach. Even multipurpose platforms have limitations in this respect; they have a finite magazine capacity.

Inherent in this limitation is the "too many roles" problem, well expressed in a relevant article published in the U.S. Naval Institute Proceedings:

> ". . . There would also be a magazine loadout problem in certain ships if they were asked to be ready for too many different roles. A high utility weapon such as an antiship Tomahawk may have to be left behind to make room for a nuclear Tomahawk that has a very low probability of use. In some ships, the tradeoff would be among Harpoons, ASROCs, or anti-air warfare missiles and nuclear Tomahawks. In our current fleet of attack submarines, the tradeoff may even involve some of their torpedoes. This situation will be somewhat alleviated but not completely solved with the fixing of the vertical launch missile systems in our ships. These weapons load tradeoffs may make these ships marginally ready for any mission but not adequately ready for their primary mission."*

Dedicating selected SSNs to land attack simplifies the C^3 problem and eliminates (for these submarines) the tendency to keep them on station

* Johnson, LT Paul G., "Tomahawk: The Implications of a Strategic/Tactical Mix," U.S. Naval Institute Proceedings, April 1982.

until all types of weapons have been expended. There are recognized disadvantages to this concept. One is that while the concept reduces the "too many roles" concern, it exacerbates the "not enough SSNs" dilemma. The second disadvantage is the loss of integrated support to the naval forces, possibly leading to higher platform attrition among the non-dedicated naval combatants, as previously discussed in Section 7.2.2.2.

(b)(1)
1.3 (a) (1), (2)

DELETED

7.3.3 Dedicated Weapons Option

(b)(1)
1, 3(a)(1), +(2)

DELETED

(b)(1)
1.3(a)(1)+(2)

DELETED

7.4 LOADOUT PLANS

7.4.1 Introduction

(b)(1)
1.3(a)(1)

DELETED

(b)(1)

1. 3(a)(1)+(2)

DELETED

Combining these postulated loadout plans with the various deployment options, a series of alternatives were formulated and their survivability calculated, using campaign/attrition analysis results from the three basic scenarios, as described in Section 6.

Table 7-6 shows the planned numbers of TLAM/N to be available for shipfill over the period FY82 to FY92, based on procurement figures as of 1 April 1983. The FY90 level of 564 was used throughout the loadout analysis to provide a uniform basis for comparison among the various alternatives.

Table 7-6. Planned TLAM/N available for shipfill.
Source: JCMPO Requirements/Analysis Document
Vol. Ib, 1 April 1983,

Configuration	End FY (Cumulative)								
	84	85	86	87	88	89	90	91	92
Surface (BGM-109A1)	2	37	107	168	238	311	381	435	458
Submarine (BGM-109A2)	8	48	95	126	135	172	183	203	210
Total TLAM/N Available for Shipfill	10	85	202	294	473	483	564	638	668

7.4.2 Baseline Loadout

(b)(1)
1.3(a)(1)

DELETED

7.4.3 SSN-Heavy Loadout

(b)(1)
1.3(a)(1)

DELETED

Table 7-7. 1990 baseline loadout.

Platform	No.	Type Launcher	Tomahawk Class Capacity	TLAM/N Procurement	Shipfill Distribution
Surface					
DD 963	7	ABL	56		2/14*
DD 963	13	VLS	585		8/104
DDG 51	1	VLS	30		8/8
CG 47	13	VLS	338		6/78
CGN 38	4	ABL	80		4/16
CGN 9, 36, 37	3	ABL	24		2/6
BB	4	ABL	128		8/32
Total surface	45			381	258
Submarine					
SSN 637	30	HORIZ.	240		2/60
SSN 688	31	HORIZ.	248		2/62
SSN 688	8	VLS. + HOR.	160		5/40
Total SSN	69			183	162
Total	114			564	420

* x/y = No. per ship/No. per class.

Table 7-8. SSN-heavy loadout.

PLATFORM CONFIGURATION				Alternative Loadout Plans			
				Baseline		SSN-Heavy	
Platform	No.	Launcher	Tomahawk Capacity Per Ship	Ship	Class	Ship	Class
Surface Combatants							
DD 963	7	ABL	8	2	14	2	14
DD 963	13	VLS	45	8	104	4	52
DDG 51	1	VLS	30	8	8	6	6
CG 47	13	VLS	26	6	78	2	26
CGN 38	4	ABL	20	4	16	4	16
CGN 9, 36, 37	3	ABL	8	2	6	2	6
BB	4	ABL	32	8	32	4	16
TOTAL Surface					258		136
Submarines							
SSN 637	30	Horiz.	8	2	60	4	120
SSN 688	31	Horiz.	8	2	62	4	124
SSN 688	8	VLS + Horiz.	20	5	40	8	64
TOTAL Submarine					162		308
TOTAL Surface/Sub. Loadout					420		444
Depot: Ready for Issue/Reloads					144		120
TLAM/N Available for Shipfill					564		564

(b)(1)
1.3(a)(1)

DELETED

7.4.4 All Shipfill Loadout (Baseline)

(b)(1)
1.3(a)(1)+(2)

DELETED

7.4.5 All Shipfill Loadout (SSN-heavy)

(U) This plan combines the baseline shipfill loadout from the previous case with the SSN-heavy option described in Section 7.4.3. It represents the maximum loadout case for SSNs under the distributed force concept. It is not applicable to the weapon withhold option. The all shipfill loadout concept is illustrated in Table 7-9. Both the baseline case and the SSN-heavy case are shown. Minor differences in available TLAM/N are caused by the different loadout factors and specific platform loadings.

7.4.6 Dedicated Platform Loadouts

(b)(1)
1.3(a)(1)+(2)

DELETED

Table 7-9. All shipfill loadout: baseline and SSN-heavy.

PLATFORM CONFIGURATION				Alternative Loadout Plans			
				Baseline		SSN-Heavy	
Platform	No.	Launcher	Tomahawk Capacity Per Ship	Ship	Class	Ship	Class
Surface Combatants							
DD 963	7	ABL	8	2	14	2	14
DD 963	13	VLS	45	8	104	4	52
DDG 51	1	VLS	30	8	8	6	6
CG 47	13	VLS	26	6	78	2	26
CGN 38	4	ABL	20	4	16	4	16
CGN 9, 36, 37	3	ABL	8	2	6	2	6
BB	4	ABL	32	8	32	4	16
TOTAL Surface					258		136
Submarines							
SSN 637	30	Horiz.	8	4	120	6	180
SSN 688	31	Horiz.	8	4	124	5	152
SSN 688	8	VLS + Horiz.	20	8	64	12	96
TOTAL Submarine					308		428
TOTAL Surface/Sub. Loadout					566		564
Depot: Ready for Issue/Reloads					0		0
TLAM/N Available for Shipfill					566		564

Table 7-10. Dedicated platform shipfill plus storage ashore and all shipfill loadout.

PLATFORM CONFIGURATION				SSN Land Attack			
				Shipfill + Depot Storage		All Shipfill	
Platform	No.	Launcher	Tomahawk Capacity Per Ship Tomahawk	Ship	Class	Ship	Class
Surface Combatants							
DD 963	7	ABL	8	2	14	2	14
DD 963	13	VLS	45	4	52	4	52
DDG 51	1	VLS	30	6	6	6	6
CG 47	13	VLS	26	2	26	2	26
CGN 38	4	ABL	20	4	16	4	16
CGN 9, 36, 37	3	ABL	8	2	6	2	6
BB	4	ABL	32	4	16	4	16
TOTAL Surface					136		136
Submarines							
SSN 637	30	Tube	8	2	60	5	150
SSN 688	31	Tube	8	2	62	5	150
SSN 688	8	Tube + VLS	32	32*	128	32*	128
TOTAL Submarine					250		428
TOTAL Surface/Sub. Loadout					386		564
Depot					178		0
TLAM/N Available for Shipfill					564		564

*4 VLS SSNs carry TLAM/N

DELETED

(b)(1)
1, 3a(1) + (2)

DELETED

(b)(3)

7.4.7 Dedicated Weapon Loadout

(b)(1)
1, 3a(1) + (2)

DELETED

7.4.8 Illustrative NRF Loadout

(b)(1)
1, 3a(1)

DELETED

Table 7-11. Dedicated weapon loadout.

PLATFORM CONFIGURATION					
Platform	No.	Launcher	Tomahawk Capacity Per Ship	TNF	NRF
<u>Surface Combatants</u>					
DD 963	7	ABL	8	2-14	
DD 963	13	VLS	45	4-52	
DDG 51	1	VLS	30	6-6	
CG 47	13	VLS	26	2-26	
CGN 38	4	ABL	20	4-16	
CGN 9, 36, 37	3	ABL	8	2-6	
BB	4	ABL	32	4-16	
TOTAL Surface				136	0
<u>Submarines</u>					
SSN 637	30	Tube	8	3-90	
SSN 688	31	Tube	8	3-93	
SSN 688	8	Tube + VLS	20	10-80	
TOTAL SSN				263	0
SSBN	43	Tube	8**	0	4-160
	TOTAL Surface/Sub			399	160
	Total Available for Shipfill			564	

*X-Y = No. per ship - No. per class
**Same as assumed SSN capacity

Table 7-12. Illustrative NRF withhold loadout plans.

PLATFORM CONFIGURATION				Alternative Loadout Plans							
				Shipfill + Depot Storage				All Shipfill			
				Baseline		SSN-Heavy		Baseline		SSN-Heavy	
Platform	No.	Launcher	Capacity Each Ship	All	NRF	All	NRF	All	NRF	All	NRF
<u>Surface Combatants</u>											
DD 963	7	ABL	8	2-14*		2-14		2-14		2-14	
DD 963	13	VLS	45	8-104		4-52		8-104		4-52	
DDG 51	1	VLS	30	8-8		6-6		8-8		6-6	
CG 47	13	VLS	26	6-78		2-26		6-78		2-26	
CGN 38	4	ABL	20	4-16		4-16		4-16		4-16	
CGN 9, 36, 37	3	ABL	8	2-6		2-6		2-6		2-6	
BB	4	ABL	32	8-32		4-16		8-32		4-16	
TOTAL Surface				258	66	136	None	258	66	136	None
<u>Submarines</u>											
SSN 637	30	Horiz.	8	2-60		4-120		4-120		6-180	
SSN 688	31	Horiz.	8	2-62		4-124		4-124		5-152	
SSN 686	8	VLS + Horiz.	20	5-40		8-64		8-64		12-96	
TOTAL SSN				162	46	308	138	308	94	428	160
	TOTAL Surface/Sub			420	112	444	138	566	160	564	160
	Depot Storage			144	48	120	22				
	TOTALS: Available for Shipfill & NRF			564	160	564	160	564	160	564	160

*X-Y = No. per ship - No. per class

(b)(1)
1.3(a)(1)+(2)

All four loadout examples are distributed force alternatives; the number of TLAM/N per platform varies from one option to another. There are many more ways to allocate the missiles while retaining the distributed force concept. This example is illustrative only.

7.5 SUMMARY

No loadout plans were created for the contingency withhold or platform withhold options. These concepts were included in the initial framework of the analysis, but the serious operational consequences of employing either of these options (less than optimum battle force composition, deployment in low threat areas) leads to the conclusion that adoption of either of these concepts solely to preserve TLAM/N platforms or weapons is not justified. There are other ways to enhance survivability without causing operational degradation.

Loadout plans were not created specifically for the no withhold option, for a different reason. All the loadout alternatives would serve the theater commander in this mode of operation. Fitting one to the concept that the CINCs own and operate all deployed TLAM/N, unless otherwise directed, is all that is necessary to establish an operating mode. In essence, the issue is whether or not a core TLAM/N force of some size is needed for the NRF. If it is, then these various options are ways to enhance its survivability while minimizing its impact on pre-SIOP operations. If no definite core NRF requirement is needed, then each CINC will manage and target all TLAM/N allocated to the theater in the same manner as with other theater systems.

Extreme forms of weapon and NCA withhold alternatives (such as all TLAM/N being reserved and held from deployed units, or all weapons dedicated to the NRF) were not analyzed. They were considered to be unrealistic in view of the recognized and legitimate needs of the theaters, in addition to those of the NRF.

Table 7-13 summarizes the alternative loadout plans that have been described in this section and correlates them with the various deployment options postulated. Although no loadout plans increase the surface ship assets from the baseline case, that is an additional option. Furthermore, when the missiles in storage are moved afloat (loadout options 4, 5, and 6), they can be loaded aboard surface ships instead of submarines. Submarine loading simply maximizes their survivability.

(b)(1)
1.3(a)(1)

DELETED

Table 7-13. Summary of TLAM/N loadout alternatives.

Loadout Options		Missile Quantities					Deployment Options							
		Surface	SSN	Storage	SSGN	SSBN	Contingency Withhold	Platform Withhold	[redacted] Withhold	[redacted] Withhold	Expenditure Control	Weapon Withhold	Dedicated Platform	Dedicated Weaponry
Shipfill + STG.	1. Baseline	258	162	144	--	--	X	X	X	X	X	X		
	2. SSN Heavy	136	308	120	--	--	X	X	X	X	X	X		
	3. SSGN[1]	136	122	178	128	--						X		
All Shipfill	4. Baseline	258	308	0	--	--	X	X	X	X	X			
	5. SSN Heavy	136	428	0	--	--	X	X	X	X	X			
	6. SSGN[2]	136	300	0	128	--							X	
	7. SSBN	136	263	0	--	160								X

[1] SSGN Assets are Theater Support; NRF Assets in Storage

[2] SSGN Assets are NRF

(b)(1)

1.3(a)(1)

DELETED

SECTION 8

SURVIVABILITY ASSESSMENT

8.1 INTRODUCTION

After the deployment modes and loadout plans were developed, they were collated with the platform attrition results from the campaign analysis to provide an estimate of TLAM/N survivability up to the time of NRF constitution. The probability of storage site survivability was postulated at three notional levels: all storage sites survive (P_D=0); half the storage sites survive (P_D=0.5); and all storage sites are destroyed (P_D=1.0). Because nuclear storage sites are fixed, identifiable installations, and few in number, they clearly have a high target priority in the homeland-to-homeland nuclear exchange that precedes constitution of the NRF. In this scenario, the most likely case is that P_D=1 and the storage sites are destroyed.

8.2 PLATFORM SURVIVABILITY

As shown in Table 8-1, the attrition of deployed TLAM/N platforms, both surface ship and submarines, was low.

Table 8-1. Attrition of TLAM/N platforms.

(b)(1)

1.3(a)(1)

DELETED

Predicted carrier and AOE/AOR losses were high, as expected with nuclear strikes on the battle forces: 5 to 10 carriers lost out of 13 or 14 deployed and about half the surface ships. As noted earlier, surface combatant losses are reduced by ASM target weighting against larger ships and by intership spacing in nuclear attacks eliminating collateral damage to other ships from detonations at CV/AOE locations. Furthermore, battleship SAGs were generally kept from high threat locations and, in some cases, risk to the entire battle force was substantially reduced by nuclear strikes on SNA bases.

The campaigns are not intended to forecast the outcomes of future wars or to represent future combat exactly. However, the three scenarios span the set of strategic assumptions relevant to TLAM/N force management issues. Moreover, the engagement outcomes are consistent with those produced by recent Navy studies. The overall result supports the need for a distributed offensive capability.

8.3 TLAM/N SURVIVABILITY

Table 8-2 displays TLAM/N survivability into the post-SIOP phase for the seven loadout alternatives in each of the 3 scenarios. These notional storage site survival levels are indicated for each loadout, as discussed in Section 8.1. The platform and contingency withhold deployment options are not represented since no platform attrition was calculated for those deployment alternatives. In the calculations for the other options, all TLAM/N on the platforms in overhaul or maintenance were assumed to be in storage and therefore were addressed under storage site survivability.

(b)(1)
1.3(a)(1)

DELETED

Table 8-2. TLAM/N survivability results.

Loadout Alternative	% Survival in Depot Storage	TLAM/N Surviving to Post-SIOP					
		7-Day		30-Day		90-Day	
		No.	%	No.	%	No.	%
1-Baseline + Storage	100 50 0	505 396 306	90 70 54	507 398 288	90 71 51	526 417 307	93 74 54
2-SSN - Heavy + Storage	100 50 0	515 418 320	91 74 57	518 421 323	92 75 57	528 431 333	94 76 59
3-Baseline: All Shipfill	100 50 0	496 447 398	88 79 71	498 449 400	88 80 71	494 457 419	88 81 74
4-SSN - Heavy All Shipfill	100 50 0	508 462 414	90 82 73	511 465 417	91 82 74	521 475 427	92 84 76
5-SSGN + Storage	100 50 0	531 419 306	94 74 54	534 422 309	95 75 55	544 432 319	96 77 57
6-SSGN: All Shipfill	100 50 0	524 486 447	93 86 79	527 489 450	93 87 80	537 499 460	95 88 82
7-SSBN: All Shipfill	100 50 0	515 469 421	91 83 75	518 472 424	92 84 75	528 482 434	94 85 71

(b)(1)
1.3(a)(1)+(2)

[illegible]ETED

8.4 CONCLUSIONS -

The results of this attrition analysis lead to the following conclusions:

- TLAM/N platform attrition is apt to be fairly low, with submarines having a small but important advantage in this respect over surface ships

- Submarines possess other inherent operational advantages over surface ships which permit them to employ TLAM/N in a hostile environment with less risk and a smaller force presence than is possible with surface combatants.

(b)(1)

1.3(a)(1)+(2)

SECTION 9

CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This study has examined the potential utility of TLAM/N in a nuclear reserve role and as an addition to the current nuclear force posture of the theater commanders. The analysis has focused specifically on the uncertainties associated with extended conflict, both prior to and in conjunction with nuclear weapons employment.

The analytical approach followed in this project began with an extensive review of the historic evolution of the NRF as reflected in changes in national nuclear weapons employment policy. A detailed examination ensued of the NRF as it is currently configured. This examination included investigation of the nuclear weapons employment planning framework for the NRF, and the relationship between strategic nuclear planning and regional nuclear planning.

A strategic context for the NRF was next developed. This included a review of likely national strategies and their impact on concepts for employment of the NRF. Three scenarios were developed to serve as the basis for the campaign and attrition analysis performed later in the study.

Three current concepts for the employment of TLAM/N were then investigated. Competing requirements for TLAM/N as part of the NRF or to provide theater support were analyzed i relationship to the Navy's distributed force concept for TLAM/N deployment. A targeting analysis and other studies provided insights that supported the conclusion that a balanced approach should be taken to resolve these competing needs.

The principal analysis was then conducted. First, a campaign and attrition analysis was performed to determine the survivability of TLAM/N in situations keyed to the scenarios. Then a number of TLAM/N deployment options and loadout alternatives were evaluated to determine their ability to satisfy the requirements of the NRF and the theater commander without impeding the pursuit of other Navy missions. Finally, results of the attrition analysis were applied to these deployment/loadout options to determine the impact of TLAM/N survivability on these options.

This section addresses the major conclusions that result from the analysis that has been performed. They provide insights into the relationships between the NRF, theater nuclear support, and the other missions that are assigned to U.S. naval forces, and they provide viable alternatives regarding the role of TLAM/N with regard to those inherently conflicting requirements. These conclusions also provide the basis for recommendations which stem from the stated objectives of this study, namely:

- To examine current NRF guidance
- To identify operating modes for TLAM/N that will enhance its utility in the face of competing demands
- To determine if changes in NRF operating practices are required to better accommodate TLAM/N.

9.2 CONCLUSIONS

The following represent the principal conclusions that have been drawn from this investigation. They relate to the various deployment options that were developed and analyzed, to the loadout alternatives that were assessed, and to basic concepts of employment for the forthcoming TLAM/N.

9.2.1 Balanced Approach to Allocation

(b)(1)
1.3(a)(1)

(b)(1)
1.3(a)(1)

DELETED

This basic premise led to the development of various deployment options and loadout plans, which were evaluated to determine their applicability and suitability in satisfying these competing needs while minimizing the impact on the accomplishment of other Navy missions. A number of these alternatives appear viable, though one stands out as clearly superior. More detail regarding the various alternatives is provided in Sections 7 and 8 and in the subsections below.

(b)(1)
1.3(a)(1)

DELETED

9.2.2 Contingency/Platform Withhold Options

(b)(1)
1.3(a)(1) + (2)

DELETED

(b)(1)
1.3(a)(1)+(2)

DELETED

There are other reasons why platform withhold is an undesirable option. In the first place, commanders are loath to risk in-combat forces whose defenses have been deliberately degraded. A more logical decision is to remove the entire force to a less dangerous location. Secondly, moving TLAM/N platforms to an area where Soviet forces are not normally concentrated but where they still operate, or can reach, does not eliminate the possibilty of loss or damage--especially if these platforms are separated from the integrated defenses of the entire battle force. Finally the campaign analysis indicates that survivability of TLAM/N surface combatants in their normal postures is sufficiently high that reducing overall force capability to achieve further improvement is not warranted.

There appear to be no significant advantages to these two options that offset the major deficiencies.

9.2.3 NCA Withhold Option

(b)(1)
1.3(a)(1)+(2)

DELETED

9.2.4 No Withhold Option

(b)(1)
1.3(a)(1)+(2)

DELETED

DELETED

(b)(1)

1.3(a)(1)+(2)

9.2.5 Expenditure Control Option

(b)(1)

1.3(a)(4)+(2)

DELETED

9.2.6 Weapon Withhold Option

(b)(1)

1.3(a)(1)+(2)

9.2.7 Dedicated Platform Options

(b)(1)

1.3(a)(1)+(2)

DELETED

9.2.8 Dedicated Weapons

(b)(1)
1.3(a)(1)+(2)

DELETED

9.3 RECOMMENDATIONS

In view of the conclusions described above, the following actions are recommended:

(b)(1)
1.3(a)(1)

DELETED

(b)(1)
1,3(a)(1)+(2)

DELETED

- An analysis should be conducted to estimate the schedule and costs required to modify naval multi-mission platforms to provide effective strategic connectivity.

- Because flexibility requirements for the NRF demand an ad hoc targeting capability for TLAM/N, launch platforms should be modified to provide an on-board targeting capability.

- Since TLAM/N would have the greatest force-multiplier effect when deployed with surface action groups (SAGs), an analysis of tailored missile loadouts for the SAGs should be conducted.

- Because of the recognized uncertainties regarding the post-SIOP environment and extended conflict, additional analysis should be performed to better identify the likely NRF target base.

9.4 SUMMARY

This study has examined the potential of TLAM/N for employment as part of the NRF and as a key element of the theater commander's organic nuclear forces. The analysis has provided insights that support the conclusions and recommendations listed above. With respect to the purposes of the study, as described in Section 1.1, the following are the specific study results:

- Current guidance and established procedures regarding the NRF have been examined. A detailed description of these and related matters is provided in Sections 2 and 3.

- Operating modes for TLAM/N have been identified that will enhance its utility within the NRF, provide a TLAM/N capability to support the theater commanders, and provide sufficient flexibility for the effective accomplishment of other assigned naval missions. Details of the analysis are provided in Section 4 through 8.

- Current guidance and procedures for the NRF have been assessed to determine their suitability in light of the increased emphasis on extended conflict and the impending deployment of TLAM/N. No changes are deemed necessary at this time.

APPENDIX A

TOMAHAWK NUCLEAR LAND ATTACK MISSILE (TLAM/N): SYSTEM DESCRIPTION

A.1 GENERAL

The functional elements of TLAM/N include the airframe assembly, missile guidance set, warhead, cruise engine, booster, altimeter antennas, air data system, and protective capsule. The missile, illustrated in Figure A-1, is approximately 20 inches in diameter and 18 feet long with an 8.7-foot wingspread. The missile weighs about 2700 pounds at the start of cruise flight.

A.1.1 Airframe Assembly

The TLAM/N airframe assembly consists of the nose, forebody, midbody, aft body, and tail cone sections described as follows:

- Nose Section - Contains the guidance set.
- Forebody Section - Contains a nuclear warhead, altimeter antennas, fuel filler, fuel ullage tank, and fuel tanks
- Midbody Section - Contains a longitudinal through-slot that houses the wing panels in their folded position. Pneumatically-operated watertight doors open to allow wing deployment and then close the wing stowage cavity to reduce aerodynamic drag. During wing deployment, pneumatically-powered actuating mechanisms maintain symmetrical wing deployment and lock the wings in the extended position. Fuel is also contained in the lower portion of this section.
- Aft Body Section - Contains the deployable air scoop inlet with a 42-square-inch capture area, an air duct, and the forward part of the engine. The volume above and to the side of the air scoop is part of the fuel tank.
- Tail Cone Section - Consists of the after part of the engine, the exhaust tail pipe, and the four stabilizer fins. The upper fin and two side fins are pivoted for aerodynamic control; the lower fin is fixed. Before and during launch, all four fins are folded laterally, constrained by a lanyard

Page A-2 is deleted.
(b)(1)
1.3(a)(1)+(2)
(b)(3)

and covered by the missile aft shroud. The shroud is jettisoned after launch and the lanyard pulls off, which allows the fins to be deployed by torsion springs and then locked in the erect position by spring-actuated pins.

A.1.2 Missile Guidance Set

The missile guidance set consists of the following assemblies:

- Reference measuring unit and computer
- Rate gyro/accelerometer package
- Radar altimeter
- Analog filter assembly
- Battery power units.

A.1.2.1 Reference Measuring Unit and Computer (RMUC). The RMUC provides an inertial stabilized element that senses vehicle acceleration and attitude, and a digital computer that performs all computations and input/ output functions for guidance, navigation, autopilot, launch control interface. missile mission-event sequencing, TERCOM map storage, and position fixing. The RMUC is implemented using an inertial platform, 15 printed-circuit-card subassemblies, two 32K-word memory modules, and a power supply. The RMUC chassis contains the electrical connections as well as the mechanical and thermal interfaces for all elements of the guidance set, including the shock mitigation system for the platform.

A.1.2.2 Rate Gyro/Accelerometer Package (RGAP). The RGAP senses three-axis body motion for attitude-rate stabilization and maneuver control by the digital autopilot. The RGAP contains three spring-restrained rate gyros and two accelerometers, all in a single package. The three rate gyros provide missile pitch, yaw, and roll stability-augmentation control. During cruise, the vertical accelerometer is used in the altitude loop and the lateral accelerometer is used for turn coordination.

A.1.2.3 Radar Altimeter. The radar altimeter provides ground clearance measurements for terrain contour matching and terrain avoidance. The total altimeter system consists of the receiver/transmitter and the antenna/distribution system. The receiver/transmitter is part of the guidance set; the antenna/distribution system is part of the missile airframe assembly.

(b)(1)
1.3(a)(1)

A.1.2.4 Analog Filter Assembly (AFA). The AFA attenuates the RGAP output signals that are produced by vehicle bending motion, which could cause control system instability. The AFA employs active analog low-pass filtering, augmented with a digital notch filter and configured to minimize power and facilitate changes adaptable to various vehicle bending frequencies.

A.1.2.5 Battery Power Unit (BPU). The BPU provides electrical power to the guidance set during launch and distributes electrical power during flight. The BPU contains a thermal launch battery, electromechanical activation relays, an isolation diode for battery power, current limiting circuitry, a battery voltage-detection circuit, and power distribution terminal strips.

The launch battery provides power to the guidance set during a period that starts 4 seconds before launch and ends 21 seconds after launch. During this period the guidance set is disconnected from the 28-volt missile bus, and the engine-driven power source is not yet available. The launch battery is a thermal battery that can be stored for several years over a wide temperature range.

A.1.3 Engine

(b)(1)
1.3(a)(2)

A.1.4 Booster

The Tomahawk booster is a single-chamber, fixed nozzle, solid-propellent rocket motor, having a jet-tab thrust-vector control system. The booster burns for about 13 seconds and is then jettisoned by explosive bolts that hold the booster to the tail cone.

A.1.5 Radar Altimeter Antennas

The Tomahawk missile has two radar altimeter antennas, one for transmission and one for reception. The altimeter antenna beam pattern is shaped to permit operation during maximum missile pitch and roll maneuvers.

A.1.6 Air Data System

The air data system provides vehicle-sensed static and dynamic pressure to the guidance computer for flight control references. The sensing equipment consists of a static port and a heated pilot head in the engine inlet. Two separate transducers, one absolute and one differential, are located in the forward fuel tank.

A.2 OVERLAND FLIGHT SUMMARY

The operation of the TLAM/N can be logically divided into two portions: prelandfall and postlandfall. The prelandfall portion of the flight is planned onboard the launch platform. The postlandfall (overland) flight is determined at a landbased mission planning center. A typical TLAM/N mission is illustrated in Figure A-2.

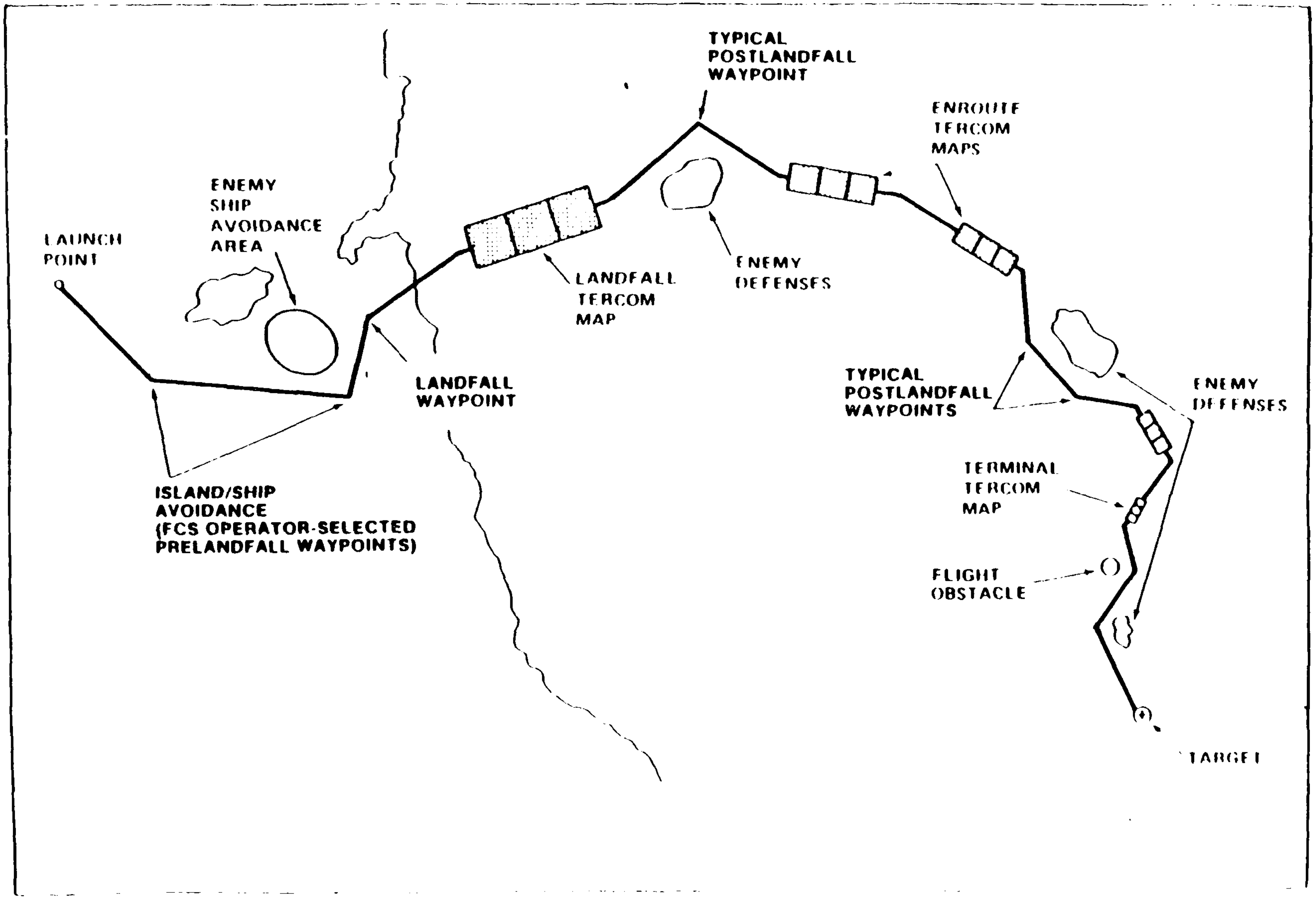


Figure A-2. Typical TLAM/N mission.

(b)(1)
1.3(a)(1)+(2)

At completion of the prelandfall portion of the flight, the missile passes the landfall waypoint and steers toward the first TERCOM map. During the prelandfall flight, the inertial guidance set drifts slightly and the location of the missile when it arrives at the first map is not exactly correct. However, the first TERCOM maps are designed by the mission planners to be large enough to ensure that the missile will fly somewhere within the maps. Operationally there may be single, double, or triple map sets that may be overlapped, adjoined, separated, colinear, or not in line, as requested by the using commands or determined by the producer. A position fix for the missile guidance system is obtained by the TERCOM process as the missile passes over each map or map set area of a TERCOM map.

A.2.1 Terrain Contour Matching

TERCOM is one of the keys to Tomahawk accuracy. Briefly, the missile-borne TERCOM system compares a sequence of terrain elevation measurements to stored terrain profiles and determines, by a best-fit process, the geographic location of the missile. The process is illustrated in Figure A-3. To perform terrain-following, as the missile flies over a map area the barometric altimeter provides a reference altitude and the radar altimeter provides a deviation from that reference. In this manner, a relative elevation profile of the overflown terrain is produced. The elevations in this profile are correlated with stored, discrete map-cell elevations of that particular TERCOM map area, which had been previously measured as part of the mission planning and then loaded into the missile before launch. The point of highest correlation indicates the best estimate of missile position within the map area. This relative position can be turned into an absolute, geographic position, because the coordinates of the stored map area are known.

The missile attempts to obtain three position fixes by passing over the three areas of a TERCOM map. These fixes are then compared for consistency. At least two of the three individual fixes must be consistent to qualify as valid position fixes. The valid positions are then used to update the guidance system. An update consists of correcting the computed missile position and making adjustments to reduce the effect of the drift rates that produced the error. If no valid position fix is found, no update is done. (The missile is nevertheless likely to be successful in overflying the next TERCOM map.)

The flight then continues via postlandfall waypoints that have been chosen to avoid geographic or defensive positions and to reach the next set of TERCOM maps most effectively. The maps that are spaced along the route are sized so that the missile can be expected to pass over each one. Missile navigation becomes more accurate with each update, so the maps usually become smaller as the flight progresses. A typical mission utilizes one landfall map, one or more enroute maps, and a terminal map.

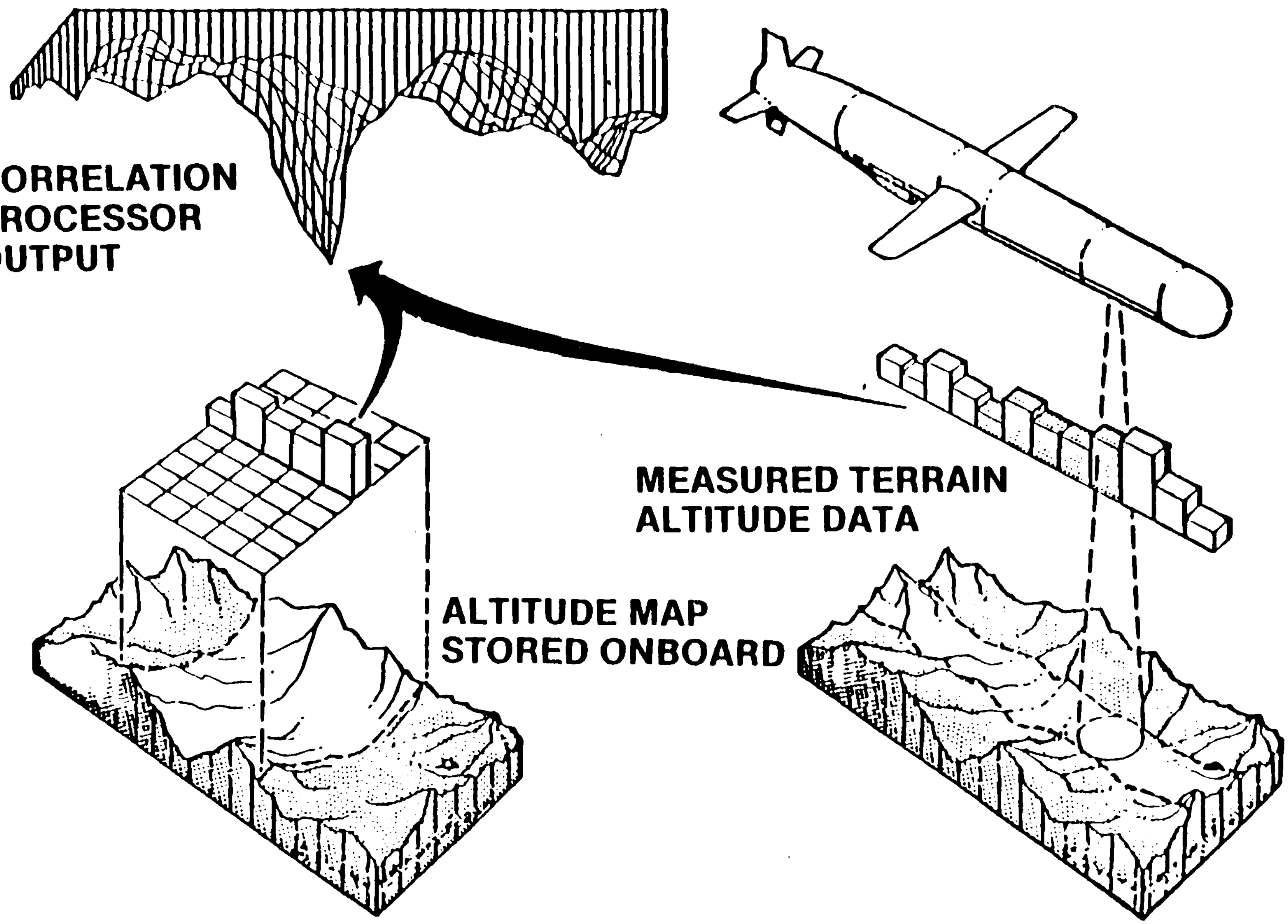


Figure A-3. Terrain correlation process.

A.2.2. Altitude Profile

The missile overland flight altitude control is also predetermined at the mission planning center. The altitude that the missile flies over each map normally decreases as the TERCOM map size decreases. Lower altitudes are specified to achieve finer altimeter resolution, which is needed as the stored map-cell size becomes smaller. Between map locations, terrain-following can be used or a higher altitude can be ordered to save fuel. The overland altitude selection is determined by the mission planner, and the necessary altitude-controlling commands are included in the mission data that is loaded before launch.

APPENDIX B

TLAM/N TARGETING ANALYSIS

B.1 INTRODUCTION

(b)(1)
1.3(a)(1)

B.2 RATIONALE FOR SELECTION OF REPRESENTATIVE TLAM/N LAUNCH POINTS

Fourteen TLAM/N LPs were selected for the target analysis, as indicated in Table B-1 and shown on the map in Figure B-1. These are not the only possible launch points, but they are representative of either forward areas where naval forces might be operating during wartime in support of conventional operations, areas where target coverage is particularly good, or, in several cases, combinations of these two. All points are high threat locations, with the risk increasing as TLAM/N ranges to the target diminish. The risk will be much greater in the conventional phase than in the nuclear phase, particularly post-SIOP, when most bomber and escort bases could be assumed to be out-of-action.

Table B-1. TLAM/N representative launch points.

Region	Launch Point	Coordinate	Location
N.W. Pacific	1	50°N/150°E	South Sea of Okhotsk (300 NM to Petro/1000 NM to VLAD)
	2	49°N/162°E	250 NM South-Southeast of Petro (1300 MN to VLAD)
	3	40°N/135°E	Sea of Japan (250 NM S.E. VLAD)
	4	41°N/143°E	East of Tsugaru Straits (500 NM to VLAD)
	5	41°N/157°E	N.W. Pacific (1250 NM to VLAD/800 NM to Petro)
	6	26°N/135°E	N. Philippine Sea (1500 NM to Khabarovsk) (1200 NM to VLAD)
Mediterranean Sea	7	40°N/13°E	W. Med-Tyrrhenian Sea (1100 NM to Sevastopol)
	8	36°N/31°30'E	E. Med-Northwest of Cyprus (700 NM to Sevastopol)
S.W. Asia	9	24°N/62°E	N. Arabian Sea (700 NM to Kabul) (1200 NM to Tashkent)
	10	15°30'N/62°E	Central Arabian Sea
Northern Europe	11	72°30'N/27°E	North of North Cape (250 NM NW of Kola)
	12	65°N/5°E	E. Norwegian Sea (750 NM to Kola)
	13	60°N/10°W	North Sea South of GIUK Gap (1500 NM to Kola)
	14	55°N/5°E	North Sea off Denmark

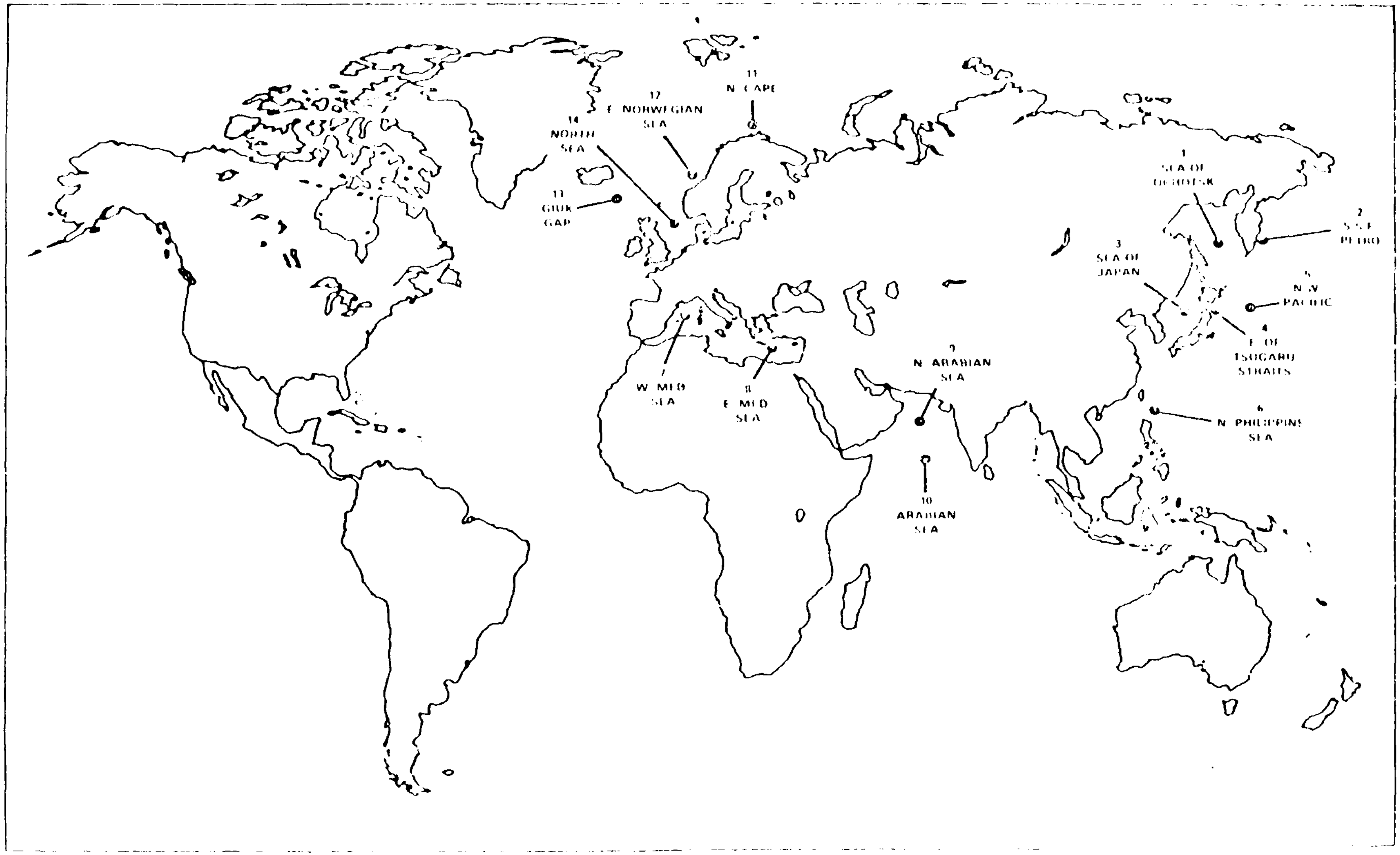


Figure B-1. TLAM/N representative launch points.

(b)(1)
1.3(a)(1)

DELETED

B.3 TLAM/N COVERAGE FOR THE NRF

The target data base utilized for this coverage analysis was derived by SAI from a 1992 FSTL (Future Strategic Target List) generated by SAC/XP. The basis of the target list is the 1982 DIA Target Data Inventory (TDI), which was modified and expanded by SAC to reflect estimated growth and changes from 1982 to 1992 in the numbers of targets in the important target categories. The resulting data base is representative of a future NRF installation data base. It reflects all the fixed targets suitable for nuclear attack throughout the areas of coverage and provides a "shopping list" of potential targets for nuclear attack, not a list of priority targets which must be struck. In other words, it is not a nuclear weapons requirements list. This target base was divided by SAI into eight broad targeting classes, as shown in Table B-3, which reflect current national targeting objectives.

(b)(1)
1.3(a)(1)

DELETED

Table B-2. Illustrative missions for representative launch points

Force/Unit	Mission (plus sea control)
Battle Force (high risk)	
Petropavlosk (1,2)	Strike
Sea Japan (3)	Strike (Vladivastok), support land campaign (Korea)
Tsugaru Straights (4)	Strike (Vladivastok)
N. Cape (Kola) (11)	Strike
E. Norwegian Sea (12)	Support land campaign, strike transit
E. Mediterranean Sea (8)	Support land campaign
Battle Force (mod. risk)	
NW Pacific (5)	Transit for strike
N. Phil. Sea (6)	Transit for strike
N. Arabian Sea (9)	Support of land campaign
GIUK gap (13)	Fowrard SLOC defense, transit, Iceland operations
W. Mediterranean (7)	Local defense, prepare for strikes
C. Arabian Sea (10)	Transit for strike
Independent SSNs only	
E. Norwegian Sea (12)	Pre-battle-force operations, ASW/ASUW
E. Mediterranean (8)	Pre-BF ops, ASW/ASUW
Sea of Japan (3)	Pre-BF ops, ASW/ASUW
Tsugaru Straits (4)	Pre-BF ops, Barrier
Sea of Okhotsk (1)	TLAM/N only
North Sea (14)	TLAM/N only

Pages B-6 through B-9 inclusive are deleted.
(b)(1)
1.3(a)(1), (2) & (4)

(b)(1)
1.3(a)(1)(2)

B.4 TLAM/N COVERAGE FOR THE EUROPEAN THEATER

(b)(1)
1.3(a)(1),(2)+(4)

Pages B-11 through
B-16 inclusive
are deleted.
(b)(1), 1.3(a)(1),(2),(3)+(4)

(b)(1)
1.3(a)(4)

B.5 TLAM/N COVERAGE FOR THE ASIA-PACIFIC THEATER

The target data base utilized for TLAM/N coverage analysis in the Asia-Pacific region was drawn from the PACOM Theater Nuclear Force Improvement Study (TNFIS) Phase II,* an ongoing, multi-contractor project being conducted for CINCPAC under DNA auspices. This data base represents the joint efforts of SAI and the other contractors, with primary inputs by the Defense Intelligence Agency (DIA), PACOM Target Planning Staff, and the Defense Nuclear Agency (DNA). The majority of the source data was provided by DIA (e.g., Target Data Inventory (TDI); however, this was supplemented in some cases with information supplied by PACOM. The organization of the data and the target selection rationale were coordinated between the various contractors and PACOM. The target base was divided into 16 target classes, as shown in Table B-11.

Because this Asia-Pacific target data base was originally used to determine nuclear weapons requirements, it differs from the representative NRF and European data bases previously described in that it is a selected list of those high priority targets that CINCPAC would likely need to strike in a world-wide war in the 1987 time period, rather than a shopping list of all nuclear suitable targets, as in the two previous cases. Although some of these targets are located beyond the overall range of current and programmed PACOM forces, all important targets were included in the data base so that PACOM could identify the requirements for either longer-range strike systems or external support (e.g., Strategic Air Command) for attack of selected targets in a world-wide-war. The basic differences between this "requirements" data base and the "shopping lists" of the NRF and European data

* Op. Cit.

Page B-18 is deleted.
(b)(1)
1.3(a)(4)

base analyses preclude a direct comparison between the three. However, this minor drawback is outweighed by the additional insights that are provided regarding the relative numbers of weapons required, in addition to range and coverage data as yielded by the NRF and European analyses.

(b)(1)
1.3(a)(1),(2),+(4)

Pages B-20 through B-26 inclusive are deleted.
(b)(1)
1.3(a)(1)(2)(3)+(4)

APPENDIX C*

COMMAND AND CONTROL FOR TLAM/N

C.1 INTRODUCTION

Introduction of TLAM/N into the fleet in the mid-80's necessitates a thorough examination of existing Navy force management structures to insure TLAM/N integration, permitting its operational employment in an expeditious manner. One of the existing Navy support systems crucial to the TLAM/N force management concept is the Naval Command and Control (C^2) System. To permit effective TLAM/N integration, it is necessary to:

- Identify the C^2 decisions required for employment of TLAM/N.
- Correlate these C^2 decisions with the existing force management structure.
- Determine the required information flow among C^2 nodes.

C.2 ASSUMPTIONS

The Navy has made the following assumptions that bear on TLAM/N C^2.

- The TLAM/N weapon system will be integrated into the operating forces utilizing the existing Navy command structure.
- The TLAM/N weapon system will become a part of the unified commanders' theater nuclear assets

---

* This Appendix is a condensed version of a draft paper prepared by SAI and submitted to DNA on 1 December 1982. It provides a conceptual approach to the C^2 requirements of TLAM/N, both as a component of the theater nuclear assets allocated to the theater CINCs and as an element of the NRF, with particular relevance to extended conflict.

- TLAM/N may also be included in the NRF. While it is recognized that TLAM/N is inherently a theater system, prelaunch survivability and endurability of TOMAHAWK launch platforms, especially in protracted war scenarios, could provide an effective weapon system for projecting post attack coercive power.

(b)(1)
1.3(a)(1)+(2)

DELETED

- Flexible targeting procedures will be developed that will use pre-planned routing to provide a targeting capability over broad geographic areas to strike unplanned DGZ's.

- The only off-board information necessary to launch a TLAM/N is command direction, nuclear release instructions, and a short data set describing the terminal parameters to be appended to an existing mission route.

C.3 COMMAND AND CONTROL DECISIONS FOR TLAM/N

The C^2 decisions required for TLAM/N employment can be separated into two major categories:

- Decisions related to the employment planning of TLAM/N
- Decisions required to execute a TLAM/N launch.

In addition, C^2 decisions must be categorized with regard to advanced planning capability. C^2 decisions regarding pre-pl[illegible]d TLAM/N missions can be significantly different from decisions that [illegible] be made to employ TLAM/N against ad hoc targets, either in an escalatory crisis period or during a post-SIOP environment.

C.3.1 Employment Planning Decisions

C.3.1.1 Pre-Planned Contingencies. Initial decisions in the employment planning of TLAM/N relate to its role in NSO's or a unified commander's contingency plans. These decisions are made within the broad context of national policy and reflect the multi-mission nature of TLAM/N launch platforms. Once the role of the TLAM/N in the unified commanders' plans has been established, primary targeting options for TLAM/N can be selected. These targeting options will be coordinated with the general fleet operating areas to establish baseline routing and required TERCOM maps for pre-planned options.

C.3.1.2 Ad Hoc Contingencies. Given sufficient time in a peacetime or non-nuclear hostile environment, ad hoc contingency targeting may utilize pre-planned missions. However, if the desired DGZ has not been pre-planned, a different sequence of command and control decisions comes into play. In place of the pre-planned employment decisions which can emphasize cost-effectiveness trades among weapon systems, the ad hoc decision maker will be more concerned with weapon/ platform availability and the capability of available weapon systems to target an unplanned DGZ. Any weapon system which lacks the flexibility to target unplanned DGZ's will provide only a limited contribution in ad hoc contingencies.

C.3.2 Execution Decisions

C.3.2.1 Pre-Planned Contingencies. Execution procedures for pre-planned nuclear contingencies are documented in various JCS, unified commander (and his naval component) and fleet unit plans and OPORDs. The introduction of TLAM/N into operational units will not require change in procedures or alterations in the chain of command. The major TLAM/N impact will not be in the decisions to be made or in the decisionmaking nodes, but in the information flow to those decisionmaking nodes.

C.3.2.2 Ad Hoc Contingencies. In a selective employment scenario, TLAM/N employment decisions will normally first consider the use of sets or subsets of pre-planned non-SIOP options. This will permit the use of pre-planned mission routes to selected DGZ's and will require a minimum of decisions at the operational levels. If a command decision is made to attack an unplanned DGZ in the selective employment phase and the decision requires a TLAM/N to fulfill this tasking, then only two options will be available. If sufficient time is available, the mission can be pre-planned at a TMPS and delivered to the launch platform. The time required will be in the range of days vice hours. If time is critical, then the mission will have to utilize pre-planned routes, deviating in the terminal phase to the new DGZ.

(b)(1)
1.3(a)(1)

DELETED

In the post-SIOP phase, with degraded communications, command and control, and shore facilities, it is reasonable to assume that ad hoc targeting will be the rule rather than the exception. Because of the degradation of support assets, many of the detailed decisions will have to be made at the operational level. Requirements to target TLAM/N against non-preplanned DGZ's will be met by flexible targeting, using pre-planned mission routing with launch platform modifications to the terminal legs.

C.4 TLAM/N DECISION NODES AND CORRELATION WITH C^2 DECISIONS

TLAM/N decision nodes may be identified by generic title. In normal operations this C^2 nodal structure is well known, documented, and exercised. The introduction of TLAM/N into the fleet expands the number of terminal nodes, while retaining the existing high-level nodes. This impact will be minimal from the viewpoint of the unified commanders, whose C^2 links are unchanged, but significant from the perspective of the operational commanders, some of whom, for the first time, could be involved in the employment of long-range nuclear strike weapons.

In a degraded environment some C^2 links may be inoperable or the C^2 nodal structure may collapse into itself as some nodes begin to assume their alternate authorities.

C.4.1 Decision Nodes

The decision nodes applicable to TLAM/N are as follows:

- National command authorities (NCA)
- Unified commander (CINC)
- Naval component commander (FLT CINC)
- Numbered fleet commander (No. FLT CDR)
- Submarine operational authority (SUBOPAUTH)
- Battle group commander (BG CDR)
- Launch platform commanding officer (LPCO)

Certain information will be required at these various decision nodes to support the selection of appropriate TLAM/N options. The types of information required are characterized below.

C.5 INFORMATION REQUIREMENTS FOR PREPLANNED OPTIONS

C.5.1 Employment Planning

C.5.1.1 Select Theater Objectives. Theater objectives will be determined by the CINC based on national objectives and policy, political realities within his assigned area of responsibility, the military forces assigned to accomplish his mission, and the threat. These theater objectives will provide staff guidelines for the development of nuclear appendixes to various war plans for the theater.

C.5.1.2 Determine Theater Use of TLAM/N. The CINC must consider the capabilities of his total available assets as well as national strategy and political constraints in determining how TLAM/N will be employed in the theater. This will normally be the first step in committing TLAM/N to specific preplanned options.

C.5.1.3 Assign TLAM/N to Specific Targets. The CINC's planning staff will consider the full range of TLAM/N capabilities in deciding which specific targets will be assigned to TLAM/N. Such technical performance factors as range, yield, accuracy (CEP), and probability of arrival (which includes a series of probabilities from probability of launch to probability of weapon firing) contribute to the determination of a single shot probability of damage (P_D) for a given target.

C.5.1.4 Designate TLAM/N DGZs. Although this decision could be accomplished by the staff of the component commander, the nuclear targeting function is normally performed by the staff of the theater commander. In addition to the missile performance factors discussed above, information is required as to the desired probability of damage, the collateral damage constraints, and geographic details regarding each individual target.

C.5.1.5 Prioritize DGZ's and Determine Mission Planning Requirements. Because the TLAM/N missile is autonomously controlled by computer generated software, mission routing must be preplanned in highly sophisticated planning centers equipped with the TMPS. The current scarcity of SLCM mission planning resources (one TMPS at FICEURLANT and one at CINCPAC), lead times to provide the data bases needed to plan a mission (terrain elevation, digitized terrain contour update maps, defensive threat intelligence, etc.), and the time required to plan and verify each individual mission all require that the CINC establish theater priorities for mission planning. In addition the CINC will establish planning parameters such as the weapon yield to be used, the desired height of burst, the acceptable ranges of probability for attrition, clobber and navigational accuracy, the CEP desired at the DGZ, and other planning constraints. These parameters will reflect higher headquarters (JCS) constraints as well as those theater planning criteria established by the CINC.

C.5.1.6 Select Probable Operating Areas. Prior to the commencement of TLAM/N mission planning, the FLT CINCs, in conjunction with the numbered FLT CDR and the SUBOPAUTH, will decide and pass to the planning centers the probable operating areas for TLAM/N launch platforms. This decision will help to determine the required landfall areas and will also provide mission planners with routing constraints because of available missile range. The information required to determine operating areas will come from OPLANS/OPORDERS and it is anticipated that this will continue to be based upon considerations other than TLAM/N. It is at this point that decisions to plan multiple routes to specified DGZs will be made.

C.5.1.7 Define Data Transport Device (DTD) Mission Library. Prior to launch platform deployment, the FLT CINC, in conjunction with the CINC, will decide which missions will be loaded on the DTDs being carried. This decision will be made either on an individual platform basis or as a general policy decision with latitude for specific exceptions. The information necessary to make this decision will revolve around available pre-planned missions and the possible operating areas for the deploying launch platform.

C.5.1.8 Prescribe TLAM/N Load Mix. The number of TLAM/N missiles to be loaded on a TOMAHAWK capable launch platform could also be determined by a general policy decision tempered by pre-deployment exceptions for specific platforms. The information flow for a general policy decision will come from the CINC when he determines the basic policy and plans for the in-theater use of TLAM/N. This decision will also involve NCA policy determinations as to the use of TLAM/N in a nuclear reserve role. The more specific load decisions will consider the national and theater alert status, number of pre-planned

TLAM/N missions available, total theater TLAM/N assets, the potential operating areas for the launch platform and the range of potential mission assignments.

C.5.2 Execution Decisions

C.5.2.1 Authorize Nuclear Release and Select Pre-Planned Option/Timing. These decisions will be made by the NCA and theater CINC based on the military situation existing in the theater and elsewhere in the world and, to a great extent, on the political dimensions of the conflict. Some situations will likely require the selection and use of a limited number of TLAM/N alone. In other options, it is likely that the theater use of TLAM/N against preplanned targets will be in a general scenario in which TLAM/N-specific decisions will be secondary. Pre-planned options and their associated TLAM/N mission plans will be developed to cover likely contingencies.

C.5.2.2 Select Specific Launch Platforms. Even in a preplanned option, a decision node which assigns the launch platform/mission combination will be required. If it is assumed that preplanned options assign certain missions to independently operating submarines, then the SUBOPAVTH will need this information to determine the operating areas and the other mission assignments of those platforms. In the case of submarines and surface ships operating in direct support of the battle group, it will be the battle group commander who has real-time information as to operating area and other missions. The data required for this decision is as follows:

- Geographic positions of launch platforms
- Current mission assignments
- TLAM/N DGZs targeted in the selected option and timing considerations
- TLAM/N preplanned mission routes which terminate at the selected DGZ.

- Mission routes which can be flown, or DGZs attacked, from given geographic locations.
- TLAM/N missiles per launch platform
- Weapon system availability (fire control/missile)
- Particular missions carried on each launch platform DTD.

C.5.2.3 Perform Overwater Planning. In a preplanned option, it is probable that the only decision left to the LPCO will be the overwater navigational portion of the TLAM/N mission and, possibly, the time of launch. The LPCO will insure that the missile is programmed and launched so as to arrive at the target within the specified delivery time window. Overwater navigation planning will use both on and off-board information such as:

- Initial way point (geographic and altitude data from the DTD)
- Ship position
- Geographic features between ship and initial waypoint
- Force dispositions in the vicinity (friendly, enemy, neutral)
- Launch envelope
- Time over target and preplanned time from initial waypoint to DGZ.

C.6 INFORMATION REQUIREMENTS FOR AD HOC OPTIONS

C.6.1 Employment Planning

C.6.1.1 Determine Specific Objectives. In an ad hoc scenario, the specific objectives will be determined by the CINC, by the NCA, or by joint decision, based on military and political considerations at the time.

C.6.1.2 Select TLAM/N Weapon System. The selection of TLAM/N to carry out specific objectives in an ad hoc scenario will require analysis of all available theater assets. In addition, constraints that might be a part of the NCA tasking could dictate performance characteristics available only in the TLAM/N system. For example, it might be essential that an unmanned weapon system be utilized and that ballistic missiles be precluded from consideration.

C.6.1.3 Designate Specific DGZs. At this point in an ad hoc contingency, the specific DGZ will be chosen. Mechanisms already established will permit this selection to take place at any of four nodes. In a selective release scenario, the DGZ and the request for release could come up the line from the numbered fleet commander, the fleet CINC or the theater CINC. In other options, such as Direct to Forces (DTF), the NCA could select the DGZ and communicate that information to the appropriate command levels.

C.6.1.4 Select TLAM/N Terminal Parameters. Reflecting any guidance provided by the NCA, the CINC will establish the combination of warhead yield, height of burst, and accuracy at the specified DGZ to meet both P_D requirements and collateral damage restrictions.

C.6.2 Employment Decisions

(b)(1)
1.3(a)(1)

[illegible]

C.6.2.2 Task Independent SSN Assets. In an ad hoc scenario, another decision node becomes necessary in order to select between the assets of the various fleet CINCs and numbered fleet commanders. This decision will be based upon the real-time split of SSN assets as well as their other mission assignments. The information required will come from the operating force commanders, but mission assignment will be made not only on the current availabilities of the force but also on long-term strategic information which might be unavailable at lower command levels.

C.6.2.3 Select Specific Launch Platform. The information required and the decisions to be made will be similar to those in the preplanned case (Section C.5.2.2).

C.6.2.4 Select Preplanned Mission Routes. This decision will not be required for the preplanned options, since in those cases the mission routing will have been determined by DGZ selection, launch area, Contingency Plan/NSC selection, or a combination of these. Route selection is a unique ad hoc decision that will permit operational personnel to utilize preplanned mission routes for basic missile routing while modifying the terminal data so as to target unplanned DGZ's. This selection of basic routing could be accomplished at any of the three operational nodes (SUBOPAUTH/BGCDR/LPCO).

C.6.2.5 Perform Overwater Planning. The information required to perform the overwater mission planning will be the same as in Section C.5.2.3.

C.6.2.6 Provide Terminal Area Modification. The information required by the LPCO will be limited, as it will be for ad hoc targeting in a post attack scenario. The LPCO will need to know:

- DGZ coordinates
- Yield
- Height of Burst
- Time constraints, if any
- Terminal leg flight altitude
- Basic Mission Route

The amount of additional information required by the LCPO will be a function of information received via the offboard command and control links.

The current mission planning architecture requires three separate numerical sets to enter flexible targeting inputs aboard the launch platform: a mission identification number, a mission verification code, and a flexible targeting authorization code. If Emergency Action Procedures (EAP) are instituted which identify mission routes in a different format, then the launch platform will require information to correlate EAP terminology with these three numerical sets. If the launch platform receives only terminal information, the LCPG will also need information to correlate DGZs with possible mission routes. The more flexibility that is desired on the launch platform, the more on-board information will be required.

APPENDIX D

ENGAGEMENT ANALYSIS METHODOLOGY

This appendix provides further details of the methodology used to assess the outcomes of engagements involving CVBGs and two types of threats--submarine and surface launched SSMs and SNA with ASMs. It amplifies the discussion contained in the main text.

SSM Threats

The first step in assessing the results of SSM attacks is to determine the number of missiles that arrive at the CVBG's area defense forces. It is assumed that these SSMs are timed to arrive over an interval of about 5 minutes, which represents as near a simultaneous raid as is operationally possible. Attacks that are more spread out in time so that they approximate a stream attack are easier for the defenses to counter. Treating the SSM attacks as single waves is therefore favorable to the attacker.

SSM attacks arrive from many types of platforms. It is commonly assumed that most of these platforms carry some fraction of their missile loadouts with nuclear warheads. Sources vary as to what fraction that is; either 25 or 50 percent is often assumed.

Each SSM platform that is engaged attempts to launch all of its conventional missiles in a single salvo. The number of missiles launched is reduced to account for reliability. An overall reliability factor of 0.75 is applied to all missile salvos at the time of launch. No further degradations are made for such things as in-flight or warhead failures. The total number of reliable missiles launched is then rounded to the nearest whole number.

The calculation of area defense effectiveness relies on a technique developed at the Center for Naval Analyses that incorporates the size of the incoming attack, the composition of the defending force, the level of offensive jamming, and the capabilities of individual SAMs to intercept the SSMs. The procedure is reported in reference B-1. The expression for the number of incoming missiles killed by SAMs (KR) is as follows:

$$KR = 1 \Bigg/ \left\{ \left(\frac{1}{K_{max}}\right)^{3.2} + \left[\frac{1}{AM\ 1-(1-Pk)^{Nx}}\right]^{3.2} \right\}^{1/3.2}$$

In this expression,

K_{max} is the maximum number of SSMs that a particular composition of air defense ships could kill, assuming a saturation-size raid. It varies from a high of 24.0 for a CG-47 in a mild jamming environment to a low value of 0.5 for a CG-26/DDG-37 under heavy jamming.

AM is the number of incoming missiles determined by the previous step.

Pk is the probability that a salvo of 2 SAMs will intercept and kill a missile. For this study, Pk was assumed to be 0.75.

Nx is the average number of intercept attempts for the screen as a whole. It is the sum of a set of values, one for each AAW escort in the screen. First, a maximum value is chosen for the most capable ship in the screen (0.75 to 1.22 for a CG-47) and then increments (0.50 for a CG-47, 0.05 to 0.09 for all other ship-types) are added for each additional AAW ship.

The value 3.2 used in the expression is a constant needed to fit the expression to data obtained from an air defense simulation.

The number of incoming missiles destroyed is then subtracted from the number successfully launched. The result is rounded off to produce the number of SSMs that survive the area AAW defenses.

The next step is to distribute the SSMs among all the ships in the force. This is done on a random basis. Each ship is assigned a weight that represents its chance of being acquired by the missile relative to any other ship. The probability that any particular ship will be acquired is the ratio of the weight for that ship to the sum of the weights for all ships in the force. Once this probability distribution is established, individual SSMs are allocated to individual ships using a monte carlo technique.

The choice of weighting values is critical to the outcome of the engagement. It is usual to assign higher weights to the larger ships, for two reasons.

- Larger ships, such as CVs, generally have the highest value to the force and therefore will be the preferred target in those instances where attackers can choose their targets.
- Larger ships provide a stronger radar return to the missile homer and are more likely to be acquired even in the absence of aimed shots.

For most of the calculations using the model, relative weights are established according to the following expression:

$$W_i = \left(\frac{T_i}{T_{min}}\right)^{2/3}$$

where,

W_i is the target weight for a ship of type i

T_i is the tonnage for a ship of type i

T_{min} is the tonnage for the smallest ship in the force.

Based on this formulation, a CVN is about 5 times as likely to be acquired by a missile as is any single DD-963. Other conventions use only two weights--one for CVs and other heavies (BBs, AOEs) and one for all other ships. Common ratios for CVs to others range from 2:1 to 4:1.

An SSM that has survived the area defenses and acquired a target must still penetrate the target's point defense in order to achieve a hit. Point defenses may consist of either hard kill systems (CIWS or NSSMS) or soft kill systems (SLQ-32, decoys, etc.) or both. Point defense effectiveness differs from one ship type to another depending on the systems installed. Based on Reference B-1, the probability of defeating an incoming SSM with hard kill systems was 0.56 for NSSMS and 0.39 for CIWS. For those ships equipped with soft kill systems, the chances of success were taken as 0.6 for high value units (CVs, BBs, AOEs) and 0.4 for the smaller escorts.

The point defense effectiveness values are used in a monte carlo model to determine which ships were hit by SSMs. As mentioned earlier, no degradation is applied due to warhead reliability.

The extent of ship damage due to SSM hits is derived from several sources. Mostly, they relate to simulations conducted by the David Taylor Naval Ship Research and Development Center. A summary of this work as applied to CVBG ships is contained in Reference B-2. Not all ship types are represented in the simulations. For example, the vulnerability numbers developed for CG-16s were applied to CGNs, CG-47s, and DD-963s.

The general forms for the probability that a is out of action (Po) or sunk (Ps) are as follows:

$$Po = 1 - (1-SSPk)^{H^{b}}$$

$$Ps = H/36 \text{ for a CV/CVN class ship}$$

$$Ps = 1-\sqrt{1-Po^2} \text{ for all other ship classes}$$

SSPK is the probability of being put out of action by a single hit, as derived from the simulations.

H is the number of hits.

b is a scaling factor ($1<b<2$) that accounts for the increase in damage caused by multiple hits.

ASM Threats

The procedure just outlined applies equally to the ASM threat, with a few exceptions. First, some of the inputs differ when dealing with ASMs vis-a-vis SSMs. This applies to kill probabilities, missile reliability, and ship vulnerability to combat damage. The other exception deals with how the engagement begins--the calculations that are required to produce the number of missiles that attempt to penetrate the area SAM defenses. This sub-section describes the first events in the ASM attack, the outer air battle.

The raid composition is an operational input. The number and type of missile carriers and ECM aircraft is specified by the user of the model. If land-based air interceptors (LBA) are included in the scenario, their effectiveness is assumed to extract a fixed percentage of all aircraft in the raid. SNA losses are assessed between the different aircraft types in proportion to their presence in the raid. The remainder reach the defensive zone assigned to F-14s from the CVBG.

The F-14s that engage are all assumed to make their interceptions before the SNA reach their weapon release point. No credit is taken for F-14 capability to shoot down ASMs.

The number of F-14s that manage to engage the raid depend upon a number of factors:

- The number of CAP that are airborne and thereby potentially capable of intercepting the first wave

- The duration of the raid, allowing sequential launches of DLIs to engage later waves
- The amount of warning time available to get additional interceptors airborne
- The level of jamming by the attackers, intended to degrade the ability of the F-14s to intercept.

The methodology relies on the analysis of the outer air battle described in Reference B-1.

Each fully operational CV provides 2 CAP and 11 DLI to the outer air battle. If the CV is fully alerted, it is assumed to have 13 DLI available. All CVs in the battle force contribute to the mutual defense. CVs that have been damaged are assumed to be unable to provide a portion of their F-14s equal to the fraction they are "not operational." (This fraction is part of the vulnerability calculations made at the end of a previous engagement).

The size of the raid is used to characterize its endurance, since successive waves are limited to no more than approximately 15 aircraft each, arriving at intervals of 5-15 minutes. The following convention was adopted

30 or less attacking aircraft - very short duration
31-90 attacking aircraft - short duration
91 or more attacking aircraft - long duration

The total number of AAMs launched at both jammers and missile carrying aircraft (NL) is given by the following expression:

$$NL = (MA)(EC)[(TC)(PC)(DU) + \frac{2}{3}(AC - TC)(PD)(DU)]$$

MA is the number of Phoenix missiles carried per F-14 (normally 4)
EC is a degradation factor for ECM (0.89 in the base case)

TC is the total number of CAP aircraft airborne

PC is the fraction of CAP on target

DU is a duration factor derived from the raid size

AC is the total number of CAP plus DLI

PD is the fraction of the DLI on target.

The number of aircraft killed (BK) is calculated from NL for two cases, depending upon whether the number of attackers (NB) is greater than or less than NL. The following expression was used:

$$BK = (PR)(NL) \text{ if } NL < NB$$

$$BK = NB\,[1 - (1-PR)^{NL/NB}] \text{ if } NL > NB$$

PR is the probability that a Phoenix AAM will destroy an aircraft at which it is launched.

The final step in the outer air battle analysis is to subtract the SNA loses from the raid size and determine the number of missiles successfully launched. SNA losses are apportioned between missile platforms and jammers according to their relative numbers in the raid composition.

Surviving missile launchers are assumed to attempt to fire 2 ASMs each. This number is reduced by a reliability factor and the total number of ASMs rounded to the nearest integer. This is the value used in the later stages of the AAW analysis.

References

D-1 - Center for Naval Analyses Memorandum, (CNA) 80-1033.00, "Anti-Air Warfare Analysis for the SEAWAR 85 Study ", 12 November 1980

D-2 - Center for Naval Analyses Memorandum, (CNA) 78-1151.10, "Vulnerability of CVs and Escorts to Conventional Weapons ," 29 September 1980