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ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

PROGRAM ANALYSIS
AND EVALUATION

June 26, 1978

19

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MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Interim Report on the PD-18 Study Entitled "Modernization of the ICBM Force" -- ACTION MEMORANDUM

Attached at Tab A is the remaining portion of the Interim Report on the PD-18 study entitled "Modernization of the ICBM Force." As you will recall, a couple of weeks ago I sent you the first two papers prepared for this report. These papers analyzed the options of deploying MX in fixed silos and launch-under-attack. (An appendix on Minuteman survivability was also included.)

Our purpose in sending you these papers was to seek your agreement that these options should not be pursued further in the evaluation of the retaliatory effectiveness of alternative forces. It was not our intention to drop these options from the study, but to discuss them only in the context of perceptions (including effects on strategic indices) and programmatic considerations. Although I believe you agreed with us on the limited military effectiveness of MX in silos, in response to your comments we will keep this option in the analysis, and evaluate its effectiveness with and without launch-under-attack. For the Interim Report, we have simply deleted from the paper on MX in silos the section that asked for your approval to handle this option as indicated above. The remainder of the paper remains essentially unchanged; so I am not sending it to you again.

We are not sure we have adequately responded to your comments on the Launch-Under-Attack paper: "Your times are not right (EA messages will be pre-cut, DSP follow-on can begin to give assessment, etc.)." The Air Force has reviewed the paper and provided some changes incorporating SIOP-5B timing. At least one of these changes is signficant; in the case where the [redacted] We have also added a section on increased capability from DSP follow-on. The revised version of the paper is at Tab B with the changed numbers and sections underlined in red. If you still have problems with the paper, we would appreciate your guidance so we can properly address this issue in the effectiveness analysis.

08-M-3246-A1

E.O. 13526, section 3.3(b)(5)(8)

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At Tab A you will find the other papers in the Interim Report. These include:

- The Introduction and Summary section which briefly summarizes each of the papers;

- a paper entitled "The Strategic Options Matrix;" and

- an appendix entitled "Analytical Methodology."

- One appendix, "The Threat," is not included because of the codeword classification; it is available if you would like to see it.

In the paper on the strategic options matrix, we are seeking your approval of our revised matrix for generating force mix alternatives and our proposed approach to conducting the cost-effectiveness analysis. The methodology appendix documents our proposed approach to strategic force mix analysis, which I believe represents a noteworthy accomplishment of the study effort to date. Taken together, these papers describe the work we plan to do this summer to evaluate the cost-effectiveness of alternative force structures. Since a lot of manhours will be involved, we should consider now whether this type of information will be helpful to you in making the decisions we face in planning our future strategic force posture.

Although a large number of comments received from OJCS, the Services, DIA, and other OSD elements have been incorporated into this report, it is not being forwarded as a coordinated product. As we indicated at the beginning of the study, our intention is to include with the final report all comments not incorporated in the study itself.

By separate cover, we are forwarding to the Executive Study Committee the entire Interim Report (including the first two papers modified in response to your comments). Four more papers will be forwarded to you around the end of July. These papers are on (1) the Triad and hedging against uncertainty; (2) quick-response hard-target kill capability; (3) multiple aimpoint systems; and (4) a treatment of the perceptions and programmatic aspects of basing MX in existing Minuteman silos. These papers are currently being written and reviewed. None require decisions; they are being prepared to highlight important issues relevant to the final report in September.

William W. Lewis

Russell Murray, 2nd
Assistant Secretary of Defense
(Program Analysis & Evaluation)

Attachments

cc: DepSecDef

Prepared by: S.R.Rubens/dms/OASD(PA&E)SP/23June78/X70381/2E-279

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A

INTRODUCTION AND SUMMARY

A. Introduction

In response to the NSC Directive of August 24, 1977, subject: "Follow-On Studies for PD/NSC-18," the Secretary of Defense initiated a DoD study to address the following related issues: (1) modernization of the ICBM force, (2) the future of the Triad concept, and (3) potential requirements for hard-target kill capability. This interim report on that study* consists of the following discussion papers:

1. MX in Existing Minuteman silos;

2. Launch-Under-Attack; and

3. The Strategic Options Matrix.

The papers are briefly summarized in the next sub-section. Also included in this report are three appendices:

1. Appendix A, Minuteman Survivability, is the executive summary of a recent SALT interagency paper on Minuteman survivability. The bottom-line conclusions are: (a) the Soviets will be capable of reducing Minuteman silo survivability to very low levels by the early 1980s, and (b) they should have confidence in their ability to do so. (Although they may have major unquantifiable uncertainties, such as fear of U.S. launch-under-attack tactics, technical uncertainties associated with reliability, accuracy, etc., should not be very great.)

2. Appendix B, Analytical Methodology, describes in detail the analytical methodology to be used in this study to evaluate the retaliatory capability of alternative U.S. force postures. The methodology has been accepted by the study working group and will enable us to evaluate relative force effectiveness over a broad range of targeting objectives under fairly realistic constraints.

3. Appendix C, Threat, is the description of the threat to be used in the study. It was prepared by DIA and will not be circulated, unless requested, because of its classification level.

There are four other papers currently in preparation which will be available at the end of July.

*Referred to as the MX/Triad study throughout this report.

- The Triad and Hedging Against Uncertainty;
- Programmatic and Perceptual pros and cons of silo-basing MX;
- Requirements for quick-response hard-target kill capability; and
- Multiple Aimpoint System issues.

B. Summary

Each of the three discussion papers is summarized below.

1. MX in Existing Minuteman Silos. This paper deals only with the added retaliatory capability of silo-based MX. Due to the amount of recent high-level interest, a separate sub-committee of the MX/Triad study working group is being formed to write a paper on the programmatic and perceptual pros and cons of this option.

The lessons learned from the SALT interagency study on Minuteman survivability lead to the following conclusions:

- Even if MX were deployed in the hardest of current silos, and even if the Soviets did not adopt special tactics against the silos containing MX, MX survivability would almost certainly be very low (e.g., 10% for a median figure).

E.O. 13526, section 3.3(b)(8)

- The Soviets could reduce MX survivability to even lower levels by preferentially targeting [redacted] and/or by using more than [redacted] This would be so even if there were substantial fratricide.

- The Soviets could have high confidence in their ability to reduce MX to very low levels; i.e., there is no evidence to support the notion that Soviet calculations would differ greatly from our own, at least after about 1983.

The paper goes on to quantitatively refute the commonly made argument that surviving MX in silos would be significantly more effective that an equal number of MM III survivors.

If the U.S. chooses to ride out an attack, there are two options: (1) pre-planned targeting with redundant coverage to account for low PLS (pre-launch survivability), and (2) optimal post-attack retargeting. The calculations show an almost imperceptible difference in retaliatory capability between 200 silo-based MX and MM III if the other legs of the Triad work as anticipated, even with optimal post-attack retargeting. Even if one of the other legs fails catastrophically, the incremental capability added by the few MX survivors is small.

This analysis is intended to counter the common argument that because 100 MM III could destroy roughly 50% of Soviet industry, the greater capability of a few surviving MX is significant. The argument is true only if the prime urban/industrial targets were left unattacked as a result of a catastrophic failure of both SLBMs and bombers.

2. Launch-Under-Attack. This paper seeks to draw a clear distinction between a launch-under-attack (LUA) capability to enhance deterrence and LUA as a high-confidence tactic to maintain an effective ICBM force if deterrence fails. A credible LUA capability may enhance deterrence, may serve the domestic purpose of dampening concerns about declining Minuteman survivability, and may be cheap relative to mobile MX or Trident II. However, the paper argues that an operational LUA capability is not a viable alternative for modernizing the ICBM force, primarily because:

- The time available to analyze attack assessment information and execute a response prior to the arrival of Soviet ICBMs would be [redacted] at best and, in many cases, [redacted] especially if the Soviets also attacked our [redacted]

E.O. 13526, section 3.3(b)(8)

- To have confidence in this tactic would require a system for transferring authority to a properly briefed and survivable figure quickly in the event communications with the President failed. Further, should the President die in an attack, timely and proper transfer of authority over nuclear release must be ensured. Both requirements raise some fundamental constitutional questions.

- The President and his potential successors would have to be thoroughly familiar with the attack assessment systems and be prepared to make a decision in very little time. Otherwise, we would be accepting an unplanned Dyad with a significant loss in our retaliatory capability.

- Finally, although the President could decide to retaliate in a few minutes, he shouldn't, as a matter of policy, have to do so.

3. The Strategic Options Matrix. The first objective of this paper is to seek Secretary of Defense approval for our proposed change to the strategic options matrix (presented in the study outline). In that outline, we addressed the question of the future role of the ICBM force in terms of the "relative role of the ICBM force." We believe the statement that best reflects the immediate issue for decision is not the ultimate deployment level but rather "Do we want an effective Triad, i.e., do we want to modernize the ICBM force so that all three legs of the Triad make a significant contribution to the retaliatory capability of our strategic forces?" The refinement of the ultimate size of the ICBM force can be left to be worked out after SALT is settled and the review of our targeting objectives has been completed. Acceptance of this change leads to the revised matrix shown below.

Revised Strategic Options Matrix

Survivable Hard Target Capability \ Do We Want An Effective Triad?	Triad With Modernized ICBM Force	Unbalanced Triad With No ICBM Modernization
Extensive Quick-Response Capability		
Extensive Non-Quick-Response Capability (No First-Strike Capability Against Silos)		
Limited Counter-Silo Capability		

The second objective is to seek approval of our proposed approach to conducting the cost-effectiveness analysis of the alternative force structures that are developed to fit the revised options matrix. We argue in the paper that it is not appropriate to study either equal effectiveness or equal cost forces. Accordingly, we recommend that alternative forces be studied that are programmatically feasible and consistent with SALT (although not necessarily such as to fill out the SNDV aggregate) -- this being more nearly the type of decision facing the Administration. A number of excursions (threat, budgetary, etc.) are also proposed.

B

PAPER #2: LAUNCH-UNDER-ATTACK

A. Introduction

The Secretary of Defense and other high-ranking Administration officials have publicly discussed a U.S. launch-under-attack (LUA) option to demonstrate the great uncertainty facing a Soviet leader contemplating a first strike against the U.S. Such statements may enhance deterrence if they are credible; they may also serve the domestic purpose of dampening concerns about declining Minuteman survivability. In discussing LUA, we must draw a distinction between LUA to enhance deterrence and LUA as a tactic to maintain an effective ICBM force if deterrence fails. There is a danger that we may come to embrace LUA as a substitute for deploying a more survivable system without fully recognizing its limitations and implications. In other words, it's one thing to talk about LUA and quite another to structure our forces such that their effectiveness is dependent on it.

The following discussion is intended to raise a number of questions and highlight some important problems associated with an operational LUA capability. Let's begin our discussion by looking at current U.S. capabilities and limitations for launch-under-attack.

B. Current U.S. Capabilities and Limitations for Launch-Under-Attack

The U.S. ICBM force has the operational capability for [redacted] Launch times are controlled to [redacted] The net effect is that the [redacted]

E.O. 13526, section 3.3(b)(5)

Current and planned U.S. missile surveillance sensors are intended primarily for tactical warning. The Defense Support Program (DSP) has recently been modified to include some raid counting capability but it is not capable of high confidence attack characterization. For example, it cannot indicate that only the ICBM force is under attack. Similarly, in the near term, the Ballistic Missile Early Warning System (BMEWS) will be limited to providing further evidence (given DSP information) of an impending attack on Minuteman. Some capability to assess attacks on Minuteman resides in the Safeguard Perimeter Acquisition Radar Attack Characterization System (PARCS), but data from this sensor is probably not available to the NCA in time to support the execution decision process for most scenarios. By 1985, we can expect a better capability to characterize the magnitude of the threat to Minuteman and with the BMEWS range resolution upgrade, we can expect a capability to indicate classes of targets that are under attack, including an indication that the NCA is targeted.

After determining that the U.S. ICBM force is under attack, there remains a finite amount of time to refine attack assessment and to execute a response prior to the arrival of Soviet ICBM reentry vehicles on Minuteman silos. The time available is very scenario dependent as seen in Figure 1.

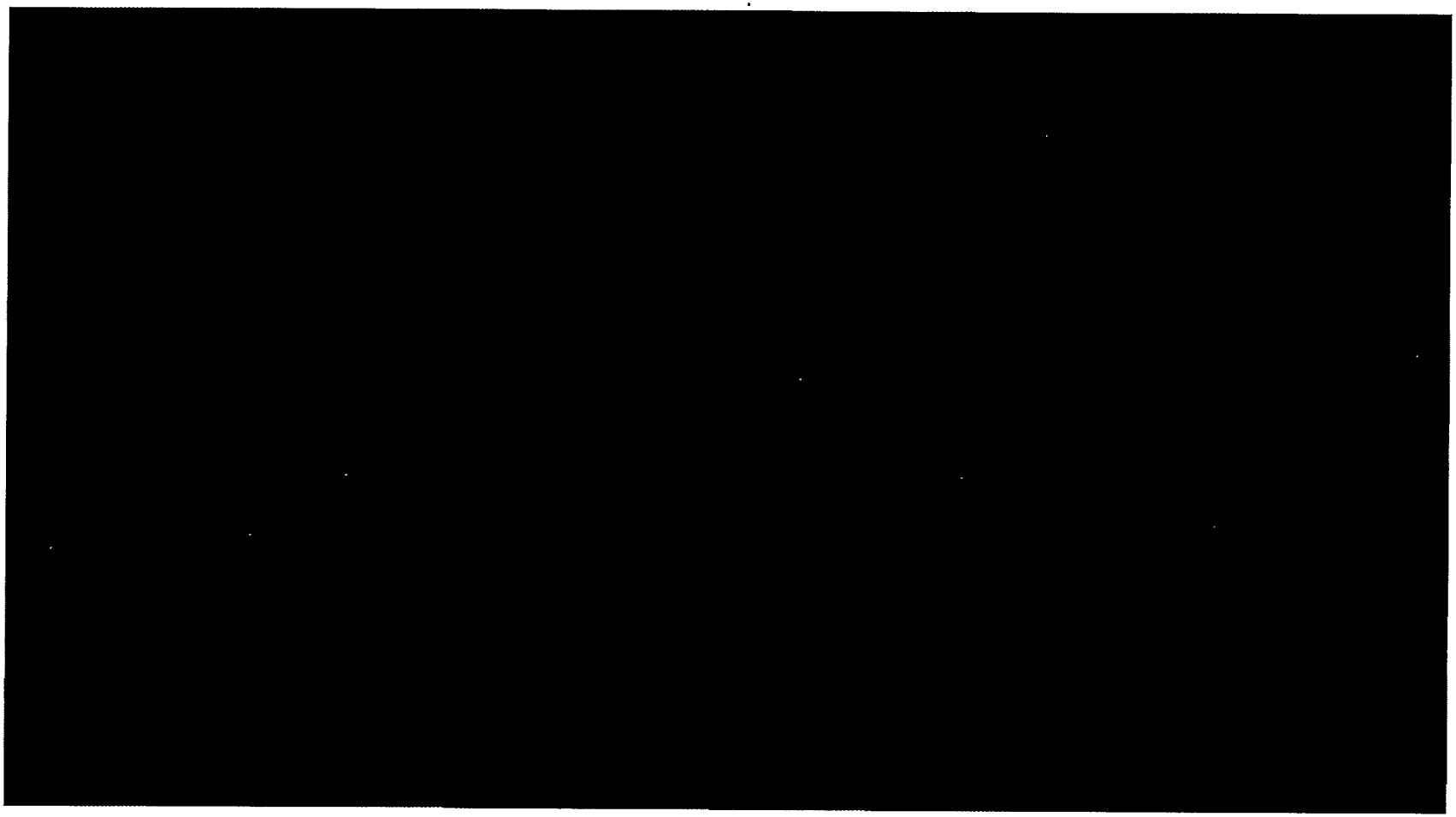
Today, preparation of an EAM [redacted] regardless of scenario. However, the time required for transmission of the EAM to first launch of ICBMs varies from [redacted] available. Given no fireout constraints (i.e., salvo launch), one minute of flyout time, and availability of the primary landline network, the execution message preparation may be initiated as [redacted]. With the current constraints, the message preparation would have to be [redacted] If it is assumed that an early [redacted]

E.O. 13526, section 3.3(b)(5)(8)

Within the time windows defined by C^3 availability, there is a continuum of attack assessment data that will be available to the NCA before the EAM decision is required. DSP reports of simultaneous Soviet ICBM/SLBM launches would begin to arrive roughly [redacted] before impact of Soviet SLBMs (depending on their launch point) and [redacted] before ICBM impact on Minuteman silos (assuming a nominal flight time of 30 minutes). SLBM radar and BMEWS reports would arrive about [redacted] before ICBM impact on silos. PARCS data on incoming RVs would arrive for NCA use from [redacted]. Thus, if C^3 nodes and the NCA are not attacked, and if DSP, SLBM radar and BMEWS assessment is required in the decision process, the decision time available to the NCA is about [redacted] If PARCS data is required, at most three minutes of decision time would be available. If the C^3 network is attacked, there would be no decision time available to use any current attack warning or assessment system other than the [redacted]

E.O. 13526, section 3.3(b)(5)(8)

General Slay in his recent testimony before the Senate Armed Services Committee said "We do well with DSP, BMEWS and the combination to give an indication that Minuteman is under attack. To confirm a large raid on Minuteman or to confirm a threatening raid on Minuteman we have no capability with DSP or BMEWS, or with the PARCS, a system we have inherited from the Army. We have some capability but we say it is poor and that the unreliability of that indication would be [redacted] percent."



E.O. 13526, section 3.3(b)(5)(8)

Independent of the sensitivities to availability of attack assessment information and C^3 assets, the critical factor in getting the execution message to the ICBM launch crew prior to the impact of Soviet RVs on the silos is the survivability of the President and the time required for Presidential decision. In the absence of strategic warning, the time required to contact the President and receive his execution decision may vary from a [redacted] If, during this time, either the NCA or the President are attacked by early arriving SLBM warheads, the execution decision may [redacted]

C. Potential DSP Improvements

E.O. 13526, section 3.3(b)(5)(8)

The draft C^3I study on Missile Tactical Warning and Attack Assessment assesses current and potential capabilities of U.S. tactical warning and attack systems, including the DSP system, to provide timely and credible information to support a launch under attack option for the Minuteman force. The study concludes that our current system would provide sufficient information to support a LUA decision, if we were willing to launch Minuteman on the basis of data indicating only that CONUS were under attack by a large force. If, on the other hand, more precise attack information were required for an LUA decision, e.g., determining that 150-450 SS-18's or SS-19's had been launched toward central CONUS, an improved DSP system would be needed to provide more accurate launch count and trajectory azimuth information.

In the near-term (1980 completion), the study proposes improving DSP azimuth accuracy by upgrading DSP software to permit processing of booster reentry data. With this improvement, DSP would provide, about eight minutes after launch or about six minutes after initial DSP readout, high confidence information for determining whether SS-18 or SS-19 missile trajectories were heading toward the Minuteman complexes.

In the longer-term (mid-1980s at the earliest), the study proposes improving DSP booster count and azimuth accuracy as part of the Sensor Evolutionary Development program. Given a decision to support these improvements now, this evolutionary upgrade to the DSP sensor would, within 2 minutes of launch, permit the system to count boosters within about 10% and provide azimuth accuracies sufficient to determine that a Minuteman threatening attack had been initiated.

While these improvements would improve the accuracy and detail of the information provided by the DSP system, it should be noted that they do not address related issues that also bear on the credibility and feasibility of LUA: the possible need for dual-phenomenology, the vulnerability of U.S. TW/AA sensors and their supporting communications systems and the vulnerability of the strategic C^3 system, including the NCA.

D. Scenario Assumptions and LUA Alternatives

To discuss a LUA option relative to other alternatives, it is necessary to examine the range of possible scenarios for a strategic exchange, and to recognize that having a realistic LUA capability for all (or even most) scenarios is very different from having such a capability under selected circumstances. Specifically, if the decision were made to retain a Triad and make either Minuteman or a relatively low cost silo-based MX system effective through LUA, we would have to ensure a reliable LUA system for all realistic scenarios, including Soviet minimum warning attacks aimed at disrupting such a capability. To do otherwise would be to accept, under certain circumstances, an essentially unplanned catastrophic loss of a Triad leg. The resulting Dyad would be considerably less effective than would be the case if we made a decision to rely only on the Dyad force and preplanned its employment accordingly.

Accepting a Dyad on day-to-day alert and a Triad on generated alert (with much greater capability) could tend to destabilize the strategic situation in a crisis by making a surprise attack far more profitable. On the other hand, if we were willing to accept a Dyad under worst case assumptions (i.e., a bolt-out-of-the-blue attack), but wanted a Triad for what we believed to be a more likely scenario (e.g., generated alert following a period of tension), then we should compare LUA with potentially cheaper ICBM modernization options than have heretofore been proposed. For all MX systems currently under consideration, cost is driven largely by the need to survive any attack. It may be possible to develop a lower cost mobile ICBM system that would be survivable under generated alert, but not under day-to-day alert. A LUA strategy would eliminate some inherent advantages of the ICBM force, principally flexibility. Further, it would give the Soviets control over when our ICBM force was used.

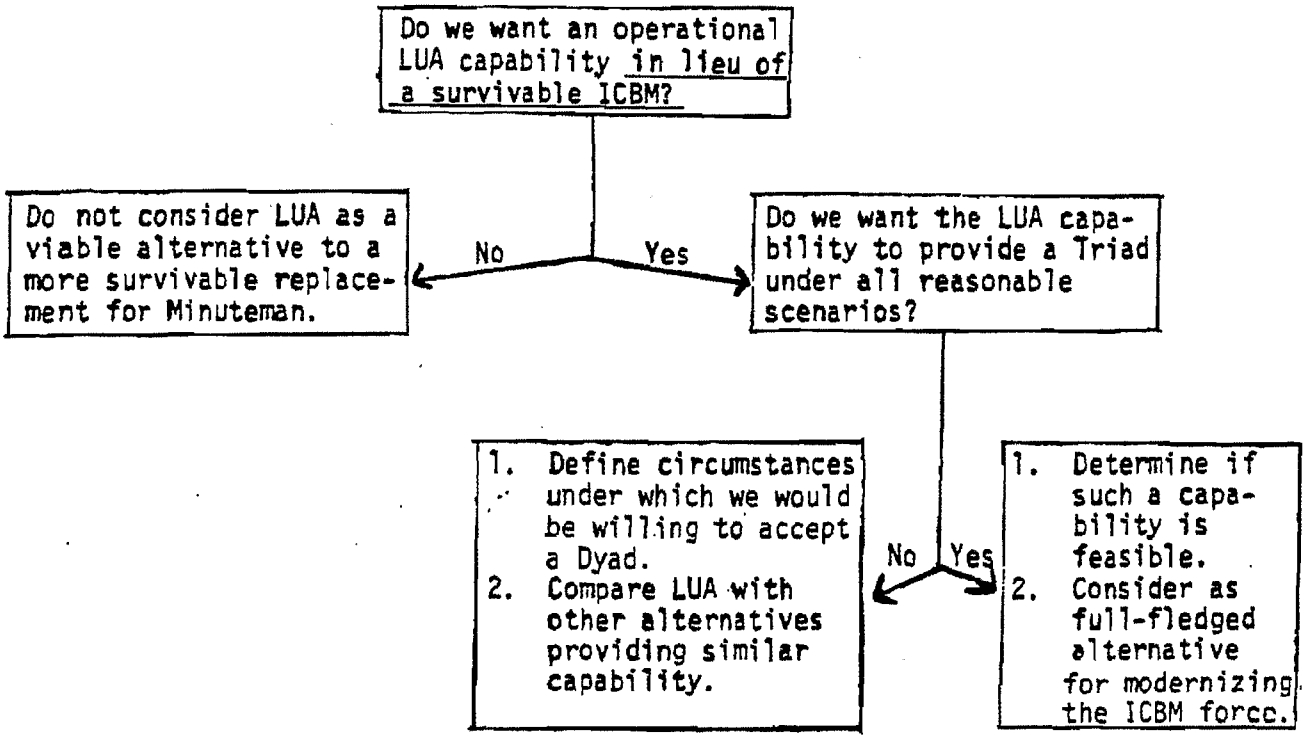
An LUA decision tree, which summarizes the relationship between scenario assumptions and alternatives for an operational LUA capability, can be depicted as shown in Figure 2.

E. Requirements and Problems Associated With An Operational LUA Policy

Let's look at some of the requirements and problems associated with the LUA policy for all cases versus such a policy under selected circumstances.

Figure 2

LUA Decision Tree



1. LUA As a Viable Alternative Under All Reasonable Scenarios. The first requirement would be a greatly improved warning and attack assessment system that the President or his successors could rely on to accurately assess the type and magnitude of the attack. These systems are vulnerable today and a fundamental question is: Can we deploy a reliable and survivable attack assessment system?

It would require a President and his successors thoroughly familiar with the attack assessment systems and the execution options as well as prepared to launch the ICBM force in minutes based only on information supplied by available sensors.

If the President doesn't survive, could we get the attack warning and assessment information to one of the President's successors located in some other part of the country (or the world) and could he (or she) execute the SIOP in time? Would this individual be able to ascertain the nature of the attack on the NCA, or even who was responsible for it?

How would the system work under the following scenario? The Soviets launch a coordinated (SLBMs and ICBMs) bolt-out-of-the-blue attack on the U.S. The Soviet objective is to destroy our ability to retaliate to the maximum extent possible so they go after our C^3. Suppose, further, that as part of the attack, SLBMs were fired on the White House [redacted] during a Cabinet meeting or a reception for some dignitary; would the President and the Cabinet survive? If not, would the next in line, wherever he might be located at the time, [redacted]

E.O. 13526, section 3.3(b)(5)(8)

Another scenario which is hard to cope with if we were to rely on LUA is the following: The Soviets attack satellites, BMEWs, and other Warning Centers with non-nuclear munitions, perhaps as part of a general non-nuclear attack. Do we immediately escalate to the massive use of nuclear weapons? [redacted] obviously does not solve our problem, but only increases instability. [redacted]

The purpose here is not to dream up the most ghastly scenario but rather to illustrate the depth of planning and coordination that would be required for an operational LUA strategy. It appears that if we desired a LUA strategy that would be effective under most scenarios, we could, a priori, choose one of the following tactics to ensure such a capability.

(a) Make the LUA response automatic given loss of certain sensors or communications;

(b) enforce a requirement that a qualified successor to the President be survivable at all times (e.g., airborne in NEACP) except those crises where the President himself would be secure.

Tactic (a) is probably unacceptable to everyone and, therefore, can be dropped. It would certainly present the danger that we could launch our ICBMs as a result of mechanical failures or the clever work of some terrorist. Tactic (b) raises profound questions regarding delegation of authority, civilian control and crisis stability. Should the President die in an attack, can we ensure that his successor will have the required survivable, anti-jam C^3 to support a LUA strategy and, at the same time, guarantee that a temporary communications failure, etc., would not lead to a premature transfer of authority over nuclear forces?

2. LUA As a Strategy Given a Crisis or Strategic Alert. It is clearly easier to develop a LUA strategy in a generated alert situation than for a bolt-out-of-the-blue attack. Given sufficient warning, the President or his appointee could be airborne in the NEACP with all systems alert and prepared for any possible attack. It is doubtful that the President himself would fly NEACP in anything but the gravest situation, which means that even in generated alert, provision for transfer of authority would have to be made in a timely manner. Nevertheless, such a system could probably be made to work today although it would still necessitate a highly formalized procedure for declaring a crisis. History provides abundant examples of surprise attacks for which strategic warnings were ignored.

F. Targeting*

A related issue concerns how we would target the ICBM force under a LUA policy. At the outset, we must recognize that LUA only salvages a fraction of the targeting capability which a secure, survivable ICBM force would have. It seems probable that we would want options to respond to different types of attacks in an appropriate manner while controlling escalation. For example, suppose the Soviets launched a countersilo-only attack, we might want to respond in kind. On the other hand, if the Soviets were attacking both counterforce and countervalue targets, we might want our ICBMs to strike at least some countervalue targets as a hedge against problems in the other legs of the Triad. Of course, we wouldn't want to attack countervalue targets if the Soviets had only gone after our ICBMs. It's clear, therefore, that there would be more to a LUA strategy than just getting a message out to execute the force; the message would have to include specifically which missiles against which targets. This selective response capability would require excellent attack assessment, pre-planning and training by the President and his successors, and the ability to decide and execute the appropriate response in minutes.

G. Summary

An operational LUA capability is not a viable alternative to modernizing the ICBM force** primarily because:

*This issue is being addressed in detail by a sub-panel of the Targeting Study.

**This is not to say we should not make an LUA option more credible to capitalize on its positive impact on deterrence.

(1) The time available to analyze attack assessment information and execute a response prior to the arrival of Soviet ICBMs would be [redacted] and, in many cases, [redacted] especially if the Soviets also attacked our [redacted]

(2) To have confidence in this tactic would require a system for transferring authority to a properly briefed and survivable figure quickly in the event communications with the President failed. Further, should the President die in an attack, timely and proper transfer of authority over nuclear release must be ensured. Both requirements raise some fundamental constitutional questions.

(3) The President and his potential successors would have to be thoroughly familiar with the attack assessment systems and be prepared to make a decision in very little time. Otherwise, we would be accepting an unplanned Dyad with a significant loss in our retaliatory capability.

(4) Finally, although the President could decide to retaliate in a few minutes, he shouldn't, as a matter of policy, have to do so.

PAPER #3: THE STRATEGIC OPTIONS MATRIX

A. Introduction

The MX/Triad study is designed to illuminate two important issues that require Presidential decisions before DoD can effectively structure a future U.S. strategic force posture. They are:

1. What should be the future role of the ICBM force?

2. What are U.S. requirements for a hard-target kill capability?

Each of these issues will be addressed separately in this study, although, as will be seen, alternative force postures will be developed to show the cost and effectiveness implications of decisions on these issues. Because it is assumed that the U.S. would not want to depend on preemption to accomplish our fundamental strategic force planning objectives, the effectiveness of alternative forces will be evaluated in terms of their survivable (i.e., retaliatory) capability. Naturally, when examining alternative force postures from the viewpoint of perceptions and crisis stability, first- and second-strike capability will be addressed.

The strategic options matrix (Figure 1) from the study outline was developed to address each of these issues. The objective of this paper is to seek Secretary of Defense approval for: (1) our proposed changes to the matrix which reflect our better understanding of the issues and scope of the study and (2) our proposed approach for conducting the cost-effectiveness analysis.

B. The New Matrix

Recall that each column and row in the original matrix represented strategy decisions the Administration could make regarding the amount of non-silo retaliatory capability appropriate for the ICBM force (represented by the columns) and the characteristics of the desired hard-target kill capability (represented by the rows).

We are proposing that the strategy decisions represented by the columns, i.e., regarding the amount of non-silo capability of the ICBM force, be changed from the "Relative Role of ICBMs" to "Do We Want An Effective Triad, i.e., do we want to modernize the ICBM force so that all three legs of the Triad make a significant contribution to the retaliatory capability of our strategic forces?" (see Figure 2). This statement better reflects the immediate issue for decision, which is not the ultimate deployment level of MX, but whether or not we should modernize the ICBM force with a more survivable missile in order to retain an effective Triad. The refinement of the ultimate size of the ICBM force can be left to be worked out after SALT is settled and the review of our targeting objectives has been completed.

Figure 1

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MATRIX OF BASIC STRATEGIC ISSUES

Survivable Hard Target Capability \ Relative Role of ICBMs	1 ICBMs Dominant — "Balanced Triad"[a] with More ICBM Capability than Current Forces	2 Balanced Triad with ICBM Capability Comparable to Today's Forces	3 Transitional Region	4 ICBMs Play a Minor Role — Unbalanced Triad with SLBMs and Bombers Dominant
A — Extensive[b] Quick-Response Capability				
B — Extensive Non-Quick Response Capability (No "First Strike Capability" Against Silos)				
C — Limited Countersilo Capability				

[a] "Balanced Triad": Each leg has the survivable capability to destroy a significant portion (__%) of the specified non-silo target base (see Section II.B.2.).

[b] "Extensive" capability: Capability to destroy a large percentage of silos and other hard targets (__%).

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Figure 2

Revised Strategic Options Matrix

Survivable Hard Target Capability \ Do We Want An Effective Triad?	Triad With Modernized ICBM Force	Unbalanced Triad With No ICBM Modernization
Extensive Quick-Response Capability		
Extensive Non-Quick-Response Capability (No First-Strike Capability Against Silos)		
Limited Counter-Silo Capability		

Within each square in the matrix, there will be several alternative force structures that satisfy the conditions represented by the respective column and row headings. For example, three ways to satisfy the conditions of square 1A are:

1. A Triad where the ICBM force has roughly the non-silo retaliatory capability of today (assuming the SIOP-5B planning factor for [redacted] plus sufficient capability to do all of the countersilo mission.

E.O. 13526, section 3.3(b)(5)

2. A Triad where the non-silo retaliatory capability of the ICBM force is roughly the same as that of the future SLBM or bomber forces plus sufficient capability to do all of the countersilo mission.

3. Same as 2 above only the countersilo mission is performed by the SLBM force.

Within Column 1, we will examine the relative merits of effective Triads where the emphasis is placed on ICBMs, SLBMs, or bombers, as well as combinations of these force elements. For Column 2, the assumption is that the ICBM force will not be modernized with a more survivable system.

C. Cost-Effectiveness Analysis

After careful consideration, we have decided that it would be impractical to conduct the cost-effectiveness analysis using either equal effectiveness or equal cost forces. Here's why:

- With respect to equal effectiveness forces:

  - Without a definitive statement of our targeting objectives, we have developed a methodology (see Appendix B) that allows us to depict the capability of alternative forces across a wide range of economic and non-silo military target destruction levels. This measure of effectiveness is not a point but rather a curve.

  - Since the force alternatives (e.g., MX, Trident II, ALCMs) would be deployed over different time frames and at different rates, the effectiveness of any one force posture will vary with time. Hence, the effectiveness curve is really a surface.

  - In addition, we plan to evaluate the effectiveness of alternative force postures in terms of their hedging potential as has been discussed in another section of this interim report.

Clearly, equal effectiveness forces at this level of detail is an analytical impossibility.

- With respect to equal cost forces:

  - Disagreements abound over whether constant or discounted cost analysis is most appropriate.

-- Discounted dollar analysis loses some of its utility when capability is delivered in substantially different time profiles.

-- Constant dollar comparisons are just discounted costs using a zero discount rate.

- There are disagreements over whether 20, 30 or more years is the appropriate costing horizon.

At the very least, a number of different discount rates and time periods would be required in order to fend off criticism that the study was biased one way or the other. This would require generating entirely new force structures for each discount rate or costing period. Not only would this quadruple (or more) the work, but, more importantly, it would make the effectiveness analysis and, in particular, the structuring of force mix alternatives dependent on costing assumptions.

Finally, and most importantly, equal cost or equal effectiveness forces do not represent the alternative decision choices we actually face. A more realistic set would be the various ways we could structure our forces to meet the SALT TWO limits. Accordingly, we have decided on the following approach which we believe is more appropriate for this study. Using the new options matrix (Figure 2), a number of forces will be developed for each square in the matrix. These forces will be programmatically feasible* and consistent with the numerical limits of the SALT TWO agreement extended into the 1990s. The effectiveness of these forces will be compared using the methodology described in Appendix B. Each of the forces will be costed for a number of discount rates (including zero) through the year 2000.

In some cases, the relative cost-effectiveness of alternative forces may depend on the measures of effectiveness and/or the costing approach considered. By presenting a range of effectiveness results and a variety of discount factors, decision-makers will be able to see the sensitivity of the results. Hopefully, this will facilitate the decision-making process.

In order to keep the number of forces analyzed to a manageable number, PA&E will develop a set of representative forces for each square in the matrix. These forces will be presented to the study working group for review and comment. To the extent possible, we will arrive at an agreed set of forces for the cost-effectiveness analysis. We will limit the number of forces for each square to the minimum necessary to highlight the range of available options.

Conclusions will be presented about the relative cost-effectiveness of forces within a given square, as well as among different squares. The latter will be used to highlight the costs and effectiveness of

*Will take into account nuclear material availability, realistic deployment rates, etc.

different approaches to satisfying: (1) a given strategic option (same row or column) and (2) different strategic options (different row and column).

Excursions will be important and involve: (1) advanced threats and unanticipated defensive breakthroughs, (2) selected SALT possibilities (e.g., greater reductions, breakdown), and (3) severely constrained budgets. These excursions will be conducted on a limited number of forces, either those that appear to be the most cost-effective or those that appear to be the most sensitive to the various excursions. Once again, to the extent possible, agreement will be sought in the working group on which forces and which excursions are to be conducted. Where agreement cannot be reached, alternate points of view will be forwarded with the final report to the Executive Study Committee.

APPENDIX B: ANALYTICAL METHODOLOGY

I. Introduction

This paper describes the analytical methodology PA&E proposes to use in the MX/Triad study to evaluate the military capability of alternative U.S. arsenals for the following tasks: targeting the Soviet Union, targeting the People's Republic of China (PRC) and the non-Soviet Warsaw Pact (NSWP), and maintaining a Secure Reserve Force (SRF). Only the targeting of the Soviet Union is dealt with in detail.

In describing capabilities against the Soviet Union distinctions are drawn among:

- economic targets
- all other non-silo targets in the data base (primarily military installations)
- ICBM silos

We believe it is important to describe an arsenal's capabilities against each of these target groups. However, dealing with the large group of non-silo non-economic targets is the most difficult technically, and this problem is given the most analytical attention in the present paper.

PA&E has made a considerable effort in recent months to elucidate long-standing differences in weapon requirements determined by simple allocation models and SIOP procedures. As a result of PA&E analysis and discussions with JCS, JSTPS and the Air Force we have developed three constraints for use with the PA&E model. These constraints are not intended to replicate their SIOP analogues, but rather to introduce in an approximate way considerations that clearly play a major role in operational targeting. The constraints are:

- a requirement that weapons be allocated in waves: a first wave against military targets and, if appropriate, a second wave against economic targets;
- a requirement that the more important non-silo non-economic targets be attacked to a specified aggregate [redacted] before targets of lesser priority are directly attacked; and E.O. 13526, section 3.3(b)(5)
- a requirement, in some calculations, that certain classes of targets be redundantly covered so as to assure a hedge against failure of a portion of the Triad.

All of these constraints have the effect of increasing weapon requirements, because all of them create special objectives to be met in addition to high levels of aggregate DE. In the absence of the constraints, the PA&E model using current SIOP forces against the current data base

predicts that the aggregate damage levels achieved by the SIOP can be achieved with 30% fewer weapons than used in the SIOP. With the above constraints, the differences in weapon count are in the noise of the calculations (e.g., differences of 0-10%). Although the amended allocation rules are by no means a simulation of the SIOP (there are major differences in weapon allocations at the microscopic level), we believe it now includes the features necessary for it to be useful in the MX/Triad study -- we can now examine issues such as the military implications of increased silo vulnerability more clearly (primarily because we now can focus on several classes of military targets), and explore the issue of hedging more informatively.

The paper previews some issues related to the methodology and suggests several areas where the proposed methodology can be augmented by analytical support from SAGA, AF (SAC & SA) and the Navy.

We hope that many of the concerns some had with the analytical approach used by PA&E in the Consolidated Guidance have been eliminated, but we must continue to recognize that models appropriate for force-mix studies must necessarily be simplified representations of reality.

The following describes our approach to dealing with each of the targeting requirements, beginning with the most straight forward (PRC, NSWP, and SRF) and concluding with the more complex (Soviet non-silo).

II. PRC, NSWP and SRF Requirements

One of the major criticisms of the PA&E calculations in the Consolidated Guidance (CG) was that no forces were allocated to cover targeting requirements for the PRC, the NSWP and the SRF. For each force posture evaluated in this study, forces will be set aside to cover these requirements. These forces will be comparable to today's level of capability under SIOP-5B alert with damage and generated without damage scenarios.

Today, the following forces are identified to satisfy PRC, NSWP and SRF targeting objectives:

System	Number of Weapons Day-to-Day Alert NSWP	PRC	SRF	Number of Weapons Generated Alert NSWP	PRC	SRF
B-52/FB-111 (Gravity Bomb & SRAM)	[redacted]					
Minuteman						
Poseidon						
Polaris						

E.O. 13526, section 3.3(b)(5)

1/ MOD Alert SLBM Warheads.
2/ Includes [redacted] MOD Alert SLBM Warheads.

We do not intend to analyze whether or not these forces are sufficient, but rather, we will set aside from each force posture comparable forces to satisfy these requirements.

III. Countersilo Requirements

In order to fully address the countersilo issue, levels of countersilo capability well in excess of that achievable with current forces will be considered. This issue will be treated, for the most part, independently from the Triad question, although, clearly, a decision on the amount of countersilo capability desired will have a major impact on our future force structure.

Countersilo capability of alternative systems (e.g., MX, Trident II, cruise missiles) will be compared in a straight forward manner. Calculations will be made of the number of weapons required (and the cost) to satisfy a range of damage expectancy (DE) goals under various assumptions regarding SALT and alert status. Inputs for these calculations will be provided by OUSDR&E (U.S. weapon system characteristics) and DIA (projected Soviet ICBM target system characteristics). Sensitivity analyses will be conducted for the key parameters. The output of this effort will be weapons requirements, costs and uncertainties.

It appears, unfortunately, that a couple of key questions important to the countersilo issue will remain qualitative and, hence, highly judgemental. Two examples come immediately to mind: (1) the time required for the NCA to get the Emergency Action Message (EAM) out may be significantly greater than the differences in reaction time of the various legs of the Triad and (2) the time urgency of Soviet silos as a function of scenario. These and other considerations bear directly on the countersilo issue. They will be discussed quantitatively to the degree possible and all sides of the issue will be outlined at least qualitatively in parallel with the calculations of weapon requirements.

IV. Non-Silo Requirements

The approach proposed to evaluate the non-silo capability of alternative U.S. forces uses as a baseline the level of capability in our current forces, as they are actually employed in current targeting plans, i.e., SIOP-5B. This is not to say that our current capability is or should be a recognized standard of sufficiency, nor that the current arsenal and the way it is employed provide a proper standard for measuring future force requirements. There is, in fact, no basis at this time for predicting what our future targeting or secure reserve force policy might be or what forces would be required for its implementation. (Future targeting and SRF objectives are being considered independently in PD-18 directed studies which are proceeding in parallel with this study. At this time, we probably cannot expect these studies to define future base case targeting objectives or SRF requirements for use in our analysis.) We propose to use our current capability to satisfy non-silo objectives as a baseline for relative comparisons, i.e., alternative force postures will be normalized to the current capability of SIOP-5B forces, because of the need to consider the capability of alternative forces on the basis of some known standard.

The proposed methodology will be described below, using as an example the calculation and display of current force capability. The discussion will consider four major topics:

- Arsenal description
- Target base
- Allocation rules
- Display of results

1. Arsenal Description. During the course of the study, alternative force mixes will be constructed to satisfy the combinations of hard target kill and level of ICBM capability contained in the options matrix illustrated below. In each case, the number of systems available for targeting non-silo installations in the USSR will be determined by (1) applying appropriate alert rates to on-line (or unit effective) forces; (2) setting aside forces to satisfy a countersilo requirement, if appropriate; and (3) setting aside forces to satisfy PRC, NSWP and SRF requirements as discussed in Section II. Available systems will be described by USDR&E-furnished weapon system characteristics (yield, CEP and weapons system reliability (WSR)) and by pre-launch (PLS) and penetration probability (PTP) factors calculated in separate analyses reflecting DIA threat data. It appears likely that sensitivities to changes in probability of arrival (PA = WSR x PLS x PTP) will have to be explored parametrically since future threat descriptions are necessarily highly uncertain.

Strategic Options Matrix

Survivable Hard Target Capability \ Do We Want An Effective Triad?	Triad With Modernized ICBM Force	Unbalanced Triad With No ICBM Modernization
Extensive Quick-Response Capability		
Extensive Non-Quick-Response Capability (No First-Strike Capability Against Silos)		
Limited Counter-Silo Capability		

The following table describes the forces available in today's SIOP-5B arsenal to target only non-silo installations in the Soviet Union under the alert with damage (AWD) and generated without damage (GWOD) scenarios. These are the forces that will be used to calculate the baseline capability against which alternative future forces will be compared.

Portions denied are S-FRD and thus outside of the jurisdiction of the Interagency Security Classification Appeals Panel.

Name	CEP	Yield 1/	AWD PA 2/	AWD Warheads	GWOD PA 2/	GWOD Warheads
At Sea Poseidon	[redacted]					
In Port Poseidon						
Alert Gravity Bombs						
Alert SRAMs						
Non-Alert Gravity Bombs						
Non-Alert SRAM						
Titan						
MM-II						
MM-III						

1/ The arsenal characterizes bomber weapons in terms of the two most predominant yielc for purposes of simplicity.
2/ PA = PLS x WSR x PTP.
3/ Reflects average number of off-line SLBMs at sea and therefore survivable.
4/ [redacted]

E.O. 13526, section 3.3(b)(5)

2. Target Base Description. The PA&E Soviet target base reflects the February 1977 NTB. The detailed NTB installation data is processed for PA&E by the Command and Control Technical Center (CCTC) as follows:

- The first step in the process is to break the installation data base into independent groups or "complexes" of installations. The purpose of this step is to group installations into manageable subsets for later development of aim areas. To do this, [redacted]

E.O. 13526, section 3.3(b)(5)

- The next step in the process is to attack the installations in each complex [redacted] This attack is carried out until a specified

E.O. 13526, section 3.3(b)(5)

E.O. 13526, section 3.3(b)(5)

damage level is achieved on each installation [redacted] The process lays down the [redacted] All installations in the complex are evaluated for damage from this weapon. Those exceeding the [redacted] level are assigned to this DGZ and are excluded from affecting the creation of subsequent DGZs. Subsequent weapons are similarly applied. Once all the installations are damaged to at least the [redacted] level, aim areas are generated by assigning each installation to the DGZ which actually damaged it the most. These aim areas are the basic targets used in the allocation model.

- Once aim areas are defined, [redacted] Yields are chosen that bracket the range of available yields in the arsenal [redacted] and may be different than either the complexing or aim area generation yields. For response information generation, each aim area is assumed to be independent (i.e., no collateral damage between aim areas). Weapons are allocated to each aim area to achieve a DE of at least [redacted] for all included installations. The actual damage achieved, an average weapon radius (a function of the yield and individual installation vulnerability), and the number of weapons required to achieve the damage are determined and saved.

E.O. 13526, section 3.3(b)(5)

- Finally, the value contained in each aim area, by attack objective category (i.e., recovery military, leadership, etc.), is filed along with the attack results listed above. With this information, enough is known about each aim area to be able to use them as targets in the allocation model.

When using aim areas as targets for the allocation models, PA&E makes a number of simplifying assumptions regarding the way in which installations within the aim area will respond to nuclear detonations.

The first assumption is that when an aim area is attacked by any weapon, all installations within the aim area are attacked and respond in an identical manner.

A second assumption is that the aim areas respond as point targets. This assumption is necessary in order to easily predict the damage response of the aim area to the detonation of a "real" weapon (i.e., reliability is less than 1.0 and CEP is greater than 0). The response functions can be treated as simple one parameter fits. The response function has the form:

$$PD = 1 - (1 - p)^N,$$

where PD = probability of damage, applied identically to all value classes within the aim area

N = number of weapons

p = fit parameter based on the response information

A third assumption is that the parameter "p" can be found by interpolation from the yields and destruction probabilities found in the description of the aim area for any yield in the range defined by the four nominal yields.

While mathematics is used extensively in the aim area creation process, calibration runs must be performed to determine that the aim areas and their response to "real" weapons adequately represent the original NTB installation data base. These comparisons with CCTC NUCWAVE* results indicate that PA&E weapon requirements against the aggregated target base are more conservative (requires more weapons) than CCTC generated requirements from the detailed source data, especially at low levels of damage. This conservatism in the PA&E approach is due to the aggregation that loses visibility to a small number of very high payoff targets.

The PA&E modeled target data base currently has fidelity to SIOP-5B objective categories of targets (leadership, recovery, etc.), that is, levels of damage can be specified for each objective category and damage (including collateral damage to non-objective installations) can be assessed for each category of targets. As in the SIOP, economic recovery damage objectives are specified and results are displayed in terms of economic recovery value (average of manufacturing value added and capital cost to replace). For non-economic installations, damage objectives and reported results are in terms of the percent of installations destroyed. Since we have no value scheme to guide the destruction of non-economic installations as in the economic recovery case, the PA&E data base flags a subset of non-economic installations which have been identified as being militarily more important. The subset excludes the silos but includes hardened launch control facilities (LCF). LCFs could be considered under the ICBM targeting requirement, but have been retained here to stress the hard target capabilities of available systems, and to provide a hedge against future hardening of other installations in the data base.

E.O. 13526, section 3.3(b)(5)

[redacted] As will be described below, the allocation rules for this analysis have been established such that the specified levels of aggregate DE by objective are achieved preferentially against the militarily more important subset in the

*NUCWAVE is a sequentially optimal DGZ generator that has full fidelity to primary and collateral damage against all elements of the Target Data Base (NTB).

process of attacking the entire non-silo NTB target base. In addition, a DE level is specified against more important hard nuclear threat installations, primarily launch control centers, to insure that these installations are not avoided in achieving aggregate DE levels.

The number of non-economic installations in the data base is summarized in the following table. In the PA&E data base each installation appears only against the objective where it has the highest priority. The single counting of NTB installations accounts for the significant differences in PA&E and JSTPS installation counts. The JSTPS counts the same installation (and its destruction) in as many objectives as it may appear. When counted in the same manner, PA&E and JSTPS counts are similar.

Number of Non-Economic Installations 1/

Objective	PA&E Data Base: More Important	PA&E Data Base: All (Less ICBM)	PA&E Data Base Adjusted for Multiple Objectives	JSTPS
Resource Recovery Military	[redacted]			
Leadership				
Nuclear Threat (less ICBM)				
Conventional Force				
TOTAL				

E.O. 13526, section 3.3(b)(5)

1/ Economic recovery installations and their associated recovery value are, of course, also included in the data base.
2/ The difference in Objective 1 military installations is attributed to changes in the data base since February 1977.

3. Weapon Allocation Rules. Over the past several months, we have made an effort to gain an understanding of how the current SIOP is constructed and how it would be carried out. We have incorporated features in our model that permit us to more faithfully duplicate the way in which weapons are actually employed in the SIOP and, in the process, our results have closely approximated JSTPS consequences of execution.

Current employment guidance [redacted] identifies Major and Selected Attack Options (MAOs and SAOs) and specifies that these options "should be encompassed in one integrated plan [redacted] The impact of this policy on planning employment of the [redacted]

E.O. 13526, section 3.3(b)(5)

[redacted]

A second allocation constraint is that we are requiring specified levels of damage expectancy by objective against a militarily more important subset of non-economic installations. This is consistent with prudent military planning, but is generally not done in allocations designed to minimize warheads to achieve high overall aggregate damage expectancies. A maximum DE level of [redacted] was chosen to provide a reasonable fit of the calculated results with the current SIOP consequences of execution.

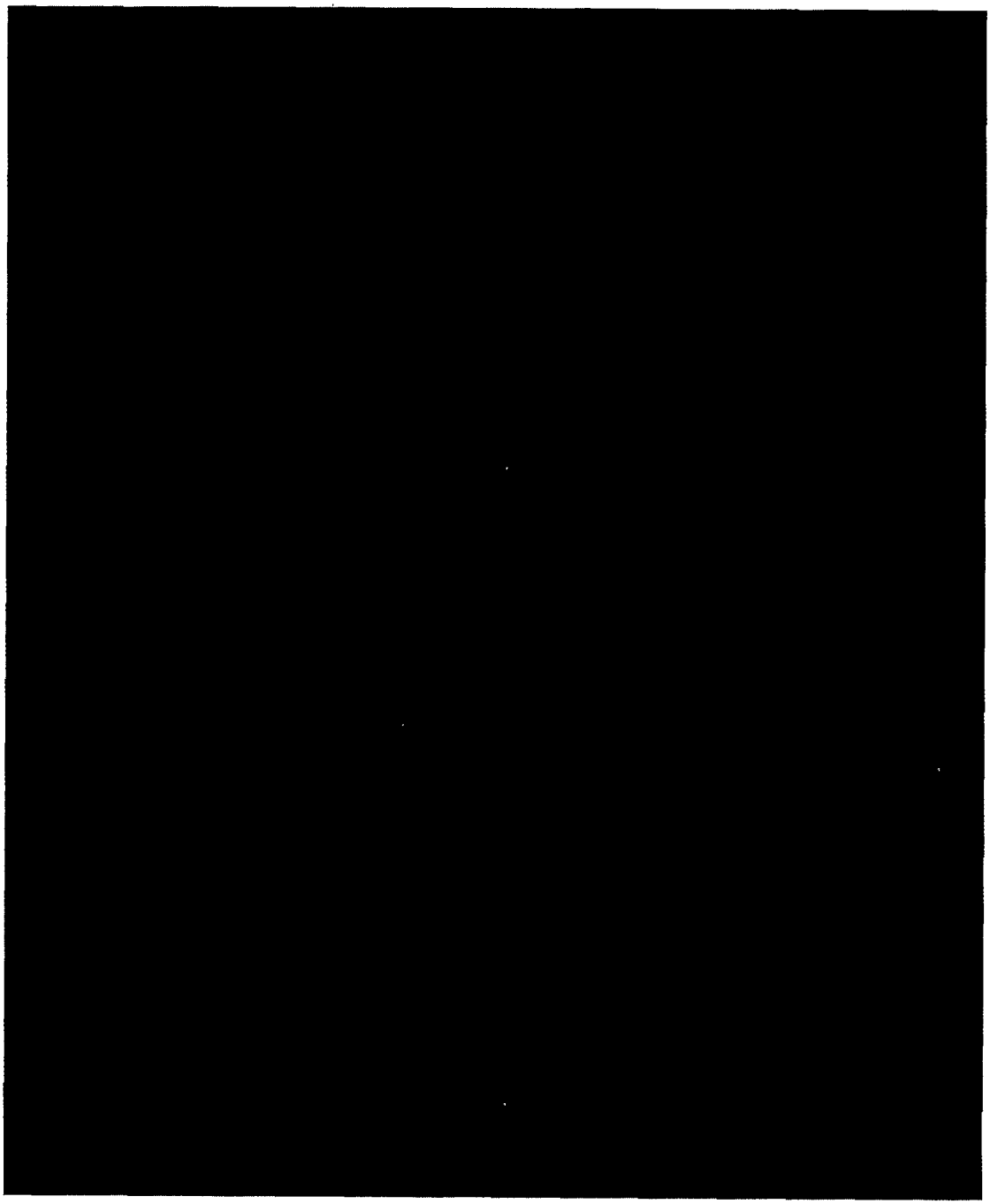
E.O. 13526, section 3.3(b)(5)

A third constraint is that we are requiring that an equal percentage of each available system in the arsenal be used to achieve the specified goals against the non-economic recovery installations. We do this to prevent the model from choosing all of the better weapons in the arsenal in the "MAO-1" allocation, leaving only less capable systems for the MAO-2 increment. This is somewhat comparable to the military planner setting aside a balance of weapon types for the economic recovery task and optimally allocating his remaining arsenal against non-economic installations.

The allocation rules and the attack sequence used to calculate the current force baseline are summarized as follows. These same rules will also apply to the calculation of the relative capability of alternative future forces.

[redacted]

E.O. 13526, section 3.3(b)(5)



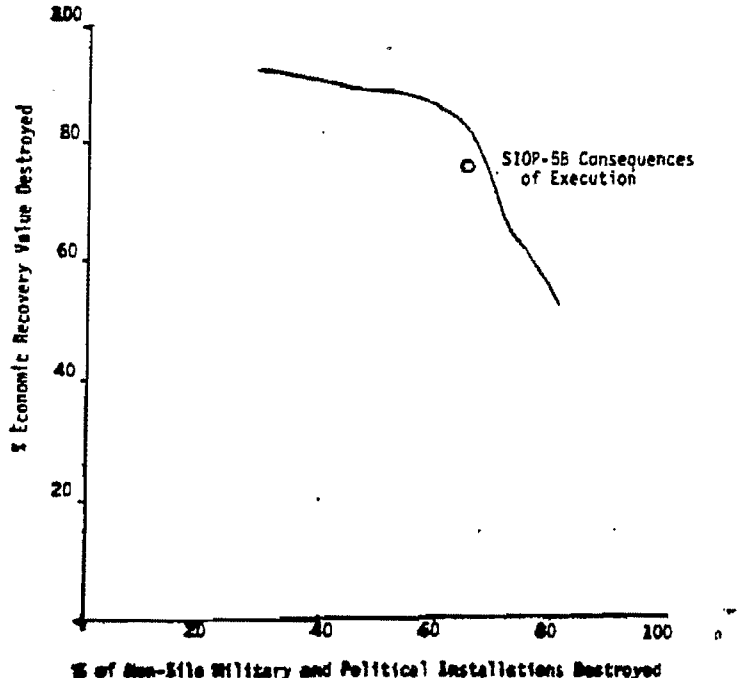
With the approach described above, it is also possible to calculate the inherent capability of individual elements of the total force, or combinations of those elements, to achieve damage across a spectrum of economic value versus non-economic, non-silo installation damage expectancies. For example, we can calculate, using the same procedures outlined above, the capability of the ICBM force alone, or the ICBM force in combination with bombers or SLBMs. This approach assumes an "optimum" allocation of the weapon systems specified -- that is, the planner would have to know that the other "legs" were unavailable

and retarget the available arsenal to achieve the calculated results. PA&E believes that this approach offers promise as a means of showing the maximum "hedge" potential of a given total force structure, and as a means of illustrating the flexibility of systems or "legs" in the force mix to achieve damage levels across the non-silo target spectrum.

4. Display of Results. This section discusses the display of force capability to satisfy non-silo Soviet targeting objectives. In all cases, the results assume that weapons required for other objectives [redacted] have been set aside. At this point in our study effort, we plan to display the results of comparative force analyses across the spectrum of possible Soviet targeting objectives. This has the advantage of showing the sensitivity of the force mix to alternative targeting policies. It also shows the capability of the force mix across the full non-silo target spectrum. Figure 1 below shows the calculated capability of the SIOP-5B AWD (non-silo USSR only) arsenal, given the detailed arsenal, target base and allocation rules described above. The figure shows: (1) the tradeoff between economic recovery value and non-silo, non-economic installation destruction; for example, when the objective is 70% DE against non-silo military and political installations (along the horizontal axis), the corresponding DE achievable against economic recovery value is about 68%; and (2) the high cost associated with damage expectancies greater than 80% for economic recovery targets and 60% for the total set of non-silo military and political installations. The O on the chart approximates the Consequences of Executing SIOP-5B.

Figure 1

SIOP-5B AWD Forces
(Non-Silo USSR Only)



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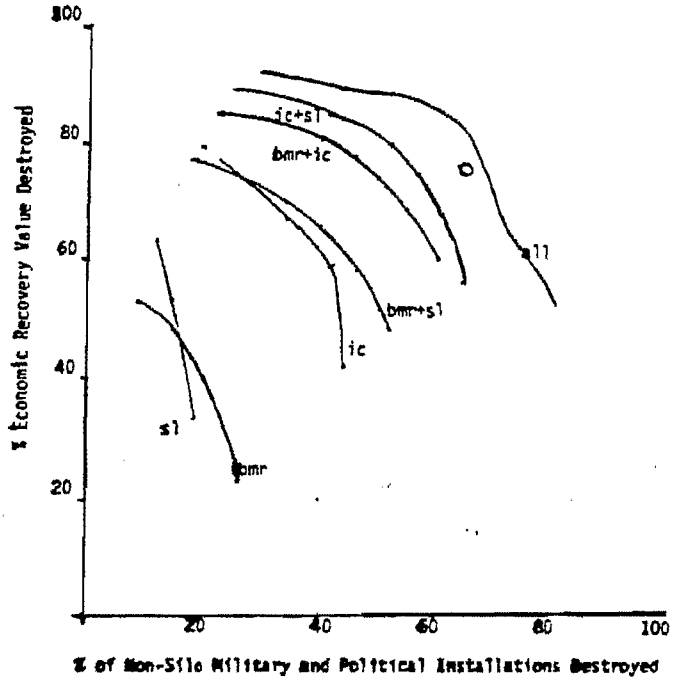
E.O. 13526, section 3.3(b)(5)

Using the same basic display, we can show the calculated capabilities of combinations of Triad force elements and of the individual legs, as in Figure 2 below. In each case, these results represent an optimum reallocation of the available element(s) and, therefore, correspond to the maximum degree of hedge potential and flexibility available in the force element(s). The figure shows: (1) the dominance of the ICBM force across the spectrum of possible targeting objectives reflecting the assumed [redacted] in SIOP-5B, the higher yield and better accuracy associated with today's ICBMs; and (2) the lack of capability in the current AWD (USSR non-silo only) SLBM and bomber forces, individually and in combination, to achieve high damage expectancies (greater than 50%) against non-silo, non-economic targets.*

Figure 2

SIOP-5B AWD Forces
(Non-Silo USSR Only)



*It should be noted that the PA&E model does not have good fidelity [redacted]

E.O. 13526, section 3.3(b)(5)

We plan to present the capability of alternative future forces in the same way as shown in Figures 1 and 2 with current force capability as a reference. It is possible that some future force mixes might be so capable as to exceed the boundaries (effectively at 90% in both dimensions) of the damage expectancy matrix and still have forces left over. To account for this possibility, and also to provide an alternative means of displaying the capability of future forces relative to current capability, we propose to: (1) select points along the DE curve for our current forces (Figure 1) that are representative of damage objectives across the spectrum -- e.g., 90% economic value, 45% other; 76% economic value, 68% other; 65% economic value, 72% other; and 45% economic value and 80% other; (2) calculate the minimum fraction that, when applied uniformly to each system in the future force mix, will provide forces with exactly enough capability (using the methodology described above except that the economic recovery objective is fixed) to achieve the specified set of goals; and (3) plot the inverse of the calculated fraction or force multiplier -- that is, Relative Force Size -- for purposes of relative force comparisons. The following table summarizes an example of this approach using illustrative Relative Force Size calculations (inverse force multipliers) that could represent the capability of some future forces. Figure 3 illustrates how the data would be displayed.

	DE Objectives		Relative Force Size		
	Economic	Other	Force 1	Force 2	Force 3
I	90%	45%	1.31	1.23	1.23
II	76%	68%	1.35	1.18	1.12
III	65%	72%	1.35	1.15	1.07
IV	45%	80%	1.41	1.11	.97

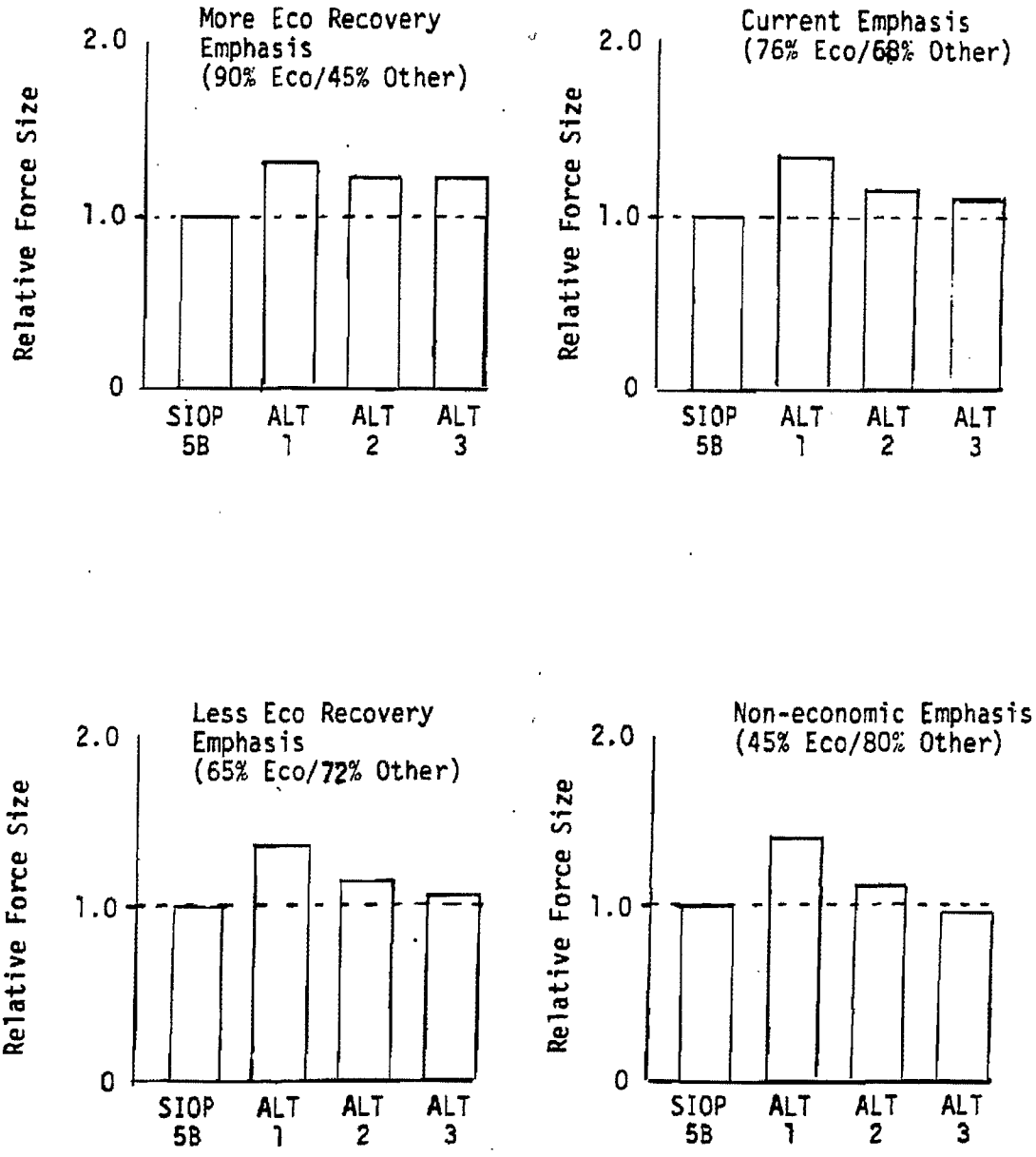
IV. Methodology Issues

A number of potential issues are not addressed specifically by the basic methodology described in the previous section. While the methodology is well suited to define relative force capabilities and attributes in large scale exchanges against a large data base, certain details, sensitivities, and fact-of-life operational constraints cannot be readily accounted for in a highly aggregated, fast running model. Many of these items can be treated explicitly, but external to the basic model; others are judgmental and more philosophical in nature and difficult to treat explicitly.

The non-silo USSR portion of the analysis is important to the study and the results of this portion should be most closely scrutinized. However, the models involved are sufficiently complex that the details of the methodology will not be well understood by the casual reader. This makes it vital that the limitations and uncertainties be clearly discussed. The details of the model and its level of aggregation has

Figure 3

Relative Force Capability to Destroy Non-Silo Soviet Targets*



* In each case, warheads to satisfy [redacted] requirements have been set aside and are not reflected in the relative capability shown.

been discussed above. However, there are several areas which required further discussion and analysis:

- First, the study is examining force structure for the mid-80s and beyond. It is unclear how the target system will change. Certainly there will be economic growth with an attendant increase in the number and type of economic installations as well as a reranking of the value structure within existing installations. This growth may or may not result in a requirement for more DGZs to destroy a comparable percentage of recovery value. Similarly, a concerted effort in Civil Defense could have a significant impact on both the size of the target system (dispersal) and the hardness of the installations. There might be a trend toward more hard targets even without a concerted Civil Defense effort. A change in targeting guidance could have a similar effect -- for example, a change that emphasized high levels of destruction of command, control and communications installations. Because of the lack of hard data in these areas, we are currently uncertain as to how much we can do quantitatively in this study. At the least, we can discuss possible impacts qualitatively.

- Second, the analysis will use the February 1977 NTB* as the installation list for developing "aim areas." Changes in the NTB since that time include (1) eliminating the economic recovery circles (E-95s) and replacing them with economic recovery installations, and (2) reordering the primary objective (recovery, leadership, etc.) associated with some installations. The effect of these changes has not been assessed in detail but should have minor impact on results based on the experience with similar changes in the past.

- Third, the aggregated model does not account for the detailed operational constraints inherent in an actual SIOP laydown. These constraints result in a less than "optimal" allocation and include:

  -- Range -- all targets cannot be reached by all weapons.

  -- Footprint -- Soviet target location does not necessarily match the footprint capability of our strategic systems. Even bombers may be affected. This may be further aggravated for a multiple weapon system by policy constraints such as option, booster, and country purity; optional withholds, and minimization of collateral damage.

  -- Time urgency considerations may require the assigning of specific weapons to specific targets.

It has not been possible to quantify the significance of the degrade in targeting efficiency due to these constraints. Even if a number could be assigned which reflected the current SIOP allocation, it would not be representative of future forces with different system characteristics. However, in the application of this model, several

*CCTC is currently processing the May 1978 NTB for use in PA&E analysis. However, this data will not be available in time to be used in this study.

factors result in an overstatement of the weapons required and these tend to compensate for not treating the operational constraints explicitly. In addition, the model will not be used for absolute force sizing, but rather for a relative comparison of alternative forces, the ranking of which will not be measurably affected by these small differences.

- Fourth, military targets are all of equal value in the Soviet targeting analysis (as in most analyses), although a higher priority set of non-economic targets is defined. However, in the SIOP world where the allocations are hand massaged, a subjective, non-quantified value scheme is apparent. [redacted] In the approach described in this paper, [redacted] We cannot say, however, that the [redacted], and we do not believe that this level of detail is appropriate or necessary for this study.

E.O. 13526, section 3.3(b)(5)

V. Analytical Support From Other Agencies

The preceding sections have suggested several areas where separate analyses will be required in support of the overall study objectives. This section will briefly summarize areas where additional analyses will probably be required and agencies presently capable of undertaking them.

A. Planning Factor Analyses. PLS and PA calculations will need to be derived using DIA-provided threat data. Alternative threat levels will be treated parametrically. These calculations may require Air Force (SA and SAC) and Navy (OP 604) support.

B. Operational Constraints. As was described above, range, footprint and option purity are not explicitly addressed in the methodology proposed for this study. It may be desirable to test the sensitivity of some alternative forces mixes to these constraints. Air Force (SAC), SAGA, and Navy (OP 604) have capabilities to address some or all of these considerations.

C. Measures of Merit. The methodology proposed in this paper has addressed a measure of capability to destroy a given set of targets. It has not addressed cost effectiveness considerations, nuclear material considerations, or "minimum cost" solutions (where cost could be in terms of MIRVs, SNDVs, etc.). These are issues which will bear strongly on the construction of specific force structure alternatives. Considerable capability to address these issues rests in DoD agencies. Navy, in particular, has a model that can derive "minimum cost" solutions to achieve alternative levels of damage against both economic and other military installations. This model was used extensively in PRM-10 analysis.

D. Hedging. The "maximum" hedging potential of alternative force mixes was illustrated in Section IV as a fallout of the proposed methodology. However, because the hedging issue promises to be critical to this study, more detailed analyses of this issue will be required. PA&E has developed a methodology -- actually a set of force allocation rules -- which drives the model to achieve pre-planned hedging of economic and/or other installations. In addition, SAGA, AF, and Navy also have analytical capabilities to address the hedging issue.