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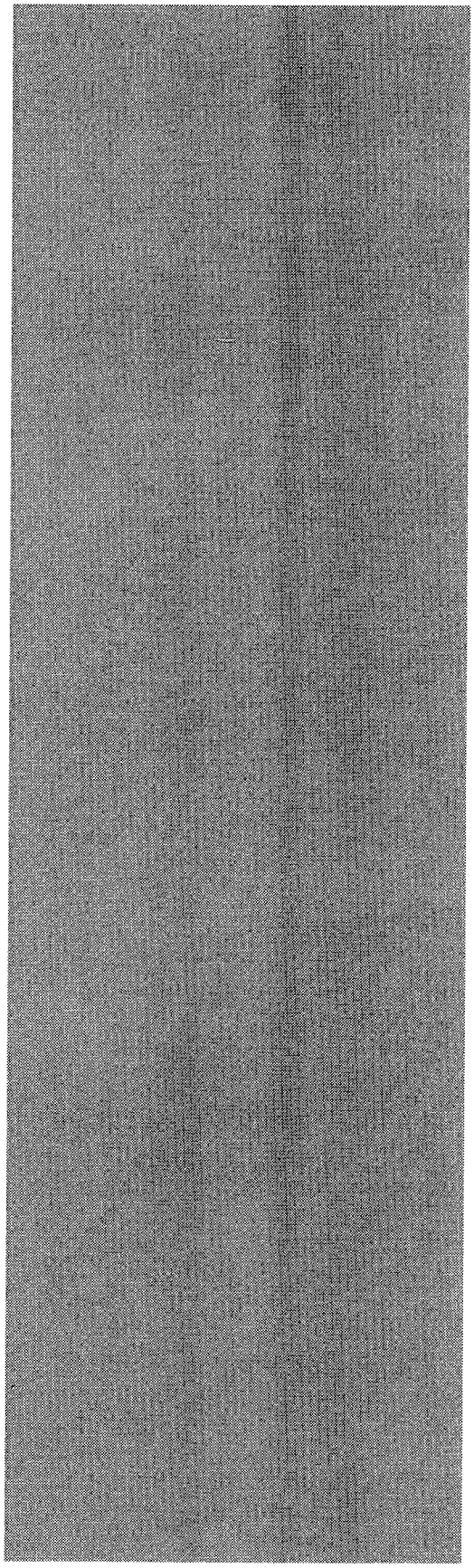

Threat Modernization in the Near Term

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U3028

Edited by Robert E. Almy, Group IS-11
Prepared by Bo West, P Division

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Accession Number: 3028

Publication Date: Mar 01, 1991

Title: Threat Modernization in the Near Term

Personal Author: Canavan, G.H.

Corporate Author Or Publisher: Los Alamos National Laboratory, Los Alamos, NM 87545 Report Number: LA-11825-MS

Report Prepared for: U.S. Dept. of Energy

Descriptors, Keywords: Threat SDS SDI KEW SBI GBI Effectiveness Deployment Development Countermeasure Fastburn Decoy

Pages: 00008

Cataloged Date: Jul 18, 1991

Contract Number: W-7405-ENG-36

Document Type: HC

Number of Copies In Library: 000001

Record ID: 22275

Source of Document: DoE

LA-11825-MS

UC-700
Issued: March 1991

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Gregory H. Canavan

Los Alamos National Laboratory
Los Alamos,New Mexico 87545

CONTENTS

THREAT MODERNIZATION IN THE NEAR TERM

by

Gregory H. Canavan

ABSTRACT

The continuing effectiveness of space-based interceptors (SBIs) depends critically on the threat modernization rate. Fast-burn missiles could degrade their effectiveness by ≈ 50%; early deployment of weapons and decoys could degrade it by a like factor, as could reducing the launch area or mobile missiles. Together, these factors could reduce SBI availability a factor of ≈ 20 and degrade effectiveness. The result could be a SBI defense that cost as much as the offense.

I. INTRODUCTION

Kinetic-energy interceptors, ground-based interceptors (GBIs) and SBIs are the most developed concepts in the SDI. They should be highly effective against the current missile threat and nominal modifications.[1] Their performance is, however, critically dependent on the spatial and temporal extent of the boost-phase engagement, which could be significantly reduced by fundamental measures that the Soviet Union controls.

Their overall effectiveness is also dependent on the effectiveness of downstream layers, which depends on the rate of modernization of penetration aids and the introduction of decoys. These issues are addressed below in the order in which they are

likely to be encountered. The paper is largely self-contained, but the essential references are indicated. A number of currently popular topics are intentionally omitted for reasons given in the references. The future of SDI now depends on the fundamental issues discussed here, and not tricks.

II. MODERNIZATION RATE

Modernization rate means the rate at which the Soviet Union could replace its current missiles with faster burning missiles in more compact launch areas from where they could punch holes in boost-phase defensive constellations. Their modernization rate will be constrained by economics. The Commission on Long-Term Strategy demonstrated that the Soviet Union would not have the resources for a major push,[2] but not everything is prohibitively expensive. The discussion below concentrates on modernization that could be executed with roughly current expenditure levels. Soviet military expenditures are a significant fraction of their national product, but strategic forces are a modest fraction of the total military expenditures, so even doubling them would be a 10-20% increase in expenditures, which should be feasible.

A. Missile Development

The Soviets currently modernize about half of their strategic missiles each decade.[3] If they replaced current boosters with moderately fast-burn boosters, which wouldn't involve large incremental costs, that could decrease their acceleration or burn phase from the SS-18s' $\approx$ 300 s to about 100 s. That would decrease their total engagement time (acceleration plus deployment) from the current 600 s to about 400 s, decrease SBI availability from 20% to about 14%, and increase the SBIs' cost per intercept by about 50%.[4,5]

Booster burn times could be decreased further, but there is no advantage to burning out below $\approx$ 130 km, because air drag would strip out decoys deployed lower.[6] Thus, the 100-s, 8-g burn assumed above is about optimal.[7] Moderately fast-burn boosters give little mass or cost penalty over current boosters;

it is largely a matter of changing fuel grain size.[8] Much could be done with strap-down tests, which might not be observed. Flight tests would occur in the last few years of development, after which missiles could be modernized to fast burn at roughly current rates and costs, and largely with existing facilities.[9]

B. Faster Deployment

Fast deployment is harder. Current buses deploy reentry vehicles (RVs) serially. Soviet SS-18s deploy 10 RVs in ≈ 300 s, or ≈ 30 s/RV.[10] U.S. buses are a bit faster; SS-24s are a bit slower; and SS-25s take about 30 s to offload their single RVs. For serial busing, significantly reducing the boost phase would require removing warheads, which would negate the gain in speed. Missiles with only one RV, or singlets, could pick up a factor of 2-3 in effectiveness relative to defenses, but only if the limits on launchers were relaxed.[11]

Going to individual precision buses for each reentry vehicle would cost about a factor of two in RVs,[12] but could reduce deployment to ≈ 30 s. It is unclear that development would be required or identifiable. In conjunction with fast boosters, deployment in a total of 30 s would decrease the total engagement time to ≈ 130 s, which is ≈ 20% of the current value. For current basing, that would reduce the SBIs' availability to ≈ 7%. Overall, faster missiles and buses could by themselves reduce SBI availability about a factor of three from current levels.

C. Launch Area

The Soviets have several options for reducing their launch area. Rebasing the missiles from the trans-Siberian railway to east of the Urals would reduce the area a factor of ≈ 3. Doing so as part of normal modernization could be executed for about the cost of the new silos. With short engagement times, that would reduce SBI availability to ≈ 3.5%. Rebasing missiles toward the center of the launch area during replacement would decrease its diameter by a factor of 2 over the next decade, which would reduce SBI availability to ≈ 2%.[13]

The missiles would still be spread over an area larger than the area used for Minuteman, so another factor of two decrease would be possible before there were fratricide concerns. SBI availability would then be ≈ 1%, so that for $ 1 M SBIs, the cost per intercept would be ≈ $ 1 M/SBI x 100 SBI/missile ≈ $ 100 M/missile, which about equals the cost of a heavy missile.[14]

D. Mobile Missiles

The same effect could be achieved earlier by replacing fixed missiles with mobiles, which could be compacted sooner and further. While mobility carries significant security costs for the U.S., it is not clear that that would be the case for the Soviet Union, for which the costs of security and preserving launch uncertainty are much less. The U.S. has argued for several decades that fixed silos are vulnerable to emerging accuracies and that mobile missiles are the best answer to this growing vulnerability.

Thus, mobiles should not be threatening when viewed from that perspective. As to intent, mobiles are missiles on wheels that could be used to disperse for survivability, stability, or to poke a hole in the defensive shield, depending on the Soviet's intent; not ours. From the perspective of capability rather than intentions, the ability to cluster before launch would represent a direct counter to a defensive shield.

E. Penetration Aids and Decoys

Decoys do not impact the boost phase directly other than by lengthening it by the time required to deploy them. They do, however, impact its effectiveness by degrading the effectiveness of downstream defenses. If the degradation becomes great enough, the boost phase can be forced to attempt to perform increasingly difficult intercepts, which have marginally decreasing utility. Thus, the ability to discriminate trades off directly against SBI numbers and performance.

For 10% leakage from the boost phase, a launch of 1,000 heavy missiles with 10 reentry vehicles per missile and 100

decoys per missile, less than the maximum load, would produce a threat of 100,000 objects. In the absence of discrimination, intercepting all with $ 2 M GBIs would cost about $ 200 B, about 20 times the cost of the SBIs and about as much as all of the missiles. For any margin, good discrimination is effective.[15]

In the absence of defenses, no decoys are needed; hence, few decoys are deployed today. If defenses were deployed, so would decoys. Experience of this decade indicates that developing decoys that could negate developed passive and active sensors could take 3-5 years, which means that they could be in place at the time of the first operational capability of SBIs. Their cost should be modest; off-loading 1-2 reentry vehicles per heavy missile should provide tens of decoys for each remaining.

III. SUMMARY AND CONCLUSIONS

SBIs should be quite effective initially, but continuing effectiveness depends critically on the threat modernization rate. Fast-burn missiles could degrade their effectiveness by ≈ 50%; fast deployment of weapons and decoys could degrade it by a similar factor. So could reducing the launch area or mobile missiles. Together, they could reduce SBI availability a factor of ≈ 20, and degrade effectiveness to ≈ $ 100 M per missile killed, which is about a draw.

None of these developments is particularly heroic, and their incremental costs are essentially those of basing. They would, however, all have to be implemented more or less in parallel for full effect. Only fast-burn boosters would give much of a signal. Mobiles are nominally reassuring, and rebasing into more compact fixed silos could be justified economically. All could be executed in ≈ 20 years at current modernization rates; fast, decoyed mobiles could accelerate modernization to roughly the same time scale as that for deploying SBIs.[16]

In any case, the end result would be a SBI defense that could cost about as much as the offense. To have any margin against SBI cost growth or defense suppression, the brilliant pebbles' original cost goals and good discrimination would have

to be achieved.[17] That is possible, but about as stressing as the development of the offensive countermeasures.

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