DE89-002099

STRATEGIC DEFENSE IN TRANSITION

University of California
Los Alamos, NM

Oct 88

19980513 096

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
NTIS

Accession Number: 2237

Publication Date: Oct 01, 1988

Title: Strategic Defense In Transition

Personal Author: Canavan, G.H.

Corporate Author Or Publisher: Los Alamos National Laboratory, Los Alamos, NM 87545 Report Number: LA-11375-MS

Descriptors, Keywords: Accident Launch Threat Research Technology Missile Proliferation GPALS ALPS TMD ABM

Pages: 014

Cataloged Date: Jul 09, 1990

Contract Number: W-7405-ENG-36

Document Type: HC

Number of Copies In Library: 000001

Original Source Number: DE89-002099

Record ID: 21172

Source of Document: NTIS

DE89002099
LA-11375-MS

Strategic Defense in Transition

Los Alamos
Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

Prepared by Bo West, P Division

An Affirmative Action/Equal Opportunity Employer

LA-11375-MS

UC-700
Issued: October 1988

Strategic Defense in Transition

Gregory H. Canavan

Los Alamos Los Alamos National Laboratory
Los Alamos, New Mexico 87545

CONTENTS

Pages ii, iii, and iv are blank.

STRATEGIC DEFENSE IN TRANSITION

by

Gregory H. Canavan

ABSTRACT

Possible objectives and programs for strategic defense include third-country, accidental, or unauthorized launches; limited attacks; initial military threats; and defense of value. Their essential features, technologies, and developmental programs are reviewed with the goal of identifying a path that would benefit from their commonalities.

I. POSSIBLE OBJECTIVES

There are a number of possible objectives and programs for strategic defense. Third-country, accidental, or unauthorized launches are addressed by launch protection systems (LPSs);[1] research on limited attacks was recommended by the Defense Science Board (DSB)[2] and seconded by other commissions;[3] initial military threats were emphasized by the Joint Chiefs of Staff (JCS); and the development and integration of their technologies would address the defense of value put forward as the initial goal of strategic defense research.

Each is positive, and all form a clear progression from modest to more demanding objectives, so it would be expected that they could be addressed in order, and that research for each would support the others and generate support for the overall program. Instead, the objectives and programs interfere, and the defenses' ability to contribute to several objectives has apparently blocked progress on any of them. The sections below review their essential features, technologies needed to meet them, and main elements of their developmental programs, with the goal of identifying commonalities and suggesting a path that could better benefit from them.

II. LAUNCH PROTECTION SYSTEMS

Third-country, accidental, and unauthorized launches are unlikely; protecting against them is analogous to insuring against remote but potentially catastrophic damage.

A. Third-Country Launch

Designs of serviceable nuclear weapons are in the literature; missiles with useful ranges and accuracies are available; and the number of reactors and pace of non-proliferation suggest that nuclear materials will become more available. Missile delivery, though not essential, is feasible, flexible, and stressing. The weapons would probably be large and delivered singly from intermediate ranges.[4]

Penetration aid technology is difficult, so early weapons probably wouldn't carry effective decoys. In small launches, accidental or intentional, sensors would be suppressed only by chance; they should survive because they could not be attacked effectively. That makes large but accurate and developed radars acceptable choices as primary warning and tracking sensors. Against limited launches, nuclear LPSs developed in previous decades could also perform acceptably. For small launches, sensors are well developed; the main problem is developing the interceptors and internetting control.

B. Accidental Launch

Accidental launches could be larger and more structured, but would still lack coordination. For intercontinental ballistic missiles (ICBMs), the issues are warning, release, and flyout times. The 100 allowed ground-based interceptors (GBIs), launched from a central site on warning from current satellites and radars, could provide adequate protection from a few missiles. There is now agreement that high-velocity GBIs from Grand Forks should be able to cover CONUS against a few ICBMs, give less coverage against standoff submarine launched ballistic missiles (SLBMs), and little coverage against close-in, depressed SLBMs.

The interceptors required would have significantly larger boosters than the GBIs designed for distributed basing against phase 1 attacks, but the cost and time for the modification should be modest. Defenses centered on the National Command Authority (NCA) could give continental coverage, but it would degrade towards the west coast and be more sensitive to release delays.

Treaty-compliant LPSs using radars could be degraded significantly by deliberate suppression, chaff, and penetration aids. In the near term there is no reason to expect them, since there would be no defenses to penetrate, and it isn't clear that one missile load of penetration aids of demonstrated performance could cause significant degradation. If penetration aids were later deployed in response to LPSs or in anticipation of later deployments, exhaustion could become a problem with non-discriminating sensors. Decoys could overwhelm modest sensors, as they were designed to do in an attack.

It is argued that the GBIs' infrared (IR) seekers and supporting discrimination sensors could be degraded significantly by "off the shelf" decoys,[5] although it isn't clear that such exist or why the Soviets should want to degrade GBIs used for protection--unless accidental launch is defined as "1-10,000" reentry vehicles (RVs), which tends to merge accidents and full attacks, discounting the value of anything but the latter. Rather than deploying IR decoys against GBIs used for protection, the Soviets could exhaust them in an actual attack with less overall penalty.

GBIs would constitute new and more usable antisatellites ASATs, probably better ASATs than current ones against inert, non-maneuvering satellites. Defensive satellites could, however, eject flares, decoys, and maneuver, so the ASATs would have to intercept reactive, survivable satellites. Against them ASATs would face roughly the same heavily decoyed threats that the GBIs would face against decoyed midcourse threats--against which they are afforded little capability by some.[6]

The sensitivity of LPSs to decoys is almost bimodal. If there were no decoys, LPSs could work well; if there were many, LPSs would fail. Awkwardly, the choice of their number is largely in the hands of the Soviet Union. Thus, the main problem becomes the context in which the decision to deploy an LPS is made. In the words of a thoughtful critic

> "If it is made in the framework of an agreement or a clear understanding between the United States and the Soviet Union that this is no more than a thin defense to protect against accidents, and both sides agree not to deploy decoys, penetration aids or the like, then indeed LPS could serve a useful limited purpose which people can debate the value of. However, if it is not done in that climate, it can lead to the deployment of penaids or of increased offenses to insure one's deterrent capability. Remember that the Moscow defense was--and still is--a very limited defense, but because it was deployed by the Russians <u>not</u> in a climate of agreement, understanding, or constructive political dialogue, it led us to deploy many more warheads to counteract it. MIRVs were the best penaid."[7]

The Soviets could flood simple protection; the question is what would give them the incentive to do so? For that the Moscow defense analogy is useful. MIRVs were the best penaid, but they were not developed for that defense. MIRVs were developed to penetrate the Talin line, then thought to be a capable military defense. When it shrank to the protection of Moscow, MIRVs were deployed elsewhere to reduce the cost of deterrence. The penaids for Moscow were reduced to chaff dispensers that were developed deliberately and deployed sparingly, reflecting little concern over Moscow's limited protection. Thus, MIRVs do illustrate that the context is critical, but they also appear to indicate that protection of Moscow didn't stimulate countermeasures, although concern for real defenses had large, untoward effects.

Thus, if the Soviets thought LPSs were threatening, they would probably take steps to offset it, but if LPSs were clearly and correctly portrayed as a wider version of the thin Moscow defense, it isn't clear why they would do so. The LPSs' capability enters this calculus. An LPS that could negate the RVs from many missiles would be technically superior to one that could only defend against one missile; that would in turn be better than no protection. If, however, the Soviets interpreted the stronger protection as defenses and deployed penaids, the larger LPS could prove less effective than the others even in defense.

The key issue is how to convince the Soviets that the LPS is just light protection, particularly if it is being described as preparation for deployment to build support. One approach would be a package deal of an LPS together with a 10-15 year moratorium on deployment of defensive components. Another would be to abandon pretense, build the LPS as a test bed for strategic defense, and see what countermeasures were induced. A third would be agreement between the United States and the Soviet Union on how to meaningfully differentiate between defense and protection. Reduced rhetoric about space shields as perfect on the one hand and as adjuncts to first strikes on the other could indicate such convergence. With it the original point would be restored: if the LPS was for limited protection, there would be no incentive for the Soviets to deploy penaids, and hence accidental launches would not have any.

Against limited launches, the nuclear LPSs developed in previous decades could also perform acceptably. In addition to timeline and releasability issues, however, nuclear interceptors have serious blackout and self-suppression problems, which do not scale down for LPS threats. Thus, if GBIs could engage in a shoot-look-shoot mode, their compound kill probabilities could be larger than that from a single nuclear weapon, including reliability. Thus, in practice there may not be a large gain in performance from nuclear interceptors.

Using radars as the primary sensors discards about half the RVs' flight time. It would be desirable to launch the interceptors based on satellite information, which would retain their full flight time and give the maximum engagement opportunity. Current satellite sensors give warning of booster launches, but they cannot track buses, which have the capability to redirect RVs too far for GBIs to be launched on booster trajectories. Near-term modifications would not achieve the order of magnitude increase in sensitivity needed to see buses and extract accurate trajectories. Advanced midcourse satellites could, but would involve significant cost and development. An intermediate measure is advanced sensors on probe rockets, which would cost less and see more, but not all, of the RVs' trajectories.

Alternatively, the GBIs could be dispersed. Their timeline sensitivity results from having to fly from a single site to intercepts across the continent. Those sensitivities would be reduced if the GBIs were based in two or more sites across the northern border, from which current GBIs would have adequate performance with radar warning. The number of objects per missile is a concern. A large missile has about 10 RVs, but there are typically 3-10 objects associated with each RV, which means that sensors that could not discriminate them could have to fire all 100 interceptors to have one attempt on each object from one missile. There is a possibility that current GBI sensors could reduce the number to a few objects per RV, permitting the GBIs to handle several missiles.

Unless sensors were improved, protection would degrade or the number of interceptors would have to increase. For accidental attacks this would not be an economic issue, but it would be a treaty issue. An alternative would be for each side to develop the means to disable or destroy accidentally launched buses. That would produce a more tractable target for protective deployments at the expense of inserting potential Achilles' heels into each side's strategic forces. Such fixes do, however, appear to be the technologically simplest solutions.

SLBMs, other than those from bastions, have shorter timelines and arbitrary attack azimuths. The timelines for close-in SLBMs on depressed trajectories are so short as to require the dispersal of the radars and interceptors around the perimeter. On depressed trajectories, however, penetration aids would be ineffective, so modest sensors and interceptors could be used.[8]

C. Unauthorized Launch

Unauthorized launches are intentional and have the potential for coordination. Apart from the possibility of greater size, they resemble accidental launches. Unauthorized launchers might both release missiles and interfere with warning sensors to minimize the amount of time allowed for the U.S. to respond. Reducing the impact of such interference would require correcting known sensor susceptibilities as well as new vulnerabilities.

III. LIMITED ATTACKS

Limited attacks add structure and intent; the countermeasures are capable, survivable sensors. Limited attacks would be intended to disrupt the connectivity of the defensive and retaliatory forces rather than destroy them, which they would do by suppressing warning sensors and then attacking unalerted forces. For warning satellites that could be accomplished by interference, direct attack, or weapons concealed in space, all of which will become more credible in coming decades. The problem is acute with radars. Those large enough for warning and tracking are effectively immobile and could be suppressed by ICBMs, SLBMs, or cruise missiles. Thus, radars would be unreliable even for battle management.

Interceptor issues are related to those for LPSs. The bulk of the attack could be mounted with SLBMs, whose timelines dictate that interceptors be distributed around the defended targets for effectiveness. That would help survivability of the defenses, which would also be targeted. Given proper information, modest interceptors should perform well against the kinematically stressing, bare threats. The fundamental distinction from LPSs is that defenses against limited attacks would be strongly suppressed, so radars would be marginal. Warning and tracking would thus pass to satellites, the only developed sensors with the coverage, accuracy, and potential survivability required. Their development would be demanding, and the accuracy needed would require observation by multiple satellites, which implies a large, expensive constellation of capable platforms.

IV. INITIAL THREATS

The JCS' treatment of initial threats stressed negating the leading edge of accurate ICBM attacks on military targets. Its subordination of SLBM attacks, a critical precursor, would be corrected by implementing the measures for limited attacks. GBIs and sensors developed for limited attacks would also be appropriate to negate the larger ICBM component of initial threats. They would be most effective if deployed with a limited boost-phase layer to attrit and modulate the threat reaching downstream layers. Midcourse sensors could then sense and exploit those variations to produce higher survival levels than those possible with single-layer or non-adaptive defenses.

Space-based interceptors (SBIs) are developed and lethal, but their costs have grown significantly from initial estimates--partly for institutional reasons, partly due to uncertainties in the threat. There are attempts to control costs through reconfiguration of current designs or through radically new approaches, without which SBIs could become too expensive to be effective in the boost phase. Midcourse performance would be degraded without some boost-phase layer; small directed energy weapons (DEWs) might be accelerated to supplement the SBIs. If not, boost-phase lethality would be delayed until one become viable or discrimination reached a level at which the boost phase could be be bypassed altogether.

The main distinction between limited attacks and initial threats is the level of discrimination needed. Current GBIs could remain effective up to about ten credible decoys per RV.[9] For more, they would no longer be effective at the margin, and it is unlikely that their effectiveness could be restored with passive sensors. Endoatmospheric interceptors could provide a modest gain, but it saturates. The long-term balance depends on the development of active discrimination concepts, whose those platforms could also provide boost-phase lethality.[10]

V. AREA DEFENSE

Protection of value is not synonymous with area defense. LPSs could protect value with small deployments that would be overwhelmed by large, determined attacks. Defense of value requires high performance, competent layers, and robustness. It is distinguished from lesser defenses by the requirement for high attrition and emphasis on value. There is some protection of value in each level of defense discussed above. It is explicit in LPSs, implicit in the shift of offensive weapons from value to defended military targets, and explicit again in direct attempts to defend value at higher levels. At each the ability to defend value grows; it is not clear how far current technologies could carry it. Known technologies cannot be shown to reach useful levels, but there are no known barriers to further development. Pursuit of the defense of value would require that the deployment of elements useful at lower levels be accompanied by research and development on advanced interceptor and sensor concepts needed for operation at higher levels.

VI. COMMON TECHNICAL THEMES

Several themes cut across these discussions. One is the progression of emphasis from interceptors to sensors. LPSs could be largely implemented with existing radars; no further development of advanced sensors would be required. The principal issue is GBI development. Their principal decision is not technological, but whether interceptors and radars should be based in one site or distributed to improve capability. Performance and sensitivity are the issues more than cost in small deployments.

Priorities shift in limited attacks; for them the emphasis is on sensors, more than interceptors. Vulnerable radars could no longer be used. Probes or satellites to replace them could be difficult and expensive to develop; it is not clear that the current development of warning sensors would do so. To address limited attacks it is necessary to stress sensors, as recognized by the DSB. If, however, both LPS and limited attacks were addressed, the sensors and interceptors would be developed to give reasonable protection against accidental or unauthorized attacks. They would have to evolve further to provide defense against intentional, determined NCA attacks. Capability against limited NCA and military strikes would develop command, sensor, and interceptor technologies required for initial threats. The key technology for continued viability is discrimination. These defenses would have a capability against global accidental launches, ICBMs, and SLBMs, which would constitute an adequate deterrent to military threats. By extending their deployments, a partial ability to defend value might evolve.

VII. SUMMARY

Strategic defenses could address a range of threats; there is an appropriate progression of technologies to do so. LPSs could protect against a range from small to large launches and from undirected to directed attacks. Their technology would feed into limited attacks, whose sensors would in turn be needed for initial threats. If discrimination was added, the main elements would be in place for desired levels of defense. Thus, there are possible progressions in interceptors, sensors, and discrimination. The isolation of LPSs from limited attacks produces conflict, but the two taken together build on one another both technically and programmatically.

Strategic defense is at a crossroads. The ultimate goal appears hard to achieve with developed technologies, so an interim step of development is required. The JCS's phase 1 is not likely to be delivered on the original timescale, because its execution is contingent on the results of that research. There are statements that interceptor, discrimination, and survivability issues are insuperable, but SBI issues largely involve cost, discrimination depends on techniques that are known if not developed, and survivability could be attained with known technologies.

There are conflicting claims on program priorities ranging from LPSs to defense of value; comparable priority is claimed for each. It is time to reassess these priorities. The basic question is whether it is worthwhile to continue strategic defense research, to which the answer is clearly yes. The technologies have proceeded well, if their integration has not, and there is no obvious barrier to their continued development. Moreover, the trends in survivability and offensive force asymmetry, and cost, which motivated the resumption of strategic defense research, have continued or worsened. Strategic defense also appears to have had a positive influence on arms control. All of these factors argue for continuation at some pace. The options below relate to the issue of pace.

VIII. OPTIONS

1. Continuing research and developing a LPS in a single site with radar warning and tracking constitute the lowest level of activities with significant near-term deliverables. Research alone is not sustainable at the current level; it could be in concert with the LPS. Most LPS funds would go for sensors, command, and integration. GBIs would be used much as they are. In concert they should provide reasonable protection from ICBMs, though less from SLBMs.

Funding for LPS deployment is estimated to be about $ 5 B over 5 years. The current strategic defense research effort is pressed to maintain research on the advanced sensors, SBIs, and DEWs for phase 1. If $ 1 B/year for the LPS was taken from the current program, the remainder might not sustain it. If the LPS was deployed at $ 0.5 B/year, it would be stretched out and lose value. If additional funding was used to deploy the LPS, it could be deployed, research continued, and phase 1 developed without diluting those efforts.

2. A variant is an LPS with interceptors spread around the perimeter, which would provide more protection against SLBMs at the cost of several billion dollars more for engineering and siting.

3. A second variant would be to use the LPS to protect the NCA with the same technology, which would improve its connectivity at some degradation of protection of the west coast. Implemented with the technology intended for the later defense of high-value targets, the costs could increase significantly for survivable sensors, radars, and interceptors for low and airbreathing threats. Those costs could be recouped if it were

later decided to deploy phase 1. This option is about the lowest level that would have military significance as recognized by the JCS. It could, however, lose popular support, since it could be viewed as entry-level protection of military targets rather than value.

4. The next level would be one of the above plus a focused effort to develop and/or deploy the sensors needed for phase 1.

5. The next step would maintain phase 1 as the main goal of the program. The risk in such a program would be significant, since the interceptor and discriminator issues of phase 1 are known. It would thus be a gamble to maintain schedule by spending on the low-risk parts of the program, while high-risk elements developed at the rate permitted by technology and remaining funds. The sensors now under development are costly, not needed for LPSs, and not obviously appropriate for phase 1.

IX. CONCLUSIONS

Research at roughly the current level, execution of one of the LPS options, and development of appropriate sensors for phase 1 would contain most of the elements necessary to retain schedule and reasonable expectation of success. It would deploy an LPS on the time scale set by additional funding and produce an option for a phase 1 decision in 2-4 years. That sounds different than the intent of the Defensive Technology Study, but actually represents its called-for narrowing of options, quantification of uncertainties, establishment of a stable path, and identification of major decision points. As such, it represents a mature version of the earlier decision process.

REFERENCES

1. S. Nunn, "Arms Control in the Last Year of the Reagan Administration," United States Senate speech to the Arms Control Association, 19 January 1988.

2. R. Everett, "DSB Report of the SDI Milestone Panel," U.S. Department of Defense, 13 April 1988.

3. F. Iklé and A. Wohlstetter, Discriminate Deterrence, Report of the Commission on Integrated Long-Term Strategy (Washington D.C., U.S. Government Printing Office, January 1988).

4. G. Canavan, "Goals for Limited Strategic Defenses," Los Alamos National Laboratory report LAUR-88-1024, May 1988.

5. T. Postol, private communication, Center for International Security and Arms Control, Stanford University, 21 June 1988.

6. T. Postol, op. cit.

7. S. Drell, private communication, Center for International Security and Arms Control, Stanford University, 6 July 1988.

8. G. Canavan, "Goals for Limited Strategic Defenses," op. cit., App. A.

9. G. Canavan, "Adaptive Preferential Defense and Discrimination," Los Alamos National Laboratory report LA-UR-87-3224, November 1987.

10. G. Canavan and J. Browne, "Neutral Particle Beams in Strategic Defense," Los Alamos National Laboratory report LA-UR-88-1624, May 1988.

Printed in the United States of America
Available from
National Technical Information Service
US Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Microfiche (A01)

Page Range	NTIS Price Code	Page Range	NTIS Price Code	Page Range	NTIS Price Code	Page Range	NTIS Price Code
001 025	A02	151-175	A08	301-325	A14	451-475	A20
026-050	A03	176-200	A09	326-350	A15	476-500	A21
051 075	A04	201 225	A10	351 375	A16	501 525	A22
076 100	A05	226-250	A11	376-400	A17	526-550	A23
101-125	A06	251 275	A12	401 425	A18	551-575	A24
126-150	A07	276-300	A13	426-450	A19	576-600	A25
						601-up*	A99

*Contact NTIS for a price quote.