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# Report of the Defense Science Board Task Force Subgroup on Strategic Air Defense

## (SDI MILESTONE PANEL)

May 1988

Office of the Under Secretary of Defense for Acquisition
Washington, D. C. 20301-3140

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

April 13, 1988

MEMORANDUM FOR SECRETARY OF DEFENSE
UNDER SECRETARY OF DEFENSE (ACQUISITION)

SUBJECT: Report of the Defense Science Board Task Force Subgroup on Strategic Air Defense (SDI Milestone Panel)--INFORMATION MEMORANDUM

Attached is the report of the SDI Milestone Panel. We have reviewed the SDI Program and recommend that the Program be replanned as a number of steps leading to a Phase One system capable of meeting the JCS requirement rather than as a single major action.

We will be pleased to meet with you to discuss the report, if you so desire. We believe we have completed the task you gave us but stand ready to continue our work if you so desire.

Robert R. Everett

Robert R. Everett
Chairman

Attachment

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DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW (OASD-PA)
DEPARTMENT OF DEFENSE

13 April 1988

# Defense Science Board
## Report of the Strategic Defense Milestone Panel


Summary

1. In view of the technical, budgetary, political, and arms control uncertainties surrounding the ballistic missile defense program, the Panel recommends planning a number of steps in the technical development and deployment of a system to meet the JCS requirements rather than a single major action.

2. From a development point of view, priority should be given to the sensors, processing and communications necessary to provide an adequate assessment of what is actually going on, the nature and extent of the attack, and the detection and tracking of boosters and reentry vehicles. This framework is needed whatever weapons are actually used, and the research, development, and experimentation required to provide it involves most of the critical technologies. This surveillance system should evolve as the supporting technology becomes available, allowing the inclusion of whatever weapons are available and wanted. This restructuring would help assure priority attention to critical technical problems despite budget uncertainties.

3. Deployment should be in steps, each of which should provide some capability and have some value in itself. One possible set of steps is as follows:

First - A limited, treaty compliant, deployment of 100 fixed ground-based long range interceptors cued from existing warning sensors. Such a system falls within our present demonstrated technical capabilities. It would be a limited deployment and as such would have limited capabilities, but it would provide some preferential defense as well as some protection against accidental or third country attacks or blackmail attempts.

Second - A treaty compliant deployment of the next generation of space surveillance systems to improve our early warning detection and assessment of a ballistic missile attack and to lay the foundation for subsequent steps that can deal with larger and more sophisticated attacks.

Third - A deployment to protect the NCA against decapitation by ballistic missiles, including those from submarines. This would require the emplacement of shorter range interceptors.

Fourth - Further expansion, including additional bases and ground-based interceptors and improved sensors to cope with countermeasures.


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Fifth - The addition of space-based interceptors for boost and post-boost attack to fully meet the JCS requirement. This step might begin before step 4 was completed.

Sixth - The addition of space-based or ground-based directed energy weapons.

For each step the deployment decision would entail a separate and discrete act.

4. The first two deployment steps as well as the continued development of improved weapons up to the point of prototype demonstration could all reasonably be judged to be allowable under the narrow definition of the ABM Treaty. The third step may be achievable within the Treaty depending on the characteristics of the systems deployed. Subsequent deployment steps would require renegotiation of or withdrawal from the Treaty. The continued evolution of the surveillance system as described above does not appear to be constrained by the Treaty.

5. This approach would allow for more confident decisions and more flexibility in the face of uncertainties and would probably not require any more time in the long run.

6. The JCS have not addressed the utility of deployments short of the full Phase I deployment. Their views on the utility of possible phased deployments and the desirability of proceeding with them should be explored.

7. The Panel understands that the SDIO is evaluating this concept and is developing alternative plans for a stepped deployment.

8. We believe very strongly that capable long term engineering support for the SDIO is essential to carry out this large complex program. The existing limitations on such support should be removed as a part of any agreement on the future of ballistic missile defenses.

Introduction

The Strategic Defense Milestone panel was reconvened at the request of the Secretary of Defense to review the current plans for the Strategic Defense Initiative. The Panel met three times during February and March 1988, was briefed by the SDIO and held discussions with the Secretary and his staff, with General Abrahamson, and with General Herres. A list of the members participating is attached.

In general, we believe that the concerns we expressed last year are being addressed in a forceful manner but many concerns are yet to be satisfactorily resolved. This is not surprising since many of the problems facing the SDI are of substantial difficulty and require a great deal of work to solve. Although the plans for attacking these problems appear reasonable in themselves, we are concerned about the larger problems that result from the financial and political uncertainties that surround the program. These uncertainties lead to unrealistic schedules and to a wasteful process of replanning as funding changes. Varying interpretations of the constraints imposed by the ABM Treaty lead to confusion in the testing process.

About a year ago, a decision was made to develop the SDI system in phases. The SDIO is currently engaged in a demonstration and validation program looking toward a Milestone II decision on a proposed concept for a first phase deployment. Preparatory to this decision, SDIO will have to develop a detailed plan and schedule for FSED and deployment of the Phase One concept. Because of the complexity and cost of the Phase One concept, the time required to deploy it and the political sensitivity of issues related to the ABM Treaty, we believe that SDIO should plan the Phase One deployment as a sequence of steps, each accomplishing a useful mission. Such a sequential program, which pays for itself with incremental benefits as it goes, will be more likely to achieve support than one which contributes little or nothing until the completion of Phase One.

Typically, large complex systems whether military or commercial, have not been created all at once. Rather they have all evolved over a period of time with each new step built on the foundations of technology, management, and public acceptance previously established. Air defense systems were evolved in this fashion, as were air traffic control systems, commercial telephone systems, and carrier task forces. Further, these systems continue to evolve.

Development

The Strategic Defense System has been thought of by many as a collection of major components, BSTS, SSTS, SBI, ERIS, PROBE, etc. tied together by a Battle Management/$C^3$ system of some sort. The concerns we expressed last year in our SDM Panel report focused on the surveillance, background and signature measurement, discrimination, system engineering and BM/$C^3$. We believe it would be better to think about ballistic missile defenses as first of all a surveillance system together with its associate processing and communications, whose purpose is to determine the actual characteristics of an attack, to find the boosters against the background and to find the RVs amid the decoys, chaff, nuclear effects, and other countermeasures and to determine where they are and where they are going. Given such information, decisions can be made, and actions taken within existing limitations. Actions can range from alerting to dispersal, to active defense, to striking back. Without adequate information none of these actions can be confidently taken.

The need for information is not limited to RVs of course. The characteristics of attacks of all sorts, from aircraft, cruise missiles, and other weapon systems armed with either nuclear or non-nuclear warheads, must be correctly and promptly determined if the country is to be defended.

Once a surveillance system exists it can be used to provide information to whatever weapon systems are available, ground or space based, KKV or DEW. A limited surveillance system now exists, consisting of the warning satellites and radars. This system should evolve as better sensors, better information on objects and backgrounds, and better processing and communications are developed and deployed.

This way of looking at ballistic missile defenses should help to enforce an orderly set of priorities on the development program. It will continually emphasize the need for system design, for a measurement program, and for a close tie between ballistic missile defenses and the other deterrent forces.

Emphasis on a surveillance system will not, of course, remove or even weaken the need for weapons and their associated fire control. However, it will make possible an evolutionary approach to weapons development and procurement. The several types now under development could then be deployed when and if they make sense in themselves. Each element will not be hostage to the successful development and deployment of the others. A ballistic missile defense system will, in fact, exist at all times. the process is one of improving that system in ways and at rates which are both possible and acceptable.

Deployment

There are a number of possible ways in which a ballistic missile defense system might be deployed in steps. It is neither necessary nor possible to lay out a fixed plan for all steps at this time because the actual steps to be taken depend on technical advances, international relations, and public acceptance. The first step or two must be defined, however, and subsequent steps outlined as possibilities. The purpose is to provide a set of options for future decision makers.

While the Panel is in no position to specify a plan in detail, we suggest the following possible directions for a stepped deployment plan.

First - A limited deployment of long range ground based interceptors. These interceptors would be IR-terminally-guided, their launch and initial direction being cued from the existing warning sensors. They would be something like ERIS but would probably be somewhat larger, both to provide greater performance margins and to permit deployment before the final high quantity production version of the interceptor is complete. The earlier version should have adequate performance margins to provide, from a single deployment site, a very thin area defense for much of CONUS. If such an interceptor deployment were sited at Grand Forks or in the national capital region it would be Treaty-compliant so long as the number of interceptors remained below 100.

We were favorably impressed by the Phase One Engineering Team (POET) group's proposal for such a deployment. Capability would be limited, especially against countermeasures, but a thin defense over much of the country would provide some preferential defense against small attacks, and some protection against accidental unauthorized launches and against third country attacks and threats of blackmail.

The choice of an initial site involves political judgments and is beyond the scope of our Panel. We note that the Grand Forks site currently exists and would provide coverage over most of CONUS while a deployment in the national capital region would provide a beginning for an NCA defense. We note also that a decision to switch our permitted deployment from Grand Forks to the national capital region would have to be announced by October 1988, the end of the current 5-year ABM Treaty review period.

Either choice would establish a base from which the BMD system could evolve, put BMD into the military operational structure and teach valuable lessons about the management and operations of such a system. Last, but not least, it would make a start toward achieving symmetry with Soviet BMD deployment activities and, in this way, contribute to inhibiting breakout.

Second - Begin to update and improve our surveillance, in particular by deploying an improved satellite Early Warning System (EWS). Better space surveillance is needed to provide better warning and better attack assessment through better counting and tracking, whatever happens in active defense. Whether this improved space surveillance involves the currently specified BSTS or something more like an improved satellite EWS is a matter for further thought. We should not think of an improved satellite EWS as the end of the line. Later and still better versions should be expected.

Improvements to other surveillance systems should be investigated as well. The process of measuring background and gathering information on friendly and unfriendly objects in space is a continuing one and should be pursued as an intrinsic part of the evolution of the surveillance system, an evolution which would proceed in parallel with the other steps.

Third - Install shorter range interceptors in the Washington area to protect the NCA against decapitation by ballistic missiles, including those from submarines. We prefer a dual-mode surface-to-air missile system with capabilities similar to those of the Soviet dual-mode SA-12, such as an improved version of Patriot, which would have capabilities against aircraft and cruise missiles as well as short range ballistic missiles. The use of equipment already in production would greatly reduce costs. HEDI is also a possibility.

Fourth - Further expansion, including additional bases and interceptors, to cover other parts of the country and cope with larger attacks and improved sensors to cope with countermeasures.

Fifth - The addition of space-based interceptors for boost and post boost attack. The deployment of this step would presumably meet the JCS requirement.

Sixth - The addition of space- or ground-based directed energy weapons.

The development of these or equivalent steps would be carried to the point of decision but would not be deployed unless actually wanted at the time. Each step would build upon the previous steps, most of which would continue to coexist.

The ABM Treaty

There is not a force acting on the SDI program that is more damaging or more insidious than the present debate on the "narrow vs broad" interpretation of the ABM Treaty.

The notion of the "broad" interpretation of the ABM treaty has been promulgated presumably to give the SDIO program greater flexibility to plan and carry out its testing program. In fact, it has had the opposite effect; the present testing program is in a straitjacket. This has come about in large part because in the course of debate on "narrow" vs "broad" interpretations of the treaty, the "narrow" interpretation of the treaty itself was so squeezed by both the opponents and proponents of SDI that it lost all reasonableness. Whatever else is done, a way must be found to terminate this debate.

The Treaty is ambiguous in many of its details; two areas of ambiguity appear to be especially important for the kind of sequential program we believe is desirable. The first arises from the lack of a clear definition of "systems based on other physical principles" (OPP). The second ambiguity arises from the conflict between the Treaty's allowance of early warning radars on one hand and, on the other, its prohibitions on development of mobile, including space-borne, radars and its restrictions on deployment of stationary radars for acquisition, tracking and battle management. As an illustration of the deleterious effect of this ambiguity, we currently operate satellites for early warning, but find that BSTS, which would perform similar functions, is considered questionable. Because the Soviets exploit ambiguities to the limit (and beyond as in the case of Krasnoyarsk), a U.S. policy that restricts us to activities that are unambiguously permitted by the Treaty could seriously impair our security.

We believe, therefore, that DoD should define a technically optimum testing and deployment program and should then adhere to that program except when Treaty constraints unambiguously require it to otherwise. The DoD should place the burden of proof on those who would restrain the program.

In our opinion, there is a way of reading the treaty which separates the important from the less important. The Treaty limits the number of effective ABM interceptors each country can have by placing a limit of 100 on launchers, requiring that they be fixed, restricting them to limited areas, and prohibiting rapid reload and MIRVing. The Treaty says nothing about the size, range, velocity, or guidance of the interceptors. The Treaty limits the radars to the vicinity of the launchers but permits warning radars around the periphery of the country. It says nothing about and therefore places no limits on warning satellites.

We believe that the first two deployment steps, plus the follow-on development of weapons up to the point of prototype demonstration, could be judged to be allowable under the Treaty. The third step may be achievable within the Treaty depending on the characteristics of the systems deployed. Subsequent deployment steps would require renegotiation of or withdrawal from the Treaty. The continued evolution of the surveillance system as previously described does not appear to be constrained by the Treaty.

We also believe step one to be treaty compliant by comparison with the existing Soviet ABM deployment. The step one system is very similar in general terms, contains only elements already in the existing Soviet system, and has capabilities which are similar to and may be less than the Soviet system. The differences are largely technical details which are not even mentioned let alone limited by the Treaty.

We do not see that the Treaty limits tactical warning and attack assessment (both sides had IR satellites at the time the Treaty was written) so step two should not violate the treaty.

Step three may or may not violate the Treaty depending on what is actually done. Numbers of SA-10's are deployed around Moscow and the Soviets are beginning to deploy SA-12s. Arguing by analogy as before, dual-mode surface-to-air missiles with capabilities comparable to the SA-12 can be deployed around Washington without violating the Treaty.

Schedule

A stepped process such as we have described would appear to lengthen the schedule by increasing the number of deployments and requiring money for earlier deployment. The current schedules are very uncertain, however, not only because of technical uncertainties but because of funding uncertainties. If the present program enjoyed stable funding and support, it might go faster without intermediate steps. We believe, however, that the difficulty of supporting such a large decision all at once and of bringing all system elements to a satisfactory stage at the same time make the all-at-once plan very risky. The stepped plan allows much more confident decisions and much more flexibility in the face of uncertainties. Furthermore it allows decoupling the schedules of many of the system elements. We think a stepped plan will eventually lead to shorter schedules and lower costs than the current Phase I plan.

Requirements

The JCS requirement for Phase I was very important in placing a foundation under the SDI program. A stepped program such as described above would not meet the current requirement until something like the fifth step. The JCS have not addressed the utility of deployments short of the full Phase I. Their views on this matter need to be explored and the military utility of various steps agreed upon.

System Engineering Support

The Panel was pleased to learn that the ad hoc system engineering team under discussion last year has been established and is in operation under the title of Phase One Engineering Team or POET. We believe this is an important advance but are still concerned about the need for long term support. We think that a stepped deployment increases this need if the steps are to be properly planned and integrated.

The SDIO's need for responsive, long term systems engineering and technical assistance is very evident to the Panel; we think this need must be satisfied if we are to achieve an effective ballistic missile defenses. The Systems Engineering and Integration contractor, although needed to meet other demands, is not a substitute. We recommend strongly that the Secretary of Defense make such support available to the Director, SDIO, from the resources of existing DoD FCRC's and ensure this support is fully responsive to the long-term needs of the SDIO. Should these actions be ineffective or inadequate in providing the type or quality of engineering and technical assistance required by the SDIO, an agreement should be reached with Congress to support the establishment of a new and separate FFRDC to satisfy SDIO requirements.

SDIO

The concept of a stepped deployment and of an evolutionary surveillance, processing, and communications system has been discussed with Lieutenant General Abrahamson and his staff. We understand that they are evaluating the idea and are developing alternative plans for a stepped development.

Mr. Robert R. Everett
Task Force Chairman

Attachment

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Report of

Defense Science Board

On

# SDIO

# BRILLIANT PEBBLES

# SPACE BASED INTERCEPTOR CONCEPT

DECEMBER 1989

Office of the Under Secretary of Defense
for Acquisition
Washington, D.C. 20301-3140

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

29 DEC 1989

MEMORANDUM FOR SECRETARY OF DEFENSE
DEPUTY SECRETARY OF DEFENSE

SUBJECT: Final Report of the Defense Science Board on Brilliant Pebbles

I am pleased to forward the final report of the DSB on Brilliant Pebbles. The DSB recommends that both the Brilliant Pebbles program at Livermore and the current baseline program in the Air Force be continued until the critical issues are resolved and differences quantified, a process estimated to take about two years. A number of related matters are discussed as well.

We will be pleased to meet with you to discuss the report and stand ready to help in any way.

Robert R. Everett
Chairman

Attachment

Approved for publication______________

**REPORT OF**
**DEFENSE SCIENCE BOARD**
**ON**
**BRILLIANT PEBBLES**

## INTRODUCTION

At the request of the Deputy Secretary of Defense, the Defense Science Board formed a Task Force to review and assess the interceptor concept development known as Brilliant Pebbles and to report by the end of September 1989. The Brilliant Pebbles Task Force was formed in June 1989 and met six times from June through September with the Strategic Defense Initiative Organization (SDIO), the US Air Force Space Systems Division, the Lawrence Livermore National Laboratory (LLNL), the JASONS, and other groups that are examining parts of the Brilliant Pebbles program.

## BRILLIANT PEBBLES

Brilliant Pebbles (hereafter referred to as BP) is an LLNL concept for the space-based layer of the Phase I or kinetic-kill version of the Strategic Defense Initiative (SDI). BP is more than an alternative design of a Space-Based Interceptor (SBI). It is, first, a different architectural approach to the space-based segment than the one that has been consistently pursued by the SDIO for some years and, second, a different approach to the design and exploratory development process.

In the BP design process, costs and weight are ruthlessly controlled; the former by using state-of-the-art components wherever possible and the latter by providing for just-enough capabilities rather than redundant or excessive capabilities for accomplishing the BP mission.

The BP architecture is based on a distributed system comprised of large numbers of small, more-or-less autonomous spacecraft which can perform the functions of surveillance, communications, acquisition, track, target designation and interception. The functions of other system components such as the Boost Surveillance and Tracking System (BSTS) are reduced and in some cases, such as those of the Space Surveillance and Tracking System (SSTS), eliminated. The current baseline SDI architecture design assigns various functions to different system elements, all of which must operate if the system is to work. The baseline SBI design is dependent upon external surveillance for target assignment, and, in some cases, mid-course updates. BP was originally conceived as highly autonomous. It has become more integrated as work has progressed. The LLNL designers are responding to external suggestions while maintaining autonomous modes, at least for backup.

The greater dispersion and autonomy of BP (at least in backup modes) are clearly advantageous, leading to lowered vulnerability, larger production runs, greater flexibility, and lessened reliance on other Strategic Defense System (SDS) elements.

The design of BP thus far has been examined by a number of competent and independent groups. The examinations have pointed to several areas of possible improvement, but no fundamental flaws have been found in the concept. The design is both innovative and capable, but by no means complete, and is still changing. In fact, it is changing rapidly. This is not bad, but good, because the design is getting better as a result of improvements in technology, constructive criticism, and suggestions from all parts of the SDI community. Several critical issues do exist and have yet to be resolved. In order to keep down weight and cost, some components are marginal in performance and may need upgrading. A plan that identifies how the critical issues will be resolved and when resolution is to occur should be developed.

The work on BP has also had a good effect on the current SBI design, causing the designers to consider BP technology and concepts and to look at new ideas. BP and SBI have been moving closer together as work proceeds.

Our recommendation is to pursue the present Brilliant Pebbles program as is, with the SDIO continuing to fund the BP through LLNL and the SBI through the Air Force. We suggest that this arrangement continue until the advantages and disadvantages of a system architecture based on BP are clearly understood in a quantifiable manner. This should be accomplished as a prerequisite to a Milestone II decision. This is not a simple task and will require a substantial effort. Our estimation is that it will take about two years. This process will also ensure realistic trade-offs between the two approaches, encourage innovation on the part of both groups, maintain a baseline of design and organization that could be implemented if required, and aid both designs to evolve and come closer together, resulting in a possibly different but certainly better design in the future. As we indicated in our 1988 report on SDI, we think the potential for limited defenses on the way to a full Phase I deployment continues to merit attention. We believe, therefore, that the reassessment of the space-based layers of the Phase I architecture should identify the capabilities of a phased deployment against small attacks.

In particular, we do not believe the BP should replace the SBI in the Phase I SDS baseline at this time for two reasons. First, the BP design is neither complete nor stable, nor is there yet a well-defined program acquisition strategy for transitioning BP into system acquisition. A move to adopt the BP concept would therefore create substantial upset and delay. Second, the pressures that would be generated to freeze the BP design would hamper and probably soon end the desirable process of improvement now underway. We do also suggest that LLNL be asked to prepare and keep up-to-date a written description of the design, not just of the BP, but of the entire BP system and how it is to be operated. The BP design should not be frozen, but encouraged to evolve, in order to help others understand and make suggestions and to aid the process of transferring technology to other activities.

PRODUCTION

The production and deployment of large numbers of identical spacecraft is something new, and offers opportunities for innovation and for substantial savings in costs. This opportunity is particularly evident for the BP or other space based interceptor concepts which would exist in thousands. There are also opportunities for new approaches to launching many small satellites. We are concerned that the SBI organizations, which are involved in the acquisition of one-of-a kind or few-of-a-kind satellites, may find it difficult to take full advantage of such opportunities, especially if they are instructed to prepare to build on a definite time schedule. We urge that the SDIO put more real effort into innovative approaches to manufacturing and launch of space-based interceptors, including automated factories, high-rate missile-production techniques and facilities, and factory prepackaged launch and payload vehicles. Such capability could have valuable applications well beyond strategic defense.

FLIGHT TESTS

At the moment both the BP and SBI groups are proposing flight tests. Two sets of tests would be difficult and expensive and we believe unnecessary. It appears to us that these tests are being thought of as demonstrations to show a particular design is satisfactory rather than tests to gather needed knowledge and data for any space based concept. The DSB has been concerned for some time about the lack of basic background and signature information. We therefore recommend that any flight test program be directed primarily toward gathering needed knowledge and information. One properly planned flight test program should provide background and sensor performance data for both SBI and BP, and perhaps for other concepts as well.

A demonstration program could be carried out at a later time, when a choice among alternatives has been made.

## COUNTERMEASURES

We suggest that more attention be paid to countermeasures and, in particular, suggest that Red Team efforts be augmented and continue throughout the exploratory period.

## SPACE SURVEILLANCE AND TRACKING SYSTEM (SSTS)

Brilliant Pebbles concept analyses have indicated that the SSTS is not needed for boost/post-boost intercepts. SBI contractors seem to agree. This architectural change implies that the SSTS should be rethought based on its other purposes. A rethought SSTS may be less complex and less costly than the current version.

## BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS)

In the fully autonomous mode, the BP does not require the BSTS as presently envisioned in the Phase I SDS baseline. However, a Tactical Warning / Attack Assessment (TW/AA) system is needed whether or not a ballistic missile defense system is ever deployed, and such a system could provide surveillance for BP. In our opinion, the TW/AA mode of operation should be primary and the more autonomous operation of the BP should be a backup. The ability to operate without the BSTS is a very valuable feature which should greatly improve survivability of both the BP system and of the BSTS itself, since it would become a less valuable target.

The current design of the BSTS is matched to a specific SDI concept that results in the satellite being large, complex, technically risky, and raising ABM Treaty problems. Since the SDI concept is still open to change we suggest that the design of BSTS should be reexamined. It may be better to focus development on an improved TW/AA satellite with only those features for SDI that can be defined and justified at this time.

## DISTRIBUTED SURVEILLANCE

We are impressed by the Brilliant Pebbles technology and intrigued by the possible use of this and related technology for other purposes. One interesting possibility is the use of BP technology for a distributed boost surveillance system. This idea should be given further consideration, but we believe that the satellite elements should be designed for the purpose and not necessarily derived directly from BP. The sensors, apertures, cooling, and communications should be reconsidered, recognizing that weight is a less serious consideration.

## CLARIFYING THE TASK OF THE SDIO

The SDI program appears to suffer from a conflict of purpose. At times the program has emphasized research on new and better technologies and concepts. At other times it has emphasized deployment of a system. These two aims are in competition especially in view of the nature of the existing acquisition process.

There is no reason why the processes of exploring and getting ready to build cannot go on in parallel. There could be at any time a design that could be implemented, i.e., developed and deployed if necessary or desired, and an exploration of alternatives, with a mechanism for getting new and proven ideas into the current design. This is a reasonable approach if clearly delineated, the balance of the activities defined, and the transfer mechanism described. Once a firm decision to develop and deploy is made, the balance would necessarily change, but no such decision is imminent. There is not now a clear direction to SDIO about which of these objectives they are supposed to pursue and if both, as seems likely, the relative emphasis on the two.

We therefore urge that the Secretary of Defense make the relative balance between exploration and building clear to the Director,SDIO, so that his limited resources can be properly employed.

## BUILDING vs EXPLORING

The Department of Defense (DoD) has a process for building things. This process, while costly, difficult, lengthy, and often criticized, does get things built. The build process necessarily involves making choices and limiting alternatives.

The DoD does not have an effective process for doing a thorough exploration of alternative technologies and concepts. Exploration is usually done only as a part of the build process, because exploration is expensive and adequate funds are not made available unless a decision to build has been made. The build process, however, tends to shut off exploration, partly to save money and partly to make sure that no new idea will arise to interfere with decisions already made.

Much of the difficulty now being experienced with acquisition stems from setting detailed requirements before adequate exploration has taken place. Lacking the discipline that real knowledge brings to what is doable and how best to do it, these requirements are usually overstated, leading to the delays, overruns, and performance shortfalls that are so common. Perhaps even more serious, the build process fails to take advantage of new ideas and possibilities, both technical and operational. Serious consideration should be given to revising this procedure. We should explore first and then ask whether a buildable system is worth the cost rather than determining what is required first and then struggling to build it, whatever the cost.

This dichotomy is evident in the SDI program. Although the SDI is supposed to be a research & development program, the build model has been applied and has led to fixing the system design too early before adequate exploration of alternative technologies was completed. The system has been divided into components, component descriptions have been set in concrete (or at least in molasses), and innovation has been thwarted despite efforts to encourage it.

Serious consideration should be given to applying the exploratory design approach (of which Brilliant Pebbles is an example) across the SDI, to both the system and the elements. The same approach should be considered for other DoD programs as well. The exploratory approach involves the design by a capable organization with technical depth and experimental resources, operating under a minimum of procedural restraints, and with system specifications not yet fixed.

## SUMMARY OF RECOMMENDATIONS

1. Continue to support the Brilliant Pebbles exploratory effort at LLNL directly under the SDIO.
2. Continue the SBI program in the Air Force with encouragement to innovate and to make use of Brilliant Pebbles technology and concepts when desirable.

3. Establish a plan and schedule for resolving the critical issues related to the BP concept and architecture and quantifying the differences between BP and the baseline.
4. Plan for one integrated flight test program directed toward gathering data needed for both the SBI and BP programs.
5. Reexamine the current designs of SSTS and BSTS to make sure they are still appropriate.
6. Consider applying the exploratory process (of which Brilliant Pebbles is an example) to the other elements of the SDI.
7. Determine the relative balance desired between exploration and building in the SDI program, in general, and the space based layer in particular and inform SDIO.

# APPENDIX A

## <u>TERMS OF REFERENCE</u>

THE DEPUTY SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

2 8 AUG 1989

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference - Defense Science Board Task Force on Brilliant Pebbles

I request you to organize a Defense Science Board Task Force to perform a top-level technical assessment of the Strategic Defense Initiative space-based interceptor concept, Brilliant Pebbles.

The Strategic Defense Initiative Organization is considering the future course of its work on the Brilliant Pebbles concept and has arranged for a number of studies of various aspects of the space-based interceptor (SBI) concept this summer. The Task Force should review and evaluate the Brilliant Pebbles concept and make recommendations with regard to:

- The advantages of the concept as compared to the present SBI design,
- The soundness of the required technology,
- The risks and cost in developing the demonstration/validation design, and
- The validity of the demonstration/validation flight experiments.

A report in briefing form is desired by September 1989.

The Deputy Director of Defense Research and Engineering for Strategic and Theater Nuclear Forces will sponsor the Task Force, and Mr. Robert R. Everett will serve as chairman. Mr. Dale E. Moore, DDR&E/S&TNF(DS) will be the Executive Secretary, and LtCol David L. Beadner, USAF, will be the DSB Secretariat Representative

The terms of reference for this Task Force include no assignments that would indicate the Task Force would be participating personally and substantially in the conduct of any specific procurement, or place any member in the position of acting as a "procurement official."

D. J. Atwood

Donald J. Atwood



62699

The terms of reference for this Task Force include no assignments that would indicate the Task Force would be participating personally and substantially in the conduct of any specific procurement, or place any member in the position of acting as a "procurement official."

DGC

11 JUL 1989

# APPENDIX B

## TASK FORCE MEMBERSHIP

**DEFENSE SCIENCE BOARD**
**BRILLIANT PEBBLES INTERCEPTOR CONCEPT**
**TASK FORCE MEMBERSHIP**

**Task Force Chairman**
Mr. Robert R. Everett
Private Consultant

**Members**
Dr. Solomon J. Buchsbaum
Executive Vice President, Customer Systems
Bell Laboratories

Mr. Vincent Cook
Private Consultant

GEN Russell E. Dougherty (Ret.)
Private Consultant

Mr. Daniel J. Fink
President
DJ Fink Associates, Inc.

Dr. John S. Foster, Jr.
Private Consultant

Dr. George H. Heilmeier
Senior Vice President and Chief Technical Officer, Corporate RDE
Texas Instruments, Inc.

Dr. Robert J. Hermann
Vice President, Science & Technology
United Technologies Corporation

Mr. Fred S. Hoffman
PAN Heuristics Services, Inc.

Mr. Theodore Jarvis, Jr.
The MITRE Corporation

Mr. Walter E. Morrow, Jr.
Director, Lincoln Laboratory
Massachusetts Institute of Technology

Dr. William J. Perry
Managing Partner
H&Q Technology Partners

**Executive Secretary**
Mr. Dale E. Moore
OUSD(A)/DB

**Military Assistant**
LtCol David L. Beadner, USAF
OUSDRE(A)/DSB

# APPENDIX C

## TASK FORCE MEETINGS

**DEFENSE SCIENCE BOARD**

**BRILLIANT PEBBLES TASK FORCE MEETINGS**

**19-20 June 1989**
**Washington, D.C.**

**10-11 July 1989**
**Livermore, CA**

**26 July 1989**
**Los Angeles, CA**

**31 July 1989**
**San Diego, CA**

**22-23 August 1989**
**Arlington, VA**

**20 September 1989**
**Arlington, VA**

September 14, 1989

3

**Minutes for the Defense Science Board Task Force Meeting**
**on the**
**Brilliant Pebbles Interceptor Concept**
**10 - 11 July 1989**

The second meeting of the Defense Science Board (DSB) Brilliant Pebbles Task Force was held at Lawrence-Livermore National Laboratories (LLNL) in Livermore, California. The meeting started at 0900 on 10 July and ended at approximately 1200 on 11 July.

The DSB meeting convened at Lawrence-Livermore National Laboratories to review the design and development status of the Brilliant Pebbles interceptor concept. The agenda, including times, and meeting attendees are listed in Attachment A.

On 10 July 1989 the Task Force was briefed by Dr. Scott on Interceptors Overview, by Dr. Collela on Lifejacket Overview, by Dr. Ledebuhr on Sensors and Communication Technology, by Dr. Scott on Computing and Processing Technology and by Dr. Whitehead on Propulsion and ACS Technology. In the afternoon the Task Force was briefed by Dr. Collela on Nuclear Survivability, by Dr. Wood on Pellet and Laser Survivability, by Dr. Hyde on Battle Management Software and Guidance and Control Software and by Dr. Scott on Attitude Measurement Software. In an Executive Session issues raised by these briefings were discussed.

On 11 July 1989 the Task Force met for discussions of system operational issues, program goals, program plans, test programs, producibility and technology transfer and ended with an Executive Session to wrap up the two-day meeting.

Robert R. Everett

Robert R. Everett
Chairman

## ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

10 JULY 1989

**DSB BP Task Force**
Mr. Robert R. Everett
Dr. John S. Foster, Jr.

**Observer**
Mr. Fred S. Hoffman

**OSD**
Dr. Bruce Pierce, OUSD(A)/DS
Mr. Dale E. Moore, OUSD(A)/DS
Dr. Thomas J. Welch, USD(A)/DSB
LtCol David L. Beadner, USAF, USD(A)/DSB
LTC Walter Seiberling, USA, SDIO
CAPT Marvin J. Weniger, USN, JCS

**W. J. Schafer Associates**
Dr. Robert C. Sepucha
Dr. Ed Gerry

**Aerospace Corporation**
Mr. John R. Stevens

**LLNL**
Dr. Nicholas J. Colella
Dr. Roderick A. Hyde
Dr. Arno Ledebuhr
Dr. Lyn D. Pleasance
Dr. Jeffrey B. Shellan
Dr. Walter S. Scott
Dr. John C. Whitehead
Dr. Lowell L. Wood

**Task Members Not in Attendance**
Dr. Solomon J. Buchsbaum
Mr. Vincent N. Cook
Dr. John M. Deutch
Gen Russell E. Dougherty (Ret.)
Mr. Daniel J. Fink
Dr. Edward A. Frieman
Dr. George H. Heilmeier
Dr. Robert J. Hermann
Mr. Walter E. Morrow, Jr.
Dr. William J. Perry

## ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

11 JULY 1989

**DSB BP Task Force**
Mr. Robert R. Everett
Dr. John S. Foster, Jr.

**Observer**
Mr. Fred S. Hoffman

**OSD**
Dr. Bruce Pierce, OUSD(A)/DS
Mr. Dale E. Moore, OUSD(A)/DS
Dr. Thomas J. Welch, USD(A)/DSB
LtCol David L. Beadner, USAF, USD(A)/DSB
LTC Walter Seiberling, USA, SDIO
CAPT Marvin J. Weniger, USN, JCS

**W. J. Schafer Associates**
Dr. Robert C. Sepucha
Dr. Ed Gerry

**Aerospace Corporation**
Mr. John R. Stevens

**LLNL**
Dr. Nicholas J. Colella
Dr. Roderick A. Hyde
Dr. Arno Ledebuhr
Dr. Lyn D. Pleasance
Dr. Jeffrey B. Shellan
Dr. Walter S. Scott
Dr. John C. Whitehead
Dr. Lowell L. Wood

**Task Members Not in Attendance**
Dr. Solomon J. Buchsbaum
Mr. Vincent N. Cook
Dr. John M. Deutch
Gen Russell E. Dougherty (Ret.)
Mr. Daniel J. Fink
Dr. Edward A. Frieman
Dr. George H. Heilmeier
Dr. Robert J. Hermann
Mr. Walter E. Morrow, Jr.
Dr. William J. Perry

**AGENDA FOR THE DEFENSE SCIENCE BOARD MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT**

**10 - 11 JULY 1989**
**LAWRENCE-LIVERMORE NATIONAL LABORATORIES**
**LIVERMORE, CA**

10 July

| | | |
|---|---|---|
| 0900 | Introduction | Dr. W. Scott, LLNL |
| 0910 | Interceptor Overview | Dr. L. Pleasance, LLNL |
| 0935 | Lifejacket Overview | Dr. N. Colella, LLNL |
| 1000 | Sensors and Communication Technology | Dr. A. Ledebuhr, LLNL |
| **1100** | **BREAK** | |
| 1115 | Computing and Sensor Processing Technology | Dr. W. Scott, LLNL |
| 1145 | Propulsion and ACS Technology | Dr. J. Whitehead, LLNL |
| **1245** | **WORKING LUNCH** | |
| 1345 | Integration - Tour | Dr. L. Pleasance, LLNL |
| 1405 | Sensor Development - Tour | Dr. A. Ledebuhr, LLNL |
| 1425 | Propulsion and ACS - Tour | Dr. J. Whitehead, LLNL |
| 1445 | Nuclear Survivability | Dr. N. Colella, LLNL |
| 1530 | Pellet and Laser Survivability | Dr. L. Wood, LLNL |
| **1545** | **BREAK** | |
| 1600 | Battle Management Software | Dr. R. Hyde, LLNL |
| 1620 | Guidance and Control Software | Dr. R. Hyde, LLNL |
| 1640 | Attitude Measurement Software | Dr. W. Scott, LLNL |
| **1700** | **EXECUTIVE SESSION** | Mr. R. Everett, Chairman |

11 July

| | | |
|---|---|---|
| 0730 | Discussions: System operational issues; program goals; program plan; test program; producibility; tech transfer | |
| **1030** | **EXECUTIVE SESSION** | Mr. R. Everett, Chairman |

Dale E. Moore

Dale E. Moore
Executive Secretary

Attachment A-1

September 14, 1989

**Minutes for the Defense Science Board Task Force Meeting
on the
Brilliant Pebbles Interceptor Concept
31 July 1989**

The fourth meeting of the Defense Science Board (DSB) Brilliant Pebbles Task Force was held at the Naval Oceans Systems Center, San Diego, California. The meeting started at 1300 and ended at 1630. The list of attendees is contained in Attachment A. There was no planned agenda as there was only one topic of discussion. The Task Force received a summary briefing by John M. Cornwall on the JASONS Review of Brilliant Pebbles. Following the briefing the Task Force convened into an Executive Session to discuss issues that had been raised.

Robert R. Everett
Chairman

# ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

31 JULY 1989

**DSB BP Task Force**
Mr. Robert R. Everett
Dr. Solomon J. Buchsbaum
Mr. Vincent N. Cook
Mr. Daniel J. Fink
Dr. John S. Foster, Jr.
Dr. Edward A. Frieman
Dr. George H. Heilmeier
Dr. Robert J. Hermann
Mr. Walter E. Morrow, Jr.
Dr. William J. Perry

**DSB Members**
Charles A. Fowler
Eugene Fubini

**Observers**
Mr. Fred S. Hoffman
Mr. Theodore Jarvis, Jr.

**OSD**
Dr. Thomas J. Welch, USD(A)/DSB
LtCol David L. Beadner, USAF, USD(A)/DSB
LTC Walter Seiberling, USA, SDIO

**W. J. Schafer Associates**
Dr. Ed Gerry

**Briefing**
John M. Cornwall, JASONS

**Task Force Members Not in Attendance**
Dr. John M. Deutch
Gen Russell E. Dougherty

Attachment A

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1989 Report of Closed Meetings of the
Defense Science Board Task Force on
Brilliant Pebbles Intercepter Concept
under Section 10 (d)
of the Federal Advisory Committee Act

The fourth meeting of the Task Force was held on 31 July 1989 at the Naval Ocean Systems Center, San Diego, CA. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so intertwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received a summary briefing by John M. Cornwall on the JASONS Review of Brilliant Pebbles. Following the briefing the Task Force convened into an Executive Session to discuss issues that had been raised.

Dale E. Mosey
for Robert R. Everett
Chairman

September 14, 1989

**Minutes for the DSB Task Force Meeting**
**on the**
**Brilliant Pebbles Interceptor Concept**
**19 - 20 June 1989**

The first meeting of the DSB Brilliant Pebbles Task Force was held in the Pentagon, Washington, DC from 0830-1600.

The Defense Science Board (DSB) Fact-Finding meeting convened in 1E1049 to address the plans and objectives for a review of the Brilliant Pebbles interceptor concept. The agenda, including times, and DSB members attending the meeting are listed in Attachment A.

On 19 June 1989 the Task Force received a series of status briefings at this fact-finding meeting. The members were briefed by BrigGen Schnelzer on the SDI Phase Program, by Dr. Kosovych on SDS Phase I Architecture, by LTC Seiberling on Brilliant Pebbles Concept and Studies Overview, and by Doctors Wood and Scott on the Brilliant Pebbles Technical Summary. In an Executive Session issues raised by these briefings were discussed.

On 20 June 1989 there were discussions on Brilliant Pebbles Operation and Design, and the Task Force ended the two-day meeting with an Executive Session.

Robert R. Everett
Chairman

# ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

19 JUNE 1989

**DSB Task Force Members**
Mr. Robert R. Everett
Dr. Solomon J. Buchsbaum
Mr. Vincent N. Cook
Dr. John M. Deutch
Gen Russell E. Dougherty, USAF (ret)
Dr. John Foster
Dr. George H. Heilmeier
Dr. Robert J. Hermann

**Observer**
Dr. Albert J. Wohlstetter

**OSD**
Dr. Thomas J. Welch, USD (A)/DSB
LtCol David L. Beadner, USAF, USD (A)/DSB
Dr. Bruce J. Pierce, OUSD (A)/DS
Mr. Dale E. Moore, OUSD (A)/DS
CAPT Marvin J. Weniger, USN, JCS
LtCol James Ford, USAF, Secretary of the Air Force/Acquisition
BrigGen Garry Schnelzer, USAF, SDIO
Col Dennis Riva, USAF, SDIO
LTC Walter Seiberling, USA, SDIO
Dr. Kosovych, SDIO/POET

**LLNL**
Dr. Walter S. Scott
Dr. Lowell L. Wood

**W. J. Schafer Associates**
Dr. Robert Sepucha

**Task Force Members Not in Attendance**
Mr. Daniel Fink
Dr. Edward A. Frieman
Mr. Walter E. Morrow, Jr.
Dr. William J. Perry

# ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

20 JUNE 1989

**DSB Task Force Members**
Mr. Robert R. Everett
Mr. Vincent N. Cook
Gen Russell E. Dougherty, USAF (Ret.)
Dr. John Foster
Dr. Robert J. Hermann

**OSD**
Dr. Thomas J. Welch, USD (A)/DSB
LtCol David L. Beadner, USAF, USD (A)/DSB
Mr. Dale E. Moore, OUSD (A)/DS
CAPT Marvin J. Weniger, USN, JCS
BrigGen Garry Schnelzer, USAF, SDIO
LTC Walter Seiberling, USA, SDIO
Dr. O'Dean Judd, SDIO
Col James Simmons, USAF, HQSSD/CNN

**LLNL**
Dr. Walter S. Scott
Dr. Lowell L. Wood

**W. J. Schafer Associates**
Dr. Robert Sepucha

**Task Force Members Not in Attendance**
Dr. Solomon J. Buchsbaum
Dr. John M. Deutch
Mr. Daniel Fink
Dr. Edward A. Frieman
Dr. George H. Heilmeier
Mr. Walter E. Morrow, Jr.
Dr. William J. Perry

ATTACHMENT A-3

**AGENDA FOR DSB TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT 19-20 JUNE 1989 THE PENTAGON WASHINGTON, D.C.**

**19 JUNE**

| | | |
|---|---|---|
| 0090 | Overview of the Strategic Defense Initiative Phase I Program | BrigGen Schnelzer, SDIO |
| 1000 | Overview of SDS Phase I Architecture | Dr. Kosovych |
| 1100 | Brilliant Pebbles Concept and Studies Overview | LTC Seiberling, SDIO |
| 1230 | Brilliant Pebbles Technical Summary | Dr. Wood/Dr. Scott, LLNL |
| 1500 | Executive Session - Discussion | Mr. Robert R. Everett, Chairman |

**20 JUNE**

| | | |
|---|---|---|
| 0900 | Brilliant Pebbles Operation and Design | (LLNL) |
| 1200 | Executive Session - Discussion | Mr. Robert R. Everett, Chairman |

Dale E. Moore

Dale E. Moore
Executive Secretary

# ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

26 JULY 1989

**DSB BP Task Force**
Mr. Robert R. Everett
Mr. Vincent N. Cook
Mr. Daniel J. Fink
Dr. Edward A. Frieman
Dr. George H. Heilmeier

**Observer**
Mr. Theodore Jarvis, Jr.

**OSD**
LtCol David L. Beadner, USD (A)/DSB
Mr. Dale E. Moore, OUSD (A)/DS
CAPT Marvin J. Weniger, USN, JCS
LTC Walter Seiberling, USA, SDIO

**W. J. Schafer Associates, Inc.**

Dr. Robert Sepucha

**Martin Marietta**

Mr. Jim Boginis
Mr. Joe Cox
Mr. John Durrett
Mr. Kim Feller
Mr. Dale Heldstab
Mr. J. Kent O'Kelly
Mr. Jim Mcanally
Mr. Marv Odefey
Mr. John Stevens
Mr. Berry Swanson
Mr. Rich Vandekoppel

**Rockwell International**
Ms. Jeanne Cahill
Mr. Bill Kuhn
Mr. Dan Lekawa
Mr. Frank Demattia
Dr. John Peller
Mr. Bill Sorge
Mr. Dean Farmer
Mr. Brien Schletz

**LLNL**
Dr. Walter Scott

**International Technical Services**
Mr. Hal Kaysen

**AF/SSD**
Maj Arnie Alanis, USAF
Col William O'Brien, USAF
Col Roger Colgrove, USAF

**Task Force Members Not in Attendance**
Dr. Solomon J. Buchsbaum
Dr. John M. Deutch
Gen Russell E. Dougherty
Dr. John S. Foster, Jr.
Dr. Robert J. Hermann
Mr. Walter E. Morrow, Jr.
Dr. William J. Perry

**AGENDA FOR DSB TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT**

**26 JULY 1989**
**U.S. AIR FORCE SPACE SYSTEMS DIVISION**
**LOS ANGELES, CA**

26 July

| | | |
|---|---|---|
| 0820 | Introduction | Col O'Brien, AF/SSD |
| 0830 | SBI Overview | Maj Arnie Alanis, AF/SSD |
| 0900 | Government Reference Concept (MCV) | Maj Arnie Alanis, AF/SSD |
| **1000** | **BREAK** | |
| 1015 | Rockwell Integrated Technology | Dr. John Peller<br>Rockwell International |
| 1120 | Rockwell Special Study Concept | Dr. John Peller<br>Rockwell International |
| **1300** | **Working Lunch** | |
| 1320 | Martin Special Study Concept | Rm. Rich Vandekoppel<br>Martin Marietta |
| 1420 | Martin Integrated Technology | Rm. Rich Vandekoppel<br>Martin Marietta |
| **1550** | **BREAK** | |
| 1545 | SDS Launch Study | Col Roger Colgrove, AC |
| 1630 | Executive Session - Informal Discussion | |
| 1730 | Depart for Airport | |

Dale E. Moore

Dale E. Moore
Executive Secretary

Attachment A-1

September 14, 1989

**Minutes for the Defense Science Board Task Force Meeting
on the
Brilliant Pebbles Interceptor Concept
22-23 August 1989**

The fifth regular meeting of the Defense Science Board (DSB) Brilliant Pebbles Task Force was held at the W. J. Schafer Associates, Arlington, VA from 0900 on 22 August to 1500 on 23 August. Both the agenda and a list of attendees are contained in Attachment A.

On 22 August 1989 the Task Force was presented a Conflict of Interest Review by Mr. Ream, followed by a series of status briefings on the Brilliant Pebbles Interceptor Concept and issues related to it. A copy of the Standards of Conduct and the "Procurement Integrity" provisions of the Office of Federal Procurement Policy Act are contained in Attachment B and C. An introduction briefing was provided by LTC Seiberling. The Task Force was then briefed by Maj. Schlichting on Strategic Defense Requirements/Operations, by Dr. Weiner on Sensor Assessment, by LtCol Skvarenina on BP Architecture Analysis and Space-Based Architecture Study, by GEN Levan (Ret.) on Countermeasures Assessment, and by Dr. Wood on Brilliant Pebbles Update. In an Executive Session issues raised by these briefings were discussed.

On 23 August 1989 the Task Force was briefed by Dr. Scott on Brilliant Pebbles Update, by Mr. Rothrock and Dr. Sepucha on BP Technical Assessments, by MAJ Apo on BP Experiments, by Col Simmons on SBI Acquisition Strategy and ended with an Executive Session to wrap up the two-day meeting.

Robert R. Everett
Chairman

## ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

22 AUGUST 1989

**DSB Task Force Members**
Mr. Robert R. Everett
Dr. Solomon J. Buchsbaum
Dr. John Foster , Jr.
Dr. George Heilmeier
Dr. Robert J. Hermann
Mr. Walter E. Morrow, Jr.

**Observers**
Mr. Fred S. Hoffman
Mr. Theodore Jarvis, Jr.

**OSD**
Dr. Thomas J. Welch, USD (A)/DSB
LtCol David L. Beadner, USAF, USD (A)/DSB
Mr. Dale Moore, OUSD (A)/DS
Dr. George R. Schneiter, OUSD (A)/DS
Dr. Bruce J. Pierce, OUSD (A)/DS
CAPT Marvin J. Weniger, USN, JCS
Mr. John Ruble, PA&E
Dr. David A. Lee, PA&E
Capt. William K. Stockman, USAF, PA&E
Mr. Dave Ream, GC

**BDM International, Inc.**
Mrs. E. Quatrevaux

**Briefers**
LTC Walter Seiberling, USA, SDIO
Lt Col Timothy Skvarenina, USAF, SDIO
Maj Jim Schlichting, USAF, USSPACECOM
Gen C. J. Levan (Ret.), ARES Corporation
Dr. Stephen Weiner, MIT/LL
Dr. Lowell Wood, LLNL
Dr. Walter Scott, LLNL
Dr. Robert Sepucha, W. J. Schafer Associates
Mr. Sean Collins, W. J. Schafer Associates
Mr. R. L. Rothrock, BDM International, Inc.

**Task Members Not in Attendance**
Mr. Vincent Cook
Dr. John M. Deutch
Gen Russell E. Dougherty (Ret.)
Mr. Daniel Fink
Dr. Edward A. Frieman
Dr. William J. Perry

# ATTENDEES AT THE DEFENSE SCIENCE BOARD TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT

23 AUGUST 1989

**DSB Task Force Members**
Mr. Robert R. Everett
Dr. Solomon J. Buchsbaum
Dr. Robert J. Hermann
Mr. Walter E. Morrow, Jr.

**Observers**
Mr. Fred S. Hoffman
Mr. Theodore Jarvis, Jr.

**OSD**

LtCol David L. Beadner, USAF, USD (A)/DSB
Mr. Dale Moore, OUSD (A)/DS

CAPT Marvin J. Weniger, USN, JCS
Mr. John Ruble, PA&E
Dr. David A. Lee, PA&E
Capt. William K. Stockman, USAF, PA&E

**BDM International, Inc.**
Mrs. E. Quatrevaux

**Briefers**
LTC Walter Seiberling, USA, SDIO
Lt Col Timothy Skvarenina, USAF, SDIO
Maj Jim Schlichting, USAF, USSPACECOM
Gen C. J. Levan (Ret.), ARES Corporation
Dr. Stephen Weiner, MIT/LL
Dr. Lowell Wood, LLNL
Dr. Walter Scott, LLNL
Dr. Robert Sepucha, W. J. Schafer Associates
Mr. Sean Collins, W. J. Schafer Associates
Mr. R. L. Rothrock, BDM International, Inc.

**Task Members Not in Attendance**
Mr. Vincent Cook
Dr. John M. Deutch
Gen Russell E. Dougherty (Ret.)
Mr. Daniel Fink
Dr. John S. Foster, Jr.
Dr. Edward A. Frieman
Dr. George Heilmeier
Dr. William J. Perry

**AGENDA FOR DSB TASK FORCE MEETING ON BRILLIANT PEBBLES INTERCEPTOR CONCEPT**

**22 - 23 AUGUST 1989**
**W.J. SCHAFER ASSOCIATES**
**ARLINGTON, VA**

22 August

| | | |
|---|---|---|
| 0900 | Conflict of Interest Review | General Counsel |
| 0915 | Introduction | LTC Seiberling, SDIO |
| 0945 | Strategic Defense Requirements/ Operations | Maj Schlichting, USSPACECOM |
| **1045** | **BREAK** | |
| 1100 | Sensor Assessment | Dr. Weiner, MIT/LL |
| **1200** | **Working Lunch** | |
| 1230 | Brilliant Pebbles Architecture Analysis | Lt Col Skvarenina, SDIO |
| 1330 | Space - Based Architecture Study | Lt Col Skvarenina, SDIO |
| 1445 | Countermeasures Assessment | Gen (Ret.) C. J. Levan, ARES |
| 1545 | Brilliant Pebbles Update | Dr. Wood, LLNL |
| **1645** | **Executive Session** | |

23 August

| | | |
|---|---|---|
| 0830 | Brilliant Pebbles Update | Dr. Scott, LLNL |
| 0930 | Brilliant Pebbles Technical Assessments | Mr. Rothrock, BDM |
| **1030** | **BREAK** | Dr. Sepucha, WJSA |
| 1045 | Brilliant Pebbles Experiments | MAJ Apo, SDIO |
| **1145** | **Working Lunch** | |
| 1215 | SBI Acquisition Strategy | Col Simmons, AF/SSD |
| **1300** | **Executive Session** | |

Dale E. Moore
Dale E. Moore
Executive Secretary

THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

RESEARCH AND
ENGINEERING

(6)

23 JUN 1981

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: DSB Summer Study: Strategic Defense

You are requested to undertake a Summer Study on Strategic Defense, addressing U.S. and Soviet capabilities to defend their respective homelands and their allies against strategic attack.

The political and technical environments relating to the defense of the U.S. and its allies have undergone significant change in the past few years. These changes include:

- o A marked increase in the number and capability of re-entry vehicles in the Soviet offensive force, and their ability to fractionate their SS-18s.
- o Significant advances in target acquisition, tracking, and discrimination, as well as in information processing, and the ability to net their radar defenses.
- o The advent of the modern long-range cruise missile, and the existence or potential existence of cruise missile defenses.
- o Production of the Soviet Backfire bomber, and its utilization.
- o The growing importance of U.S. and Soviet space systems.
- o Soviet development of an ASAT capability.
- o Proposed basing modes for M-X which allow a small number of ABM interceptors to provide significant leverage.
- o Growing proliferation of nuclear weapons.

As a result, a re-examination of strategic defense policy, missions, priorities, posture, and capabilities is needed. This review should include defense against ballistic missiles (IRBM, ICBM, and SLBM), air-breathing vehicles (cruise missiles and bombers), and space systems.

Specific findings and recommendations for U.S. strategic defense policy and programs are needed in answer to the following questions:

1. What is the present and projected capability of Soviet strategic defensive systems? What are the combined effects of the several elements (civil, air, and ABM) of Soviet defense and the several layers (barrier, overflight, and terminal) of air defenses. Are there vulnerabilities that the U.S. could reliably count on?

2. What should be the role of U.S. strategic defense capability vis-a-vis offensive retaliation as a deterrent to nuclear war? Can the U.S. meet the objectives should deterrence fail if there is an imbalance in defenses?

3. What should be the mission priorities for a strategic defense system? What should we try to consider defending: NCA, $C^3I$ assets, ICBM forces, bombers, urban-industrial targets, population?

4. What is the present and projected state of the art in U.S. strategic defensive systems? What sort of raids can be defended against at reasonable cost?

5. Ballistic missile defense. What is the history, what are the alternatives, and what BMD program(s) should be pursued, at what level of funding? How do these recommendations change if M-X is deployed in a multiple aim point basing mode?

6. Bomber defense. What is the history, alternatives, and recommended program?

7. Cruise missile defense. What alternatives are available? What programs should be pursued?

8. ASAT. What are the alternatives and recommended programs? Should the U.S. allow uninhibited Soviet reconnaissance in the aftermath of an attack?

9. What should the U.S. position be on the ABM treaty? What are the arms control implications of the alternative programs discussed above?

10. What contribution to strategic defense do $C^3I$ systems make? What improvements or additions are needed to improve their survivability, endurance, and reconstitution?

11. Are there synergistic effects between civil, air and ABM defenses and what, for the U.S., is the best combination of these?

12. What nuclear release procedures are dictated by the strategic defense alternatives recommended?

13. Are the basic technologies needed for future strategic defense systems being pursued with appropriate priority and resources? If not, what changes should be made?

This Summer Study topic will be sponsored by Dr. James P. Wade, Jr., Principal Deputy Under Secretary of Defense for Research and Engineering. Mr. Thomas C. Reed has agreed to serve as Chairman and Mr. Verne L. Lynn, Director, Defensive Systems, OUSDRE/S&TNF, will serve as Executive Secretary.

R. D. DeLauer

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

28 October 1981

MEMORANDUM TO MEMBERS, 1981 DEFENSE SCIENCE BOARD SUMMER STUDY ON STRATEGIC DEFENSE

SUBJECT: Final Report

The final report of the DSB Summer Study on Strategic Defense has been prepared in two volumes. Volume 1 is a summary written essentially by Tom Reed and is ready for printing; Volume 2 is the collection of chapters written by the subpanels and is in the final stages of review. When the documents are approved for distribution, those with the proper storage facilities will receive a copy of Volume 1 and those portions of Volume 2 pertaining to their subpanel, unless there is a requirement for more.

Let me take this opportunity to reiterate Tom Reed's statement of appreciation for the outstanding job you did for the Panel this summer. I trust that you will find the final report to be a worthwhile product of our labors.

Larry

Verne L. Lynn
Executive Secretary
Summer Study on Strategic Defense

STRATEGIC DEFENSE PANEL

Revised Schedule for
Friday, 7 August

| | | |
|---|---|---|
| 0830-1130 | Resulting Policies. ABM and Arms Control, Nuclear Release, and LUA | (Welch) |
| 1145-1300 | Working lunch. Identification of contentious areas. | (Gaylor) |
| 1300-1500 | Second Iteration of Conclusions and Recommendations | |
| 1300-1320 | BMD | (Walsh) |
| 1320-1340 | Air Defense | (Dougherty) |
| 1340-1400 | ASAT | (Fletcher) |
| 1400-1415 | $C^3I$ | (Everett) |
| 1415-1430 | Technology | (Allen) |
| 1430-1500 | Policy | (Welch) |
| 1500-1630 | Systems Integration | (Toomay) |
| 1630-1700 | Administration & Logistics Next week's schedule | (Reed/Lynn) |

7 August 1981

# STRATEGIC DEFENSE PANEL

## SECOND WEEK SCHEDULE
## (10-14 August)

MONDAY, 10 August

| | | | | |
|---|---|---|---|---|
| Prior to 0830 | Near final draft of report to typing* | | | |
| 0830-1100 | Iteration of Integration Panel report and discussion | | | (Toomay) |
| 1100-1200 | Panel work** (Rooms assigned 1100-1400 as indicated below) | | | |
| | Reed meetings with Panel Chairmen or panels to comment on report draft (Room 3038) | | | |
| 1100-1115 | BMD | Ch. 10 | (Room 2071) | |
| 1115-1130 | AD | Ch. 9 | (Room 2071A) | |
| 1130-1145 | $C^3I$ | Ch. 12 | (Room 2073) | |
| 1145-1200 | ASAT | Ch. 11 | (Room 2065) | |
| 1200-1300 | LUNCH | | | |
| 1300-1400 | Panel work continuing | | | |
| | Continue Reed meetings with panels to comment on report draft | | | |
| 1300-1330 | Policy | Ch. 8&13 | (Auditorium) | |
| 1330-1345 | Sov. Capa. | Ch. 7 | (Vault) | |
| 1345-1400 | Technology | Ch. 14 | (Room 3032) | |
| 1400-1630 | Evaluation of proposed integrated plan and program by Policy Subpanel - Chptrs 16 and 17 | | | (Welch) |
| 1630-1700 | Administration and Logistics | | | |

*Support staff provide to Exec Scty, short handwritten summary for each panel of substance of changes in Monday version compared with the Friday issue in notebooks.

**Generate 2 page summary of panel report and 2 chart summary of panel conclusions and recommendations, both as aid in preparing overall exec summary section and final briefing. Support staff will have drafted first cut at these by Monday morning.

TUESDAY, 11 August

| | | |
|---|---|---|
| 0830-1200 | Panels rewrite chapters based on Monday discussions. Prepare afternoon presentations | |
| 1200-1300 | LUNCH | |
| 1300-1700 | Panel Chairmen summarize conclusions and recommendations to entire group (third iteration) | |
| 1300-1325 | BMD | (Walsh) |
| 1325-1350 | AD | (Dougherty) |
| 1350-1415 | ASAT | (Fletcher) |
| 1415-1440 | $C^3I$ | (Everett) |
| 1440-1500 | Technology | (Allen) |
| 1500-1600 | Integration | (Toomay) |
| 1600-1700 | Policy | (Welch) |
| 1700-1800 | Reed summarize overall for Augustine with Flax and Lynn | |

WEDNESDAY, 12 August

| | |
|---|---|
| 0830-1200 | Reed dry run of final briefing and discussion of final positions for all members |
| 1200-1300 | LUNCH |
| 1300-1700 | Authors tidy-up chapters |
| | One hour meeting for those interested in Chapter 6 on History |
| 1500-1600 | Reed dry run to DSB management with Flax and Lynn |

THURSDAY, 13 August

Vugraphs Finalized

Contingency, repairs, etc.

Typing inputs close at noon if possible

FRIDAY, 14 August

| | |
|---|---|
| 0830-1230 | Wrap-up for visitors (all members invited) |
| 1400 | Mil Air departs Lindberg Field |

Defense Science Board - 1981 Summer Study
Air Defense Panel
Pentagon, Room No. 3D1034 - 0900-1700
21 July 1981

| | |
|---|---|
| 0900 | Preliminary Remarks - Gen Dougherty |
| 0910 | Boeing Approach - Thomas Kornell |
| 0950 | Break |
| 1000 | Lockheed Approach - Robert Moore |
| 1040 | DARPA Approach - Basil Papadales |
| 1120 | USAF Candidates - Col Russ Mannex (AF/RDSD) |
| 1145 | Lunch |
| 1400 | BIM - Dr. Sherman Karp (DARPA) |
| 1420 | Near Term Approaches/Creative Thoughts - Verne Lynn (OUSDR&E) and John Darrah (NORAD J-5) |
| 1530 | Break |
| 1540 | Executive Session - Gen Dougherty |

1 July 1981

SUB-PANEL TOPICS/MEETINGS**

DSB Strategic Defense Summer Study

| Sub-Panel | Chairperson | Date | Place |
|---|---|---|---|
| Air Defense | Gen. Dougherty | 7 July* | Pentagon; Rm. 4D330 in A.M. & Rm 3E267 in P.M. |
| Policy & Civil Defense | MGen Welch | 15 July# | Pentagon; Rm 4E334 |
| BMD | Mr. Walsh | 16 July* | System Planning Corporation<br>15 Wilson Boulevard<br>Arlington, Virginia |
| Soviet Capabilities | Dr. Flax | 20 July* | Institute for Defense Analyses<br>400 Army-Navy Drive<br>Arlington, Virginia |
| ASAT & Technology | Dr. Fletcher | 16 July#<br>29-30 July* | Space Division, Los Angeles<br>The Pentagon |
| $C^3I$ | Mr. Everett | 17-18 July# | Aerospace Corporation,<br>Los Angeles, California<br>(Dr. Rechtin's Office)<br>From 1:00 P.M. on 17 July<br>TO 12:00 P.M. on 18 July |

** For updates and additional information on above meetings: Prime source is Chairperson's office, Alternate source is Panel Military Assistants (Lt. Col. Yarnall or Lt. Col. Atkins).

* Dr. Flax will attend meeting.

\# Mr. Reed will attend meeting.

1 July 1981

ASSIGNMENTS

DSB Strategic Defense Summer Study

- Soviet Capabilities

  Dr. Flax (Chair)
  Mr. Mann
  Mr. Raber
  Mr. Weiser

- Policy, Civil Defense

  MGen. Welch (Chair)
  Dr. May (2nd week)
  Mr. Nitze (2 days)
  Dr. Rice (Part time)
  Dr. Rosenbaum
  Dr. Schneider (1st week)
  MGen. Toomay
  Dr. Van Cleave
  Mrs. Wohlstetter (Part time)
  Mr. Pittman (2 days)
  Adm. Russell
  USDP (TBD)

- BMD

  Mr. Walsh (Chair)
  Mr. Davidson
  Dr. Easley
  Mr. Fink (1-2 days)
  Mr. Freedman
  Mr. Fuhrman
  Dr. Gold
  Dr. Hartunian
  MGen. Tate
  Dr. Wagner
  Mr. Kupelian

- Air Defense

  Gen. Dougherty (Chair)
  Mr. Delaney
  BGen. Jacobson
  LGen. LeVan
  MGen. Brown

- ASAT & Technology

  Dr. Fletcher (Chair) (All but 10th)
  Mr. Boileau (2nd week)
  Mr. Lynn
  Dr. Rechtin*
  Dr. Sutherland
  Mr. Walquist

- C3I

  Mr. Everett (Chair)
  LGen. Dickinson (4-7 Aug)
  Dr. Rechtin*
  Mr. Reed

- Support

  LtCol Yarnall
  Mr. Winter
  LtCol Atkins

*Dual membership

1 July 1981

SUB-PANEL TOPICS/MEETINGS**

DSB Strategic Defense Summer Study

| Sub-Panel | Chairperson | Date | Place |
| --- | --- | --- | --- |
| Air Defense | Gen. Dougherty | 7 July* | Pentagon; Rm. 4D330 in A.M. & Rm 3E267 in P.M. |
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** For updates and additional information on above meetings: Prime source is Chairperson's office, Alternate source is Panel Military Assistants (Lt. Col. Yarnall or Lt. Col. Atkins).

* Dr. Flax will attend meeting.

# Mr. Reed will attend meeting.

DSB STRATEGIC DEFENSE SUMMER STUDY

AGENDA

IDA Building: Room 10A31 (Except vault sessions)

Wednesday, 24 June 1981

| | | |
|---|---|---|
| 0900 | Introduction — Chairman's time | T.K. Jones (DUSDRE/S&TNF) |
| 0915 | Policy and Army Control Considerations | MGen R.T. Boverie (OUSD/P) |
| 0930 | Summary of Ballistic Missile Threat | D. Osias (DIA) |
| 0945 | History & Overview of Current BMD Program | MGen G.D. Tate (BMDPM) |
| 1015 | Break — admin matters | |
| 1030 | Site Defense Results | C. Richardson (BMDO) |
| 1045 | Low Altitude Defense (LoAD) for MPS & Silo Defense | T. Perdue (BMDO) |
| 1145 | Overlay BMD System Concept | C. Richardson (BMDO) |
| 1215 | Working Lunch (Panel Members) | |
| 1245 | BMD Technology | J. Carlson (BMDATC) |
| 1345 | Other Terminal BMD | R. Easley (SPC) |
| 1400 | Break | |
| Vault Site 1415 | Soviet BMD* | R. Clinton (MIA) |
| 1515 | U.S. Response to Soviet ABM* | LCDR Hoffman (JSTPS)<br>LCDR Nofziger (JSTPS) |
| 1615 | Overview of U.S. Ballistic Missile Warning & Attack Assessment | Col W. Craig (AF/RDS) |
| 1630 | Discussion | |
| 1700 | Adjourn | |
| 1830 | Dinner at Metropolitan Club | |

* Vault (6th Floor, Room 6MC)

# DSB STRATEGIC DEFENSE SUMMER STUDY

## AGENDA

**Thursday, 25 June 1981**

| | | |
|---|---|---|
| 0900 | Summary of Soviet Bomber & Cruise Missile Threat* | LtCol April (DIA)<br>C.H. Tross (DIA) |
| 0930 | Overview of U.S. Air Defenses | Col Abbott (AF/XOXF) |
| 1015 | Overview of Soviet Air Defenses & Associated $C^3$ | P. Scop (DIA) |
| 1035 | Overview of U.S. Strategic $C^3$ | LtGen Hillman Dickinson (OJCS) |
| 1120 | Overview of Soviet Strategic $C^3$ (* with G) | W. Wheeler (DIA) |
| 1200 | Soviet and U.S. ASAT's | LtCol George Hess (AF/RDS) |

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| | | |
|---|---|---|
| 1245 | Working lunch and discussion (Panel Members) | |
| 1600 | Adjourn | |

* Vault (6th Floor, Room 6MC)

90278

file: Strategic Defense
TF

THE WHITE HOUSE

FOR OFFICIAL USE ONLY

WASHINGTON

March 25, 1983

NATIONAL SECURITY DECISION
DIRECTIVE NUMBER 85

## Eliminating The Threat From Ballistic Missiles (U)

It is my policy to take every opportunity to reduce world tensions and enhance stability. Our efforts to achieve significant reductions in strategic offensive forces and to eliminate LRINF land based missiles are one approach to that aim. However, it is my long range goal to go beyond this. I would like to decrease our reliance on the threat of retaliation by offensive nuclear weapons and to increase the contribution of defensive systems to our security and that of our allies. To begin to move us toward that goal, I have concluded that we should explore the possibility of using defensive capabilities to counter the threat posed by nuclear ballistic missiles. (U)

I direct the development of an intensive effort to define a long term research and development program aimed at an ultimate goal of eliminating the threat posed by nuclear ballistic missiles. These actions will be carried out in a manner consistent with our obligations under the ABM Treaty and recognizing the need for close consultations with our allies. (U)

In order to provide the necessary basis for this effort, I further direct a study be completed on a priority basis to assess the roles that ballistic missile defense could play in future security strategy of the United States and our allies. Among other items, the study will provide guidance necessary to develop research and development funding commitments for the FY 85 Departmental budgets and the accompanying Five-Year Defense Program (FYDP). (U)

The Assistant to the President for National Security Affairs is assigned the responsibility to formulate detailed instructions for implementing this NSDD including organization, assignment of responsibilities, and completion dates. (U)

Ronald Reagan

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(7)

# MINUTES OF THE MEETING OF THE DEFENSE SCIENCE BOARD/DEFENSE POLICY BOARD TASK FORCE ON BALLISTIC MISSILE DEFENSE

23-24 July 1991

The fourth meeting of the DSB/DPB Task Force on Ballistic Missile Defense was held on 23-24 July 1991. The meeting on 23 July was held at the Riverside Research Institute in Arlington, VA. The meeting on 24 July was held at the Strategic Defense Initiative Organization (SDIO), The Pentagon, Washington, DC. The purpose of these meetings was to consider ballistic missile defense technology, development status, consider foreign technology advancements, review recent Desert Storm experience, and review the status of SDIO Theater Missile Defense activities.

July 23, 1991

**Opening Remarks** - The meeting was opened by Mr. Hoffman who welcomed members and Government representatives to the fourth meeting of the task force. He invited members' questions or comments. He directed members' attention to the SDIO Report to Congress on TMD, dated 30 March 1991. Mr. Fink noted that tomorrow's presentation on Theater Missile Defense by Mr. Israel would be of particular interest. The agenda for the August meeting in San Diego, CA, was discussed.

**Sponsor's Comments** - Mr. Frank Kendall, OSD Director Tactical Warfare Programs, briefed the members on the results of the Joint Committee Review of the TBM Program held 10 July 1991. He highlighted issues he saw emerging as a result of that meeting.

**OSD Strategy and GPALS Arms Control** - Dr. J. D. Crouch, OSD/ISA, introduced Mr. Steve Cambone who discussed current policy, arms control, and congressional issues related to TMD. He reviewed for the members the results of a report prepared by USD(P) detailing the rationale for and capabilities needed to support a GPALs. The members discussed the assumptions and conclusions of the report. At the next meeting Mr. Cambone will present the results of an internal OSD study on ABM Treaty compliance issues related to TMD systems. Mr. Crouch detailed the Senate Missile Defense Act as well as other congressional positions for the members.

**Policy Issues** - Mr. Hoffman, Task Force Co-Chairman, presented an overview of key policy issues. He discussed long term issues resulting from the on-going changes in the defense postures of the United States and USSR and the growing danger from Third World threats. Shorter term issues involve Theater Defense and limited defense of the U. S. He placed these elements in the policy context for members' consideration.

**PATRIOT - Part II** - Major Bell, Army ODCSOPS, presented a briefing titled "PATRIOT Performance Assessment During Desert Storm." The briefing presents the validated assessment of PATRIOT effectiveness during the recent conflict. Data presented engagement results from both Israel and Saudi Arabia.

**Future Early Warning Systems** - Major Paul Stipe, SAF/AQS, presented a review of the Early Warning System which is intended to be a replacement for the current DSP. The briefing included operational capabilities, programmatics, and projected cost data. A performance comparison with DSP was also provided.

**Retrospective** - Dr. J. Braddock, BDM Corporation, presented a review of previous Defense Science Board studies on subject directly related to the Task Force's study: ATBM study, NATO Air Defense study, Artillery Counterfire study, and Technological Surprise study. He noted that lethality studies, in particular, had been proposed for further work. Dr. Braddock recommended a three-hour block of lethality briefing to be given to the group during the Summer Study.

**Desert Storm Strategic Mission** - Major Buck Rogers presented an overview of the Desert Storm Strategic Air Campaign. The briefing covered the following topics: Presidential objectives, planning the campaign, execution, lessons learned, and conclusion.

The first day's meeting concluded with an Executive Session. The meeting was adjourned at 1700 hours.

July 24, 1991
**Opening Remarks**

**Soviet ATBM Advancements** - Mr. Eric Edwards and Mr. Steven Williams presented a classified briefing titled "Soviet ATBM Advancements."

**Soviet Strategic $C^3$** - Mr. John Herris presented a classified briefing titled "Soviet Strategic $C^3$."

**Chinese Strategic $C^3$** - Mr. Mike Metcalf presented a classified briefing titled "Chinese Strategic $C^3$."

**TSD and Radiant Ivory** - Commander Nelson and Lieutenant J. Zwirner presented a classified briefing on TSD and Radiant Ivory.

**SDIO Red Team** - Mr. Dave Shore, Systems Planning Corporation, presented a review of SDIO Red Team activities. The overview covered all phases of the program which is evaluating countermeasures and responses.

**SDIO Theater Missile Defense Program** - Mr. Dave Israel, SDIO Assistant, Deputy Director Theater Missile Defense, presented a review of the TMD program addressing key acquisition and development issues relating to the objective of deploying a system by the mid-1990s.

The meeting ended with an Executive Session. The meeting was adjourned at 1700 hours.

Fred S. Hoffman
Co-chairman
Ballistic Missile Defense Task Force

Daniel J. Fink
Co-chairman
Ballistic Missile Defense Task Force

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

Tuesday, July 23, 1991

**ATTENDEE LIST**

| Name | Representing | Name | Representing |
|---|---|---|---|
| Bell, Austin | DA | Kendall, Frank | OSD |
| Beyster, Bob | Task Force Member | Kunsberg, P. | DoD |
| Bostrom, Carl O. | Task Force Member | Manning, Todd | SAF/AQS |
| Braddock, J. V. | Task Force Member | Masciola, Mario | RRI |
| Bunn, M. Elaine | OSD | Nosenchuck, D. M. | Task Force Member |
| Cambone, Steve | Task Force Gov Rep | Pappas, P. | Task Force Gov Rep |
| Castleberry, Paul | DNA | Pierce, Bruce | Task Force Gov Rep |
| Cattoi, R. L. | Task Force Member | Piotrowski, John | Task Force Member |
| Crouch, J. D. | OSD | Rogers, Mark B. | AF |
| Cummings, John | RRI | Russo, M. | SDIO |
| Delaney, W. | Task Force Member | Schneiter, George | Task Force Co-Sponsor |
| Dougherty, Russell E. | Task Force Member | Shallies, Kenneth | OPDUSD(P)S&R/CSO |
| Dunne, G. W. | Task Force Gov Rep | Sterbenz, Henry | Kaman |
| Fink, Dan | Task Force Co-Chair | Stipe, Paul | SAF/AQS |
| Gold, Sydell | Task Force Gov Rep | Toti, Bill | Task Force Gov Rep |
| Goure, D. | DSB Executive Secretary | Viilu, Andrus | Task Force Gov Rep |
| Graham, Wm. R. | Task Force Member | Weiss, S. | Task Force Member |
| Hoffman, Fred S. | Task Force Co-Chair | Whitehouse, E. P. | OUSD/A-DSB |
| Howard, W. E. | Task Force Gov Rep | Woolsey, James | Task Force Member |
| Ikle, F. | Task Force Member | Zeiberg, S. L. | Task Force Member |

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Strategic Defense Initiative Organization
The Pentagon
Washington, D. C. 20301

Wednesday, July 24, 1991

## ATTENDEE LIST

| Name | Representing | Name | Representing |
|---|---|---|---|
| Araki, Minoru | ~~Task Force Member~~ | Kendall, Frank | Task Force Co-Sponsor |
| Beyster, Bob | Task Force Member | Maney, Rhoi M. | |
| Bostrom, Carl | Task Force Member | Mann, Wesley | MSIC |
| Braddock, J. V. | Task Force Member | Montague, Dave | Task Force Member |
| Cattoi, Robert | Task Force Member | Pierce, Bruce | Task Force Gov Rep |
| Delaney, W. | Task Force Member | Piotrowski, John | Task Force Member |
| Dougherty, Russell E. | Task Force Member | Schneiter, George | Task Force Co-Sponsor |
| Dunne, G. W. | Task Force Gov Rep | Shallies, Kenneth | OPDUSD(P)S&R/CSO |
| Everett, Robert R. | Task Force Member | Toti, William | Task Force Gov Rep |
| Fink, Dan | Task Force Co-Chair | Vessey, John | Task Force Member |
| Fossier, Mike W. | Task Force Member | Viilu, Andrus | Task Force Gov Rep |
| Goering, Kent | Task Force Gov Rep | Weiss, S. | Task Force Member |
| Goure, D. | DSB Executive Secretary | Welch, Jasper | Task Force Member |
| Hoffman, Fred S. | Task Force Co-Chair | Whitehouse, E. | DSB Military Assistant |
| Howard, William | Task Force Gov Rep | Woolsey, James | Task Force Member |
| Ikle, F. | Task Force Member | Yoder, M. N. | |
| | | Zeiberg, S. L. | Task Force Member |

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209
23-24 July 1991

| *Tuesday, 23 July* | | *Morning Session* |
|---|---|---|
| 0815 | Registration | |
| 0830 | Opening Remarks | *Mr. D. Fink* |
| | Administrative Items | *Col E. Whitehouse*<br>*Mr. J. Cummings* |
| 0900 | Sponsor's Comments | *Mr. Frank Kendall* |
| 0930 | OSD Strategy & GPALS Arms Control | *Dr. J. D. Crouch*<br>*Ambassador Kunsberg* |
| 1100 | **Break** | |
| 1115 | DSB Retrospective | *Dr. Joseph Braddock* |
| 1215 | **Working Lunch** | |

| *Tuesday, 23 July* | | *Afternoon Session* |
|---|---|---|
| 1245 | PATRIOT - Part II | *Major A. Bell*<br>*ODCOPS/DAMO-FDE* |
| 1400 | **Break** | |
| 1415 | [Future] Early Warning Systems | *Major Paul Stipe*<br>*SAF/AQS* |
| 1515 | Desert Storm Strategic Mission | *MAJ Buck Rogers*<br>*SAF/LL* |
| 1615 | Executive Session | |

*Wednesday, 24 July* - Ambassador Cooper's Conference Room *Morning Session*

| | | |
|---|---|---|
| 0800 | Check-in | |
| 0815 | Administrative Announcements | |
| 0830 | Soviet ATBM Advancements | *Mr. Eric Edwards*<br>*Mr. Steven Williams*<br>*MSIC* |
| 0930 | Soviet Strategic $C^3$ | *Mr. John Herris*<br>*DIA* |
| 1030 | **Break** | |
| 1045 | Chinese Strategic $C^3$ | *Mr. Mike Metcalf*<br>*DIA* |
| 1130 | **Break** | |
| 1145 | **Lunch** (Executive Dining Room #3) | |

*Wednesday, 24 July* *Afternoon Session*

| | | |
|---|---|---|
| 1315 | TSD & Radiant Ivory | *CDR Nelson*<br>*SDC*<br>*LT J. Zwirner*<br>*TENCAP* |
| 1415 | SDIO TMD Program | *Mr. Dave Israel*<br>*SDIO*<br>*Mr. Clyde Bridewell*<br>*RRI* |
| 1515 | SDIO Red Team | *Mr. R. Kranc*<br>*Mr. D. Shore*<br>*SDIO* |
| 1615 | Executive Session | |

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# MINUTES OF
# THE MEETING OF THE
# DEFENSE SCIENCE BOARD/DEFENSE POLICY BOARD
# TASK FORCE ON
# BALLISTIC MISSILE DEFENSE
19-20 June 1991

The third meeting of the DSB/DPB Task Force on Ballistic Missile Defense was held at the Riverside Research Institute in Arlington, VA, on June 19 from 0830 to 1700 and on June 20 from 0830 to 1700. The purpose of the meeting was to consider ballistic missile defense development and deployment options, technology development status, technology policy controls, and the requirements process.

June 19, 1991
**Opening Remarks** - The meeting was opened by Mr. Fink who welcomed members and Government representatives to the third task force meeting. He then invited Mr. Delaney to present his views on ballistic missile defense issues, and an outline for the task force report. Mr. Hoffman drew the members' attention to a white paper entitled "The Future of Ballistic Missile Defenses and the ABM Treaty: A Basis for Consensus" by Senator John Warner (Rep. VA) et al., and an accompanying letter to the President.

**Joint Requirements Oversight Council (JROC) and the JROC Process** - LCOL Hyland, JCS, provided an overview of the JROC. He then presented a briefing on the Theater Missile Defense requirements document which will be made available to the members at the July meeting.

**Brilliant Pebbles Technical Overview - Part II** - Col Worrell, SDIO, completed the review of the Brilliant Pebbles Program, which he began at the second meeting of the Task Force. The briefing covered technical characteristics of the system as well as acquisition planning.

**SDC Concepts for Addressing the TBM Threat** - BGEN Jellett , Director, Joint Tactical Missile Defense Programs, presented a comprehensive review of the SDC program for addressing the TBM threat. He covered background requirements, threat, TMD concept elements, technical demonstrations, sensor consideration, and interceptors.

**ADI/BMD Interface Issues** - Dr. Bruce Pierce, Director, Defensive Systems, presented a briefing on the Air Defense Initiative. The briefing covered program goals, threat , mission, selected technology programs, and the program plan. The relationship between the Air Defense Initiative and the GPALS Program was discussed. Dr. Pierce concluded by discussing the ADI funding profile over the next several years.

**SDIO Family of Radars for PATRIOT and TMD** - LTC S. Peth, SDIO, presented a discussion on the history of the SDIO ground-based radar and a discussion of the application of the TMD-GBR to the PATRIOT system. An in-depth discussion took place of the rationale for solid-state technology and its productivity and availability for the TMD-GBR. Dr. Weiner, MIT/LL gave a technical presentation on the benefits of integrating TMD-GBR with PATRIOT.

The meeting ended with the Executive Session.

June 20, 1991

**Opening Remarks** - Mr. Fink opened the meeting with a discussion of briefings the Task Force would like to have presented to the Summer Study in San Diego. Agreement was reached on a tentative breakout of which presentations would be given in Washington and which in San Diego. Mr. Delaney discussed the technical areas for individual Task Force Members participation in support of the final report preparation.

**Evolutionary Road to GPALS** - Ms. Robin Bukelew, SDC, described the "Evolutionary Road to GPALS" study which is underway at SDC. She described a building-block approach to ballistic missile defense, which starts with a theater missile defense building block in the mid-1990's. The presentation covered growth from TMD to National PALS, to Global PALS, to National Defense and concluded that the evolutionary approach is practical.

**Missile & Advanced Technology Controls** - Mr. Sokolski presented an overview which covered missile technology trends - the evolution toward increasingly capable systems and components. He then discussed a strategy for coping with this trend. This discussion of strategy used efforts to control specific high performance Global Positioning System sets as an example of how the strategy is being implemented.

**GBI Technical Overview** - Mr. Jim Katechis, SDC, presented a technical and programmatic overview of the Ground Based Interceptor Program. The briefing including a review of critical issues - both at system level and at interceptor level. A video of the first successful system test, conducted in January 1991, was shown. The program chief engineer provided a technical discussion of seeker operation during the test.

**SDIO Architecture Integration Study, Part II** - As a follow-on to his presentation to the second meeting of the Task Force, Dr. Gold presented an introductory mission and threat discussion on the Architecture Integration Study. This was followed by status reports on the Evolving Architecture presented in two parts: Theater Missions by Mr. Dyer, and U. S. Defense and Global by Mr. Sepucha.

**JCS Planning Scenarios** - CDR A. Ferber, Joint Staff, presented an overview of JCS planning scenarios, how they are developed, and what is included. He concluded by noting that scenarios are intended to provide a common frame of reference and to support key planning documents. They are not, however, intended to supplant deliberate planning or directly size forces. Finally, he noted that the scenario development process is on-going.

The meeting ended with the Executive Session.

Fred S. Hoffman
Co-chairman
Ballistic Missile Defense Task Force

Daniel J. Fink
Co-chairman
Ballistic Missile Defense Task Force

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209
19-20 June 1991

AGENDA

| *Wednesday, June 19* | | *Morning Session* |
|---|---|---|
| 0815 | Registration | |
| 0830 | Administrative Items/Executive Session | *Mr. D. Fink*<br>*Mr. F. Hoffman* |
| 0930 | Joint Requirements and the JROC Process | *LCOL D. Hyland*<br>*JCS* |
| 1030 | **Break** | |
| 1115 | Brilliant Pebbles | *Col R. Worrell* |
| 1200 | **Working Lunch** | |

| *Wednesday, June 19* | | *Afternoon Session* |
|---|---|---|
| 1300 | SDC Concepts for Addressing TBM Threat | *BGEN J. M. Jellett*<br>*USASDC* |
| 1400 | ADI/BMD Interface Issues | *Dr. B. J. Pierce*<br>*DDR&E(S&TNF)* |
| 1500 | **Break** | |
| 1515 | SDIO Family of Radars for PATRIOT & TMD | *LTC Steve Peth* |
| 1615 | Executive Session | |
| 1700 | Adjourn | |

6/19/91 8:42 AM

| *Thursday, June 20* | | *Morning Session* |
|---|---|---|
| 0815 | Registration | |
| 0830 | Administrative Announcements/Chairman's Comments | *Mr. D. Fink*<br>*Mr. F. Hoffman* |
| 0900 | Evolutionary Road to GPALS | *Ms. R. Buckelew*<br>*Mr. Bob Wells*<br>*SDC* |
| 1000 | **Break** | |
| 1015 | Missile & Advanced Technology Controls | *Dr. Sokolski*<br>*ISA/NP* |
| 1115 | GBI Technical Overview | *Mr. J. Katechis*<br>*USASDC* |
| 1215 | **Working Lunch** | |

| *Thursday, June 20* | | *Afternoon Session* |
|---|---|---|
| 1300 | SDIO Architecture Integration Study - Part II | *Dr. T. Gold*<br>*Hicks and Associates* |
| 1430 | JCS Scenarios | *CDR A. Ferber*<br>*JCS* |
| 1530 | Executive Session | |
| 1700 | Adjourn | |

6/19/91 8:42 AM

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

Wednesday, June 19, 1991

**ATTENDEE LIST**

| Name | Representing | Name | Representing |
|---|---|---|---|
| Beyster, J. R. | Task Force Member | Jellett, J. M. | SDC (Briefer) |
| Blinn, R. | Teledyne Brown (Briefer) | Masciola, M. | RRI |
| Braddock, J. V. | Task Force Member | Minichiello, L. | Task Force Gov Rep |
| Bostrom, C. O. | Task Force Member | Montague, D. | Task Force Member |
| Cambone, S. | Task Force Gov Rep | Pappas, P. | Task Force Gov Rep |
| Cattoi, R. L. | Task Force Member | Peth, S. | SDIO (Briefer) |
| Cummings, J. W. | RRI | Pierce, B. | Task Force Gov Rep |
| Delaney, W. P. | Task Force Member | Piotrowski, J. L. | Task Force Member |
| Dunne, G. W. | DPB | Ross, D. | Task Force Gov Rep |
| Fink, D. | Task Force Co-Chair | Sepucha, D. C. | WJSA |
| Fossier, M. W. | Task Force Member | Shallies, K. H. | OPDUSD(P)S&R/CSO |
| Gerry, E. | Task Force Gov Rep | Tennant, S. | Task Force Member |
| Goering, K. T. | Task Force Gov Rep | Viilu, A. | Task Force Gov Rep |
| Gold, S. | Task Force Gov Rep | Weiner, S. | MIT/LL (Briefer) |
| Goure, D. | DSB Executive Secretary | Welch, J. | Task Force Member |
| Hoffman, F. S. | Task Force Co-Chair | Whitehouse, E. P. | OUSD/A-DSB |
| Hyland, D. | Joint Staff (Briefer) | Worrell, R. H. | SDIO (Briefer) |
| Ikle, F. | Task Force Member | | |

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

Thursday, June 20, 1991

## ATTENDEE LIST

| Name | Representing | Name | Representing |
|---|---|---|---|
| Beyster, J. R. | Task Force Member | Holmes, H. V. | USASDC (Attendee) |
| Braddock, J. V. | Task Force Member | Hoffman, F. S. | Task Force Co-Chair |
| Bostrom, C. O. | Task Force Member | Ikle, F. | Task Force Member |
| Buckelew, R. | USASDC (Briefer) | Katechis, J. C. | SDC (Briefer) |
| Cattoi, R. L. | Task Force Member | Knapp, G. | SDC (Briefer) |
| Cummings, J. W. | RRI | Mahoney, A. | WJSA (Attendee) |
| Delaney, W. P. | Task Force Member | Masciola, M. | RRI |
| Donalson, E. L. | Task Force Gov Rep | Montague, D. | Task Force Member |
| Dresen, T. | USASDC (Attendee) | Palmer, M. | SDIO/DA (Attendee) |
| Dunne, G. W. | DPB | Pappas, P. | Task Force Gov Rep |
| Dyer, J. L. | AIS (Briefer) | Piotrowski, J. L. | Task Force Member |
| Everett, R. R. | Task Force Member | Ross, D. | Task Force Gov Rep |
| Fink, D. | Task Force Co-Chair | Sepucha, D. C. | WJSA (Briefer) |
| Fossier, M. W. | Task Force Member | Shallies, K. H. | OPDUSD(P)S&R/CSO |
| Gerry, E. | Task Force Gov Rep | Sokolski, H. | OSD (Briefer) |
| Goering, K. T. | Task Force Gov Rep | Tennant, S. | Task Force Member |
| Gold, S. | Task Force Gov Rep | Viilu, A. | Task Force Gov Rep |
| Gold, T. S. | AIS (Briefer) | Welch, J. | Task Force Member |
| Goure, D. | DSB Executive Secretary | Wells, R. V. | CRC (Briefer) |
| Henrickson, W. L. | LMSCC (Briefer) | Whitehouse, E. P. | OUSD/A-DSB |

92-2

# MINUTES OF
# THE MEETING OF THE
# DEFENSE SCIENCE BOARD/DEFENSE POLICY BOARD
# TASK FORCE ON
# BALLISTIC MISSILE DEFENSE
30-31 May 1991

The second meeting of the DSB/DPB Task Force on Ballistic Missile Defense was held at the Riverside Research Institute in Arlington, VA on May 30 from 0830 to 1700 and on May 31 from 0800 to 1700. The purpose was to consider Theater Ballistic Missile Defense recommendations for development and deployment options, the technology underpinning, ABM Treaty implications, and other policy-related issues.

30 May 1991
**Opening Remarks**

Mr. Daniel J. Fink, Task Force Co-Chairman, opened the meeting with Administrative Items, Introduction of New Task Force Members and New Government Representatives. The Task Force Members discussed threat definition and treaty compliance issues.

**Brilliant Pebbles Technical Overview** - Col Roland Worrell, SDIO, presented the Brilliant Pebbles Technical Overview. He covered operational concepts, relationships to GPALS, program schedule and treaty compliance. The Task Force discussed issues related to these subjects. The Executive Secretary will schedule Col Worrell to return and continue the discussion.

**E$^2$I.** - Mr. Allen Sherer, E$^2$I Project Manager from USASDC HEDI Project Office, described the history and development of the E$^2$I program. Members discussed issues related to the projected capabilities of the E$^2$I missile system.

**Navy SDI** - CAPT Dick Childers and CMDR Groenig of the Navy SDI Office briefed that status of ongoing Navy SDI study projects. CMDR Groenig, Navy PMS 400, described the Aegis Weapon System and its potential for TMD application. Members' discussion focused on issues related to these subjects.

**Offense-Defense Integration Concepts.** - Mr. Greg Shulte from OSD/ISP Strategic Forces Policy Office presented Offense-Defense Integration Concepts. He covered implications at strategic and theater levels and for both offensive and defensive forces. Members discussed issues related to these subjects, as well as implications for command and control.

**Compliance Issues.**- Mr. Lee Minichiello, OUSD/A discussed ABM Treaty Compliance Issues. His briefing entitled Theater/Tactical Ballistic Missile Defense covered the USD(A) role in DoD treaty compliance authority, the USD(A) internal organizational structure, process and policy, and a discussion of compliance issues. Mr. Minichiello concluded by discussing his view of the process to be followed in obtaining future Theater Missile Defense certifications.

**T-PALS Study Overview** - Mr. Troy Crites, POET reviewed the T-PALS Study Overview which was conducted in the Fall of 1990. The study presented a series of alternatives for developing an effective Theater Missile Defense system.

The meeting ended with the Executive Session.

31 May 1991
**SDIO Architecture Integration Study (AIS)** - Dr. Ted Gold, Hicks And Associates, Inc., and Mr. Wayne Winton of W.J. Schafer provided an overview of the on-going AIS. The focus of the study, planned to last eight months, is active ballistic missile defense. The study will evaluate: Protection Against Limited Strikes, Mission Expansion Potential, Geopolitical/Strategic Factors, Cost and Schedule Alternatives, and Compatibility with Military Strategy.

**GPALS and the Allies** - Dr. David Martin, SDIO, reviewed GPALS and the Allies. Dr. Martin presented an overview of the current SDIO activities involving Allies. He reviewed the Allied view of the GPALS program, architecture initiatives, technical/research programs, and other cooperative efforts.

**Future Early Warning System Overview** - Major Paul Stipe (SAF/AQS) - Postponed.

**Air Force TMD Analysis** - LtCol Joe Rouge, (USAF/SSD) reviewed current Air Force Theater Missile Defense activities and plans for the near term. He discussed Air Force actions underway in the areas of active defense, passive defense and countermeasures.

**Brilliant Eyes Technical Overview.** - Mr. Steve Kinaman, GRC, conducted the Technical Overview. He covered the Brilliant Eyes operational concept, technical description and acquisition plan.

**Lethality Program Overview.** - LtCol Charles Martin, SDIO, conducted the overview. The presentation included a discussion of both strategic and theater kinetic energy weapon lethality as well as a summary of lethality requirements for chemical weapons. The board requested and received an evaluation of the adequacy of funding for lethality studies.

The meeting ended with the Executive Session

Fred S. Hoffman
Co-chairman
Ballistic Missile Defense Task Force

Daniel J. Fink
Co-chairman
Ballistic Missile Defense Task Force

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

Wednesday, MAY 30, ~~June 19,~~ 1991

## ATTENDEE LIST

| Name | Representing | Name | Representing |
|---|---|---|---|
| Beyster, J. R. | Task Force Member | Jellett, J. M. | SDC (Briefer) |
| Blinn, R. | Teledyne Brown (Briefer) | Masciola, M. | RRI |
| Braddock, J. V. | Task Force Member | Minichiello, L. | Task Force Gov Rep |
| Bostrom, C. O. | Task Force Member | Montague, D. | Task Force Member |
| Cambone, S. | Task Force Gov Rep | Pappas, P. | Task Force Gov Rep |
| Cattoi, R. L. | Task Force Member | Peth, S. | SDIO (Briefer) |
| Cummings, J. W. | RRI | Pierce, B. | Task Force Gov Rep |
| Delaney, W. P. | Task Force Member | Piotrowski, J. L. | Task Force Member |
| Dunne, G. W. | DPB | Ross, D. | Task Force Gov Rep |
| Fink, D. | Task Force Co-Chair | Sepucha, D. C. | WJSA |
| Fossier, M. W. | Task Force Member | Shallies, K. H. | OPDUSD(P)S&R/CSO |
| Gerry, E. | Task Force Gov Rep | Tennant, S. | Task Force Member |
| Goering, K. T. | Task Force Gov Rep | Viilu, A. | Task Force Gov Rep |
| Gold, S. | Task Force Gov Rep | Weiner, S. | MIT/LL (Briefer) |
| Goure, D. | DSB Executive Secretary | Welch, J. | Task Force Member |
| Hoffman, F. S. | Task Force Co-Chair | Whitehouse, E. P. | OUSD/A-DSB |
| Hyland, D. | Joint Staff (Briefer) | Worrell, R. H. | SDIO (Briefer) |
| Ikle, F. | Task Force Member | | |

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

MAY 31
Wednesday, ~~June 19~~, 1991

## ATTENDEE LIST

| Name | Representing | Name | Representing |
|---|---|---|---|
| Beyster, J. R. | Task Force Member | Holmes, H. V. | USASDC (Attendee) |
| Braddock, J. V. | Task Force Member | Hoffman, F. S. | Task Force Co-Chair |
| Bostrom, C. O. | Task Force Member | Ikle, F. | Task Force Member |
| Buckelew, R. | USASDC (Briefer) | Katechis, J. C. | SDC (Briefer) |
| Cattoi, R. L. | Task Force Member | Knapp, G. | SDC (Briefer) |
| Cummings, J. W. | RRI | Mahoney, A. | WJSA (Attendee) |
| Delaney, W. P. | Task Force Member | Masciola, M. | RRI |
| Donalson, E. L. | Task Force Gov Rep | Montague, D. | Task Force Member |
| Dresen, T. | USASDC (Attendee) | Palmer, M. | SDIO/DA (Attendee) |
| Dunne, G. W. | DPB | Pappas, P. | Task Force Gov Rep |
| Dyer, J. L. | AIS (Briefer) | Piotrowski, J. L. | Task Force Member |
| Everett, R. R. | Task Force Member | Ross, D. | Task Force Gov Rep |
| Fink, D. | Task Force Co-Chair | Sepucha, D. C. | WJSA (Briefer) |
| Fossier, M. W. | Task Force Member | Shallies, K. H. | OPDUSD(P)S&R/CSO |
| Gerry, E. | Task Force Gov Rep | Sokolski, H. | OSD (Briefer) |
| Goering, K. T. | Task Force Gov Rep | Tennant, S. | Task Force Member |
| Gold, S. | Task Force Gov Rep | Viilu, A. | Task Force Gov Rep |
| Gold, T. S. | AIS (Briefer) | Welch, J. | Task Force Member |
| Goure, D. | DSB Executive Secretary | Wells, R. V. | CRC (Briefer) |
| Henrickson, W. L. | LMSCC (Briefer) | Whitehouse, E. P. | OUSD/A-DSB |

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209
30-31 May 1991

## AGENDA

| *Thursday, May 30* | | *Morning Session* |
|---|---|---|
| 0830 | Registration | |
| 0900 | Welcoming Remarks, Administrative Items, Introduction of New Task Force Members and New Government Representatives, Executive Session | *Mr. Daniel J. Fink*<br>*Mr. Fred S. Hoffman* |
| 0915 | Brilliant Pebbles Technical Overview | *Col Roland Worrell*<br>*LtCol Roy Aydelotte*<br>*SDIO* |
| 1015 | Break | |
| 1030 | $E^2I$ | *Mr. Alan Sherer*<br>*SDC*<br>*Mr. Charles Kelley*<br>*Coleman Research Corp.* |
| 1130 | Navy SDI | *CAPT Richard Childers*<br>*Mr. Steve Bravy*<br>*Navy SDI*<br>*CDR Stan Groenig*<br>*PMS 400* |
| 1200 | **Working Lunch** | |

| *Thursday, May 30* | | *Afternoon Session* |
|---|---|---|
| 1300 | Offense-Defense Integration Concepts | *Mr. Greg Shulte*<br>*(ISP/NF & ACP)* |
| 1400 | Compliance Issues | *Mr. Lee Minichiello*<br>*(OUSD/A)* |
| 1500 | **Break** | |
| 1515 | T-PALS Study Overview | *Mr. Troy Crites*<br>*(POET)* |
| 1615 | Executive Session | |
| 1700 | Adjourn | |

6/3/91 9:02 AM

## *Friday, May 31* — *Morning Session*

| | | |
|---|---|---|
| 0800 | Administrative Announcements | |
| 0810 | SDIO Architecture Integration Study | *Dr. Ted Gold*<br>*Hicks And Associates, Inc.*<br>*Dr. Robert Sepucha*<br>*W. J. Schafer* |
| 1000 | **Break** | |
| 1015 | GPALS and the Allies | *Dr. David Martin*<br>*SDIO* |
| 1100 | Air Force TMD Analysis | *LtCol Joseph Rouge*<br>*(USAF/SSD)* |
| 1215 | **Working Lunch**<br>Information on Summer Study | *Mr. Ron Sliger*<br>*SAIC* |

## *Friday, May 31* — *Afternoon Session*

| | | |
|---|---|---|
| 1300 | Brilliant Eyes Technical Overview | *Mr. Steve Kinaman*<br>*GFC* |
| 1400 | Lethality Program Overview | *LtCol Charles Martin*<br>*SDIO* |
| 1500 | **Break** | |
| 1515 | Future Early Warning System Overview | *Major Danny Wilhelm*<br>*LtCol John O'Connor*<br>*(SAF/AQS)* |
| 1600 | Executive Session | |
| 1700 | Adjourn | |

92-2

# MINUTES OF
# THE MEETING OF THE
# DEFENSE SCIENCE BOARD/DEFENSE POLICY BOARD
# TASK FORCE ON
# BALLISTIC MISSILE DEFENSE

23-24 APRIL 1991

The first meeting of the DSB/DPB Task Force on Ballistic Missile Defense was held at the Riverside Research Institute in Arlington, VA on April 23 from 0905 to 1730 and on April 24 from 0845 to 1745. The purpose was to consider Theater Ballistic Missile Defense recommendations for development and deployment options, the technology underpinning, ABM Treaty implications, and other policy-related issues.

23 April 1991
**Opening Remarks**

Mr. Daniel J. Fink, Task Force Co-Chairman, opened the meeting and discussed key issues and agenda items, and the members discussed the study Terms of Reference (TOR). Mr. Calvin Vos, Attorney Advisor from the Standards of Conduct Office then briefed the Task Force on conflict-of-interest laws.

**ABM Treaty Issues** - Mr. Benson Adams, Deputy Commissioner of the Standing Consultative Commission, briefed status of arms control negotiations with the USSR.

**SDIO Theater Missile Defense Program** - COL Harold Richardson, SDIO Associate Director for Theater Missile Defense, reviewed the 1991 congressional direction to accelerate and centrally manage TMD research. He described how DoD and SDIO are organized to meet their management responsibilities and explained the FY 92 funding plans for SDIO TMD Programs. Implications for the early fielding of TMD systems were noted.

**GPALS System Architecture and SDI Program Plan** - Dr. Edward Gerry, SDIO System Architect, reviewed the President's Jan 1991 direction to refocus SDI toward protection from limited ballistic missile strikes. Possible GPALS system acquisition costs and BMD budget evolution was discussed. The Task Force members agreed to hear a briefing on the ongoing SDIO Architecture Integration Study. The Task Force Executive Secretary will schedule this briefing.

**Extended Range Interceptor (ERINT-1) Description and Program Plans** - Mr. Joe Butler, ERINT-1 Program Manager, described the ERINT-1 program. Task Force members discussed lethality and kill assessment of complex warheads.

**PATRIOT Description and Lessons Learned from Operation Desert Storm** - Mr. Gene Preston, PATRIOT Project Office, provided a system overview and description of PATRIOT. Mr. Preston reviewed results of PATRIOT performance against SCUD during Operation Desert Storm. The Executive Secretary will schedule a follow-up briefing on PATRIOT performance at a future meeting. Mr. Sid Gaddy, also of PATRIOT Program Office, described the PATRIOT Growth Program.

**Data Derived from Space-Based Sensors** - Colonel Frederick Herre, Director of Missile Warning at USSPACECOM described the USSPACECOM support to Operation Desert Storm. Task Force members discussed issues related to the lessons learned from the recent Gulf war.

24 April 1991

**Soviet Strategic Force Modernization** - Mr. Lawrence Gershwin, National Intelligence Officer for Soviet Strategic Programs, provided information on Soviet Strategic Force Modernization and nuclear weapons command and control. Dr. Peter Pappas recommended another briefing that might provide additional insight. The Executive Secretary will schedule this briefing.

**Global Proliferation of Ballistic Missiles** - [redacted] CIA, described the expansion of ballistic missile technology worldwide. The Task Force discussed issues related to proliferation. (b)(3):50 USC §403(g) Section 6

**Current TMD Program Plans and Descriptions** - Mr. Paul Lynch, Program Manager for Theater High Altitude Area Defense (THAAD), briefed the program objectives. Task Force members discussed program schedule and overall acquisition strategy. Major Logan Cox, Ground Based Radar-Theater Missile Defense (GBR-TMD) Program Office, described his program. Members discussed issues related to GBR-TMD support to THAAD and PATRIOT. Mr. Mike Holtcamp from the Arrow Joint Program Office briefed the Task Force on potential technology payoffs for the United States from the Arrow Program.

**Current SDI Policy and Recent Decisions on GPALS** - Mr. Jack D. Crouch II, Principal Deputy Assistant Secretary of Defense, International Security Policy, provided an overview of recent SDI policy decisions and an examination of GPALS prospects and issues. The Task Force held considerable discussion on the rationale for GPALS in the current and projected strategic and theater contingency environment.

**Roundtable Discussion: Recent Soviet Writings on Ballistic Missile Defenses** - A roundtable discussion was held between Task Force members and a panel consisting of [redacted] CIA; Mr. Keith Payne, National Security Research; and Mr. Dan Goure, OSD Competitive Strategies Office. The members discussed the possible impact of testing or deploying various elements of defensive systems on the ABM Treaty.

(b)(3):50 USC §403(g) Section 6

Fred S. Hoffman
Co-chairman
Ballisitc Missile Defense Task Force

Daniel J. Fink
Co-chairman
Ballistic Missile Defense Task Force

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

Tuesday, April 23, 1991

**ATTENDEE LIST**

| Name | Representing | Name | Representing |
|---|---|---|---|
| Adams, B.D. | SCC | Kelly, M.K. | OSD/ODRE |
| Braddock, J.V. | Task Force Member | Khalilzad, Z. | Task Force Gov Rep |
| Butler, J.H. | USASDC | Masciola, M.V. | RRI |
| Cambone, S. | Task Force Gov Rep | Minichiello, L.P | Task Force Gov Rep |
| Crites, T. | POET | Pallas, S.G. | Task Force Gov Rep |
| Cummings, J. | RRI | Pappas, P.G. | Task Force Gov Rep |
| Delaney, W.P. | Task Force Member | Pierce, B.J. | OSD |
| Donalson, E.L. | Task Force Member | Piotrowski, J.L. | Task Force Member |
| Dunne, G.W. (CAPT) | Task Force Gov Rep | Preston, G.A. | PATRIOT Project Office |
| Faris, A.L. | USA DCSOPS | Richardson, H.N. (COL) | SDIO |
| Fink, D. | Task Force Co-Chair | Ross, D. (COL) | Task Force Gov Rep |
| Fossier, M.W. | Task Force Member | Russo, M.S. (LCDR) | SDI/TD |
| Gaddy, S. | PATRIOT Project | Schneiter, G.R. | Co-Sponsor |
| Gerry, E.T. | Task Force Gov Rep | Siegel, S.C. | OASA (RDA) |
| Goure, D. | OSD | Tennant, S.M. | Task Force Member |
| Graham, W.R. | Task Force Member | Vos, C.M. | Gen. Counsel |
| Gustone, J.E. | SARDA | Weiss, S. | Task Force Member |
| Hagewood, E.G. | SARD-DO | Welch, J.A. | Task Force Member |
| Hansen, K.L. (Maj.) | SDIO | Whitehouse, E.P. (COL) | DSB Secretariat |
| Herre, F.P. (Col.) | USSPACECOM | Williams, C. | OSD Policy |
| Hoffman, F.S. | Task Force Co-chair | Woolsey, R.J. | Task Force Member |
| Howard, W.E. | USA | Zeiberg, S.L. | Task Force Member |
| Ikle, F.C. | Task Force Member | | |

Task Force members not in attendance at this meeting: Mr R. Everett, Mr L.D. Montague, GEN J.W. Vessey.

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209

Wednesday, April 24, 1991

## ATTENDEE LIST

| Name | Representing |
|---|---|
| Braddock, J.V. | Task Force Member |
| Bubb, E.E. (LTC) | SDIO/TDW |
| Cambone, S. | Task Force Gov Rep |
| (b)(3):50 USC §403(g) Section 6 | NIC |
| Cox, L. | USASDC/GBR |
| Crites, T. | POET |
| Cummings, J. | RRI |
| Delaney, W.P. | Task Force Member |
| Donalson, E.L. | Task Force Gov Rep/USN |
| Dunne, G.W. (CAPT) | OSD |
| Faris, A.L. | USA DCSOPS |
| Fink, D. | Task Force Co-chair |
| Gershwin, L. | CIA |
| Goure, D. | OSD |
| Graham, W.R. | Task Force Member |
| Hoffman, F.S. | Task Force Co-chair |
| Holtcamp, M.S. | USASDC/TMD |
| Ikle, F.C. | Task Force Member |
| Kelly, M.K. | OSD/ODRE |
| Lynch, W.P. | USASDC |
| Masciola, M.V. | RRI |

| Name | Representing |
|---|---|
| Minichiello, L.P | Task Force Gov Rep |
| Montague, L.D. | Task Force Member |
| Moss, K. (Lt.Col.) | SDIDO/TDW |
| (b)(3):50 USC §403(g) Section 6 | NIC |
| | CIA |
| Pallas, S.G. | OSD |
| Pappas, P.G. | USASDC |
| Payne, K.B. | NIPP |
| Pierce, B.J. | OSD |
| Piotrowski, J.L. | Task Force Member |
| Richardson, H.N. | SDIO/TD |
| Ross, D. (COL) | Task Force Gov Rep |
| Russo, M.S. | SDI/TD |
| Schneiter, G.R. | Co-Sponsor |
| (b)(3):50 USC §403(g) Section 6 | NIC |
| Weiss, S. | Task Force Member |
| Welch, J.A. | Task Force Member |
| Whitehouse, E. (COL) | DSB/Secretariat |
| Williams, C. | OSD Policy |
| Woolsey, R.J. | Task Force Member |
| Zeiberg, S.L. | Task Force Member |

Task Force members not in attendance at this meeting: Mr R. Everett, Mr M. Fossier, Mr M. Tennant, GEN J. Vessey.

# DSB/DPB TASK FORCE ON BALLISTIC MISSILE DEFENSE

Riverside Research Institute
1815 North Fort Myer Drive, Suite 100
Arlington, VA 22209
23-24 April 1991

## AGENDA

| *Tuesday, 23 April* | | *Morning Session* |
|---|---|---|
| 0830 | Registration | |
| 0900* | Welcoming Remarks, Administrative Items, Meeting Dates, Introduction of Government Representatives | *Daniel J. Fink*<br>*Fred S. Hoffman* |
| 0905 | Conflict of Interest Briefing | *OSD General Counsel*<br>*Col Vos* |
| 0915* | Discussion of Key Issues/Agenda Items for the Task Force, Review of Terms of Reference, Key Questions To Be Addressed | *Daniel J. Fink*<br>*Fred S. Hoffman* |
| 1000 | | *Ben Adams* |
| 1015 | Break | |
| 1030 | SDIO Theater Missile Defense Program | *Colonel Hal Richardson*<br>*SDIO* |
| 1115 | Overview of Current GPALS Systems Architecture and SDI Program Plan | *Ed Gerry*<br>*SDIO System Architect* |
| 1200 | **Working Lunch** | |
| | | *Afternoon Session* |
| 1300 | ERINT Description and Program Plans | *Joseph Butler*<br>*USASDC* |
| 1330 | PATRIOT Description and Lessons Learned from Operation Desert Storm | *Eugene Preston*<br>*Sidney Gaddy*<br>*PATRIOT Project Office & ODCSOP* |
| 1500 | **Break** | |
| 1515 | Data Derived From Space-Based Sensors | *Colonel Frederick Herre*<br>*USSPACECOM* |
| 1600* | Open Discussion | |
| 1700 | Adjourn | |

*Executive Session (Attendees to be determined by Cochairmen)

*Wednesday, 24 April* — *Morning Session*

| | | |
|---|---|---|
| 0830 | Soviet Strategic Force Modernization and Soviet Nuclear Weapons Command and Control | *Lawrence Gershwin*<br>*National Intelligence Officer*<br>*for Soviet Strategic Programs* |
| 0930 | Global Proliferation of Ballistic Missiles | (b)(3):50 USC §403 (g) Section 6<br>*CIA* |
| 1030 | **Break** | |
| 1045 | Current TMD Program Plans and Descriptions: ARROW, THAAD, GBR-TMD | *TBA*<br>*USA and SDIO* |
| 1215 | **Working Lunch** | |

*Afternoon Session*

| | | |
|---|---|---|
| 1400 | Overview of Current SDI Policy, Background on Recent Decisions on GPALS, and OASD/ISP Informal Outlook on GPALS Prospects and Issues | *Jack D. Crouch, II*<br>*Principal Deputy Assistant*<br>*Secretary of Defense*<br>*International Security Policy* |
| 1445* | Open Discussion | *Daniel J. Fink*<br>*Fred S. Hoffman* |
| 1545 | **Break** | |
| 1600 | Roundtable Discussion: Recent Soviet Writings on Ballistic Missiles Defenses-- Evidence of a Debate or Merely Fall-out from Glasnost? | (b)(3):50 USC §403(g) Section 6<br>*CIA*<br>*Keith Payne*<br>*National Security Research*<br>*Dan Goure*<br>*Competitive Strategies Office* |
| 1700 | Adjourn | |

*Executive Session (Attendees to be determined by Cochairmen)

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

# MINUTES FOR THE DEFENSE SCIENCE BOARD (DSB) TASK FORCE ON SDI COUNTERMEASURES

## 20 - 21 FEBRUARY 1991

The third meeting of the Defense Science Board on SDI Countermeasures was held on 20 and 21 February in Arlington Virginia. A list of attendees is included as Attachment 1, the agenda for both days is Attachment 2.

Mr Robert Everett, Task Force Chairman, opened the February 20 session with a roundtable discussion on the subjects of what the task force has learned to date, what has surfaced as important issues in the area of countermeasures development, implementation in the SDI GPALS systems analysis and design process, and what the task force believes to be areas which are in need of further investigation. Each of the members presented their views on these subjects and they became areas of interest and questions for the two days of briefings.

Dr. Tom Ward presented an overview of the SDIO SCORE (SDI Cooperative Research Exchange) activities with the United Kingdom. He stated that the purpose of SCORE is to achieve a reciprocal exchange of information on an essentially equivalent basis in areas of SDI research in which the U.S. or U.K. has a capability or program. He presented an overview of the current programs where this relationship currently exists.

Mr. Anthony Quigley and Mr. Stephen Metcalf from the U.K. Ministry of Defense presented the U.K.'s involvement in the SCORE activity. The presentations highlighted eight programs conducted solely by the British which produced results pertinent the current SDI issues, and how the results of these programs were made available to the U.S. through SCORE. Another six jointly managed (U.S. / U.K.) test programs also produced results which were made available to both countries. A summary of the technical aspects and results for each of the flight tests was presented. The U.K. is also conducting an Nth Country Threat and Countermeasure Study, the progress of which was also briefed to the DSB.

Ms. Sandra Hiltenbeitel from the Air Force Foreign Technology Center presented the technical characteristics and results of two joint US/UK SCORE Programs, Pet Worth and Red Tigress. For each of these programs Ms. Hiltenbeitel illustrated the test objectives, the test events, the information which was collected and the conclusions that were reached.
Mr. James Robbins of the Central Intelligence Agency presented the agency's assessment of global missile proliferation. The briefing highlighted countries believed to be producing and distributing medium and long range ballistic missiles, and countries believed to be purchasing them. Assessed technical characteristics such as performance and payloads were also presented.

Lt. Col. Dennis Patrick presented an update on the current GPALS system threat scenarios. This included summaries of current scenario development efforts, integration of aerodynamic threat systems, support to the Architecture Integration Study and development of a specific START constrained non-responsive threat scenario. Dr. Stephen Kramer also presented the PENAIDS and countermeasures which have been incorporated into the GPALS scenarios and described the technical capabilities for many of them.

Ms. Jean Knighten and Mr. Jan Sprinkel presented the Defense Intelligence Agency's (DIA) System Threat Assessment Report STAR validation process. The presentation focused of aspects of the intent of the STAR, material contained within the STAR, and the organizations within DIA responsible for development of the STAR. Analysis and evaluations which are currently underway to support future revisions to the STAR, as well as technical parameters for some systems were also presented.

A two hour Policy Perspective Roundtable session was held with twelve members of the SDI policy community. The panel was led by Assistant Secretary of Defense for Strategic Defense Douglas Graham. The discussion centered on the current goals and issues of the GPALS Program.

The agenda for the February 21 meeting, also held in Arlington, focused on countermeasure integration into a number of current GPALS system design programs. The meeting was preceded by a one hour round table discussion by DSB members on the material presented the previous day.

Dr. Thomas Ward introduced the agenda with a discussion of how the CMI Program has contributed to the specific SDI system selections and systems designs in the past, and some of the integration activity currently being conducted.

Col. William Ryan with the U.S. Army's Strategic Defense Command, presented an overview of the Army's Ground Based Radar (GBR) Program and introduced a number of specialty speakers. The functions of the GBR were discussed and assessments of the current GBR concept to perform these functions were presented. Operational concepts and mitigation techniques for the GBR were provided for a variety of countermeasures.

An update in the progress of the TMD Discrimination Program was provided by Lt. Col Chris Johnson. Technical specifics for eleven proposed flight tests to resolve discrimination issues related to countermeasures were presented.

Presentations on National Missile Defense (NMD) countermeasure planning by Mr. Lloyd Stoessell (SDIO), and the current Ground Based Interceptor (GBI) by Mr. Gene Lenning (SDC) were made. Mr. Stoessell described the current NMD Architecture and the role of the GBI within the architecture. Mr. Lenning presented the technical performance of the GBI and evaluations of GBI performance against selected countermeasures.

The meeting concluded with an executive session to evaluate the presentations and to consider briefings for the March meeting.

Robert T Kranc

Mr. Robert Kranc
Executive Secretary

Robert R Everett

Mr. Robert R. Everett
DSB Task Force Chairman

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES 20 FEBRUARY 1991**

**ATTENDEES**

**Members and Advisors**

**Mr. Robert Everett**
**Mr. Edwin Key**
**Dr. Seymour Zeiberg**
**Mr. Theodore Jarvis**
**Dr. John Cornwall**
**Gen. Donn Starry**
**Mr. John Walsh**

**Government Advisors**

Mr. Gene Sevin
Dr. Sydell Gold
Cdr. Allen Topp
Dr. Peter Pappas
Dr. Bruce Pierce

**Briefers and Technical Support**

Dr. Richard Bleach
Mr. Robert Feldhuhn
Dr. Theodore Gold
Ms. Sandra Hiltenbeitel
Mr. Stephen Metcalf
MGen. Malcolm O'Neill
Mr. Geoffrey Owen
Mr. Anthony Quigley
Mr. James Robbins
Col. Robert Swedenburg
Ms. Sharon Witczak
Col. Raymond Ross
Mr. Roy Dommett
Dr. Edward Gerry
Mr. Douglas Graham
Ms. Jean Knighten
Lt. Col. Kevin Ross
Mr. Gordon Oehler
Lt. Col. Dennis Patrick
Mr. Michael Rance
Ms. Jan Sprinkel
Dr. Richard Wagner
Mr. John Wright
Col. James Withycombe

Executive Secretary

Mr. Robert Kranc
Mr. Thomas Holland (contractor support)

DSB Secretariat

Lt. Col. David Beadner

**Members Not Attending**

Dr. Ashton Carter
Mr. Daniel Fink
Dr. Leon Cooper
Mr. Sanual Tennant

Robert T Kranc

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON**
**SDI COUNTERMEASURES**
**21 FEBRUARY 1991**

## ATTENDEES

### Members and Advisors

**Mr. Robert Everett**
**Mr. Edwin Key**
**Dr. Seymour Zeiberg**
**Mr. Theodore Jarvis**
**Dr. John Cornwall**
**Gen. Donn Starry**
**Mr. John Walsh**

### Government Advisors

Mr. Gene Sevin
Dr. Sydell Gold
Cdr. Allen Topp
Dr. Peter Pappas
Dr. Bruce Pierce
Dr. David Finkelman

### Briefers and Technical Support

Col. Robert Swedenburg
Mr. David Israel
Mr. Gene Lenning
Lt. Col. Chris Johnson
Lt. Col. Dennis Patrick
Mr. Lloyd Stoessell
Dr. Thomas Ward
Ms. Carol Evans
Dr. Keh-Ping Dunn
Col. Gilbert Stieglitz
Mr. Albert Perrella
Mr. Wade Kurnegay
Mr. Earl Reed
Mr. Charles Walls
Col. William Ryan

Executive Secretary

Mr. Robert Kranc
Mr. Thomas Holland (contractor support)

DSB Secretariat

Lt. Col. David Beadner

### Members Not Attending

Dr. Ashton Carter
Mr. Daniel Fink
Dr. Leon Cooper
Mr. Sanual Tennant

Robert T Kranc

Attachment 1

**DSB TASK FORCE ON SDI COUNTERMEASURES**

**AGENDA**

February 20

| | |
|---|---|
| | SDIO Score Activities |
| 0900 - 0930 | - Overview |
| 0930 - 1030 | - UK Countermeasures |
| 1030 - 1045 | - Petworth |
| 1045 - 1100 | - Red Tigress |
| | Intelligence Update |
| 1100 - 1200 | - CIA: Missile Proliferation |
| 1200 - 1215 | Working Lunch |
| Afternoon | |
| 1215 - 1300 | DIA: STAR Validation |
| | Threat Update |
| 1300 - 1400 | - Scenarios |
| 1400 - 1600 | Policy Perspectives |
| 1600 - 1700 | Executive Session |

February 21

| | |
|---|---|
| Morning | |
| 0800 - 0900 | Executive Session |
| | SDIO Program Responses to CM's |
| 0900 - 1030 | - GBR |
| 1030 - 1215 | - TMD |
| 1215 - 1230 | Working Lunch |
| Afternoon | |
| 1230 - 1400 | GBI Description |
| 1400 - 1500 | Executive Session |

Robert T Krane

92-7

**MINUTES FOR THE DEFENSE SCIENCE BOARD (DSB)**
**TASK FORCE**
**ON SDI COUNTERMEASURES**

**16 - 17 JANUARY 1992**

The second meeting of the Defense Science Board on SDI Countermeasures was held on 16 and 17 January in Arlington Virginia. A list of Attendees is included as Attachment 1 with an agenda included as Attachment 2.

Mr. Robert Everett, Task Force Chairman, opened the January 16 session at 0900, by restating that the mission of the task force is to make recommendations on the overall area of SDI countermeasures. This includes developing a firm understanding of the requirements of SDS in the GPALS environment, the adequacy of the countermeasures and how countermeasures are integrated into the system design process. The integration of these three factors is necessary for a comprehensive view of the countermeasures development process.

Lt. Col. Chris Johnson presented the TMD System Level Discrimination Flight Test Program. He presented the rationale which led to the development of specific TMD system level discrimination issues, outlined the required flight tests which would produce data sufficient to evaluate the magnitude of the discrimination issues and presented a schedule of proposed flight tests necessary to obtain the data.

Captain John Roberts and Mr. Bruce Haselman presented the Ballistic Missile Organization's (BMO) involvement in the Countermeasures Integration (CMI) Program. This breaks into three portions, the Technical Interaction Program which is where CM analysis is conducted to support the Red/Blue Interaction. The Technical Operations and Engineering Program, where databases previously developed by BMO are researched for CM applicability, and the Threat Analysis Program where specific CM technologies are developed and tested. BMO reviewed all current CM support efforts and a number of the important previous efforts.

Dr. Alex Ross, et al. presented CMI Program activities at MIT Lincoln Laboratory. These were separated into four separate briefings in the areas of the Countermeasures Technology Base, FIREBIRD test results, Theater (TMD) Countermeasure Study and planned and proposed future activities. The CM Base Program consists of broad based CM studies and analysis (primarily Red Team), and the investigation of specific technical issues. The FIREBIRD briefing focused on the results from the first flight and the objectives for the upcoming flight. The TMD Study focused on how the laboratory identifies and evaluates specific CM technologies. In the last area, the FY92 activities and the FY93-95 plans were presented.

The agenda for the January 17 meeting, also held in Arlington Virginia, was a continuation of the test related activities in the CMI Program. The meeting was preceded by a round table discussion by the task force members on the issues and concerns on the material presented on the previous day.

The first set of briefings were presented by representatives from Sandia National Laboratories on the subject of the Countermeasures Verification Program at Sandia. Al Bustamante et al. presented both flight test and analysis activities in seven specific countermeasure areas. The presentation focused on how the Sandia CM analysis activities are coordinated with the larger SDI CM and Threat Communities and how this process assisted Sandia in developing test objectives and flight test requirements. The results of recent flight tests were presented and emphasis was made on how these results provide the necessary data to establish CM requirements and effectiveness measures.

The final briefing was made by Captain Robert Kelsey on the SDIO Targets Program. Captain Kelsey explained that the prime objective of the Targets Program is to provide targets for flight tests for each of the GPALS element programs. This involved developing and integrating user requirements, developing target designs, providing delivery capability (boosters, test ranges, etc.) and integrating these elements into successful tests. A review of the current Target Program activities was provided including the GPALS programs currently supported and a few specific targets for these programs.

By agreement of the members present, future meetings of the Task Force were scheduled for the following dates: 20-21 Feb; 19-20 Mar; 9-10 Apr and 14-15 May.

Robert T Kranc

Mr. Robert Kranc
Executive Secretary

Robert R Everett

Mr. Robert R. Everett
DSB Task Force Chairman

**DEFENSE SCIENCE BOARD TASK FORCE ON
SDI COUNTERMEASURES
16 JANUARY 1991**

**ATTENDEES**

**Members**

**Mr. Robert Everett
Mr. Edwin Key
Dr. Seymour Zeiberg
Mr. Theodore Jarvis
Dr. John Cornwall
Mr. Samual Tennant
Mr. John Walsh**

**Government Advisors**

Dr. Gene Sevin
Dr. Sydell Gold
Dr. David Finkelman
COL. David Ross
Dr. Peter Pappas

**Briefers and Technical Support**

Mr. Don Coe
Mr. William Ince
Col. Robert Swedenburg
Dr. Thomas Ward
Mr. Bruce Haselman
Mr. Keh-Ping Dunn
Ms. Debbie Osborn
Mr. Charles Bruce
Mr. Bruce Deal
Capt. John Roberts
Mr. Alex Ross
Mr. Steven Achramowitz
Lt. Col. Chris Johnson

Executive Secretary

Mr. Robert Kranc
Mr. Thomas Holland (contractor support)

DSB Secretary

Lt. Col. David Beadner

**Members Not Attending**

Dr. Ashton Carter
Mr. Daniel Fink
Dr. Leon Cooper
Gen. Donn Starry

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES 17 JANUARY 1991**

## ATTENDEES

### Members

**Mr. Robert Everett**
**Mr. Edwin Key**
**Dr. Seymour Zeiberg**
**Mr. Theodore Jarvis**
**Dr. John Cornwall**
**Mr. Samual Tennant**
**Mr. John Walsh**
**Gen Donn Starry**

### Government Advisors

Dr. Gene Sevin
Dr. Sydell Gold
Col. Gilbert Stieglitz
COL. David Ross
Dr. David Finkleman
Cdr Allen Topp

### Briefers and Technical Support

Mr. Greg Foltz
Mr. Bruce Balmer
Col. Robert Swedenburg
Ms. Debbie Osborn
Mr. Al Bustamante
Capt. Robert Kelsey

Executive Secretary

Mr. Robert Kranc
Mr. Thomas Holland (contractor support)

DSB Secretary

Lt. Col. David Beadner

### Members Not Attending

Dr. Ashton Carter
Mr. Daniel Fink
Dr. Leon Cooper

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES**

**AGENDA**

<u>January 16</u>

| | |
|---|---|
| 0900 - 1045 | TMD Countermeasure Activities<br>LTC Chris Johnson |
| 1045 - 1230 | BMO Countermeasure Activities<br>Capt. John Roberts |
| 1230 - 1245 | Break (Working Lunch) |
| 1245 - 1600 | Lincoln Lab Countermeasure Program<br>Dr. Alex Ross |
| 1600 - 1700 | Executive Session |

<u>January 17</u>

| | |
|---|---|
| 0830 - 1200 | Sandia National Lab CM Program<br>Al Bustamonte |
| 1200 - 1215 | Break (Working Lunch) |
| 1215 - 1400 | SDIO T&E (Targets)<br>Capt. Robert Kelsey |
| 1400 - 1500 | Executive Session |

Attachment 2

92-7

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

# MINUTES FOR THE DEFENSE SCIENCE BOARD (DSB) TASK FORCE ON SDI COUNTERMEASURES

## 19 - 20 MARCH 1992

The fourth meeting of the Defense Science Board Task Force on SDI Countermeasures was held on 19 and 20 March in Arlington, Virginia. The agenda and list of attendees for both days are included as attachments.

Mr. Robert Everett, Task Force Chairman, opened the March 19 session at 0800, by conducting a roundtable session where each of the DSB members stated their insights into the issues involving the adequacy with which countermeasures have been developed, assessed, and integrated into the systems analysis and design processes. This became the subject of a lengthy discussion which resulted in a determination of future courses of action necessary for the task force review.

Mr. Warren Dickinson and Mr. Earl Reed from the US Army Strategic Defense Command (USASDC) presented the current concepts for the Ground Based Radar (GBR). Technical descriptions were presented for both the National and Theater Missile Defense radar concepts. A portion of the technical presentation was dedicated to a description of how USASDC develops responses to the proposed countermeasures. A number of charts were presented describing specific responses to selected radar countermeasures.

Col. John Mill (SDIO/TNS) presented the SDIO Midcourse Space Experiment Program. He stated the objectives of the program are to: 1) demonstrate IR and visible midcourse sensor functions from space, 2) provide a multispectral midcourse target and background database, and 3) integrate sensor technologies. He provided technical descriptions of the sensors, descriptions of the targets and priorities of the missions and technical descriptions of each of the tests.

The afternoon executive session was a discussion concerning the manner and adequacy with which the GBR program has been addressing countermeasures in the various GBR designs.

The agenda for the March 20 meeting addressed the activities of the PENAID Panel and the THAAD Program. The briefings were preceded by a two hour executive session where issues from the previous day, and the composition of the DSB Interim Report were discussed.

Charles Bucy (USASDC) presented the PENAID Panel's PENAIDS and countermeasures which have been incorporated into the SDI System Threat. The briefing illustrated what service agencies, national laboratories, intelligence community members and contractors comprise the membership of the PENAID Panel, and how the PENAID Panel coordinates its work with the threat and intelligence communities. Mr. Bucy described the PENAID Panel's responsibilities, process for PENAID suite development and a number of threat scenarios where PENAID suites have been incorporated. He further described in detail eight PENAID suites which have been the focus of current activity.

The Theater High Altitude Area Defense (THAAD) Interceptor concept was presented by Mr. Paul Lynd from the THAAD Project Office (USASDC). The presentation encompassed the functions of THAAD, interaction with the theater GBR and the concept of operations. Technical descriptions were provided for three current THAAD concepts; advantages and disadvantages were discussed. There was a discussion of what work the THAAD Project Office has undertaken in the area of countermeasure development and THAAD system responses.

The meeting was concluded with an executive session to evaluate the progress made over the two days and determine what briefings would be appropriate for the April session.

R L Swedenburg
Col. Robert Swedenburg
Executive Secretary

Robert Everett
Mr. Robert Everett
DSB Task Force Chairman

**DEFENSE SCIENCE BOARD TASK FORCE ON**
**SDI COUNTERMEASURES**
**19 MARCH 1992**

## ATTENDEES

### Members and Advisors

**Mr. Robert Everett**
**Mr. Daniel Fink**
**Mr. Samual Tennant**
**Dr. Leon Cooper**

**Mr. Edwin Key**
**GEN Donn Starry**
**Mr. Theodore Jarvis**

Executive Secretary

Mr. Robert Kranc
Mr. Thomas Holland (contractor support)

DSB Secretary

Lt. Col. David Beadner

### Government Advisors

Dr. David Finkleman
Col. David Ross

Dr. Peter Pappas
Dr. Gene Sevin

### Support

Mr. David Israel
Mr. Earl Reed
Col. Robert Swedenburg
Mr. John Mill

Lt. Col. Chris Johnson
Col. Gilbert Stieglitz
Mr. Warren Dickinson

### Members Not Attending

Dr. Ashton Carter
Dr. Seymour Zeiberg

Dr. John Cornwall
Mr. John Walsh

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES 20 MARCH 1992**

## ATTENDEES

### Members and Advisors

**Mr. Robert Everett**
**Mr. John Walsh**
**Mr. Samual Tennant**
**Dr. Leon Cooper**
**Mr. Edwin Key**
**GEN Donn Starry**
**Mr. Theodore Jarvis**

Executive Secretary

Mr. Robert Kranc
Mr. Thomas Holland (contractor support)

DSB Secretary

Lt. Col. David Beadner

### Government Advisors

Dr. David Finkleman
Col. David Ross
Dr. Peter Pappas
Dr. Gene Sevin

### Support

Dr. Steven Kramer
Dr. David South
Dr. Thomas Ward
Mr. David MacMillan
Mr. William Robb
Mr. Howard Rude
Mr. Paul Lynd
Mr. Earl Reed
Col. Robert Swedenburg
Mr. Charles Bucy
Mr. Michael Judd
Mr. Doug Nicholls
Mr. Warren Dickinson
Mr. Jeff Butler

### Members Not Attending

Dr. Ashton Carter
Dr. Seymour Zeiberg
Dr. John Cornwall
Mr. Daniel Fink

Attachment 1

# DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES AGENDA

## MARCH 19

| | |
|---|---|
| Executive Session | 0800 - 1000 |
| Ground Based Radar<br>Mr. Warren Dickinson<br>Mr. Earl Reed | 1000 - 1200 |
| Working Lunch | 1200 - 1230 |
| Ground Based Radar | 1230 - 1500 |
| Midcourse Space Experiment<br>Col. John Mill | 1500 - 1600 |
| Executive Session | 1600 - 1700 |

## MARCH 20

| | |
|---|---|
| Executive Session | 0800 - 1000 |
| PENAIDS<br>Lt. Col. Dennis Patrick | 1000 - 1200 |
| Working Lunch | 1200 - 1215 |
| THAAD<br>Paul Lynd | 1215 - 1330 |
| Executive Session | 1330 - 1430 |

Attachment 2

92-7

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

# MINUTES FOR THE DEFENSE SCIENCE BOARD (DSB) TASK FORCE ON SDI COUNTERMEASURES

## 9 - 10 APRIL 1992

The fifth meeting of the Defense Science Board on SDI Countermeasures was held on 9 - 10 April in Arlington Virginia. The agenda and list of attendees for both days are included as attachments to these minutes.

Mr. John Geisinger presented a preliminary design concept for a C-band escort jammer. The presentation included the characteristics, design and operational concept for the jammer. Determination was made that "off-the-shelf" components could be used, component list and prices were included. Effectiveness of the jammer against C-band radar was not presented

Mr. Troy Crites of the Phase One Engineering Team (POET) presented the Blue Team's responses to Red countermeasures. The presentation featured nine countermeasures which the Red Team posed to Blue over the last two Red/Blue exercises. A discussion of how Blue responded to the countermeasures consumed most of the briefing. The Blue Team's response to both standoff and escort jammers constituted a large portion of the briefing.

Mr. Paul Lynch with the THAAD Project Office of U S Army Strategic Defense Command (USASDC) presented the THAAD response to the Escort Jammer. The brief covered the THAAD system concept of operations, countermeasure considerations, missile concept comparisons and the terminal guidance and end-game timeline. A countermeasure response roadmap approach indicating near-term "design-to" countermeasures as well as farther term countermeasures which are being considered was also presented.

Mr. Warren Dickinson and Mr. Earl Reed also from USASDC presented the GBR response to jamming. Areas covered were performance parameters and designs for a GBR mainbeam jammer concept against the GBR, and a number of responses for the GBR.

The afternoon executive session was a discussion concerning the manner and adequacy with which the GBR program has been addressing countermeasures in the various GBR designs.

Dr. Edward Gerry discussed the deliberations and concerns in the current system architecture trade studies. Some of the questions asked of Dr. Gerry included the resiliency of THAAD and T-GBR against some selected countermeasures, the capability of the Theater Architecture to provide boost phase defense and the robustness of the architecture to provide late endoatmospheric defense.

Mr. Mick Blackledge from SDIO/TNC presented the current progress on interceptor technology and discrimination capability. Discussion centered on much of the current technology employed in LEAP and how LEAP technologies are being incorporated into the current missile concepts. Critical aspects of technology incorporation include seeker concepts, processing capability (throughput), lightweight structures, aero-optics, lethality and technology testing.

Lt. Col. Roy Aydelotte SDIO/SDG presented SDIO's current Brilliant Pebbles (BP) concepts. Included in the briefing were the current two contractor concepts and the government baseline concept of the BP Task Force. The concept of operations, performance specifications and effectiveness analysis were presented for each concept. A number of countermeasures to BP and BP responses were reviewed during the briefing.

There was an executive session at the end of the day to review the content of the day's briefings.

The agenda for the April 10 meeting, also held in Arlington, addressed the activities of two theatre defense missile programs as well as the progress made in the on-going third world technology workshop. The briefings were preceded by a two hour executive session where issues remaining from the previous day, and the composure of the DSB final report were discussed.

Mr. Michael Wheeler briefed on the progress of the Third World Technology Workshop sponsored by the Countermeasures Program. Discussion topics for the workshop included the current and nearterm capability of Iran, Pakistan and Syria in the areas of ballistic missile materials, propulsion, guidance and control, warheads, system testing and countermeasures. The preliminary conclusions of the study are that there are no serious obstacles to continued development in each of these areas by all three countries.

Lt. Col. Ray Millar from the Patriot Project Office introduced Mr. Robert Stein of Raytheon Corporation who presented the Patriot Missile Program. A complete presentation was made of the Patriot Missile System including design and performance aspects of Patriot, planned product improvements, test results and Desert Storm results. A thorough presentation was made of Patriot's capability against a broad variety of countermeasures. Responses for each countermeasure were discussed in detail.

Lt. Col. Kip Hansen from SDIO's TMD Weapons Division presented the ERINT concept. Included was the current ERINT concept of operations, requirements for acquisition and intercept, guidance system approach and endgame seeker concept. Also presented was the ERINT response to countermeasures and an in-progress report on the current ERINT ECM

Susceptibility Study.

The meeting was concluded with an executive session to evaluate the progress made over the two days and determine if briefings would be required for the May session. It was decided to devote the May session to crafting the Task Force's final report.

| | |
|---|---|
| Col. Robert Swedenburg<br>Executive Secretary | Mr. Robert Everett<br>DSB Task Force Chairman |

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES 10 APRIL 1992**

## ATTENDEES

### DSB Members

**Mr. Robert Everett**
**GEN Donn Starry**
**Mr. Samuel Tennant**
**Dr. Leon Cooper**
**Mr. Edwin Key**
**Dr. John Cornwall**
**Mr. Theodore Jarvis**
**Mr. John Walsh**

Executive Secretary

Col. Robert Swedenburg
Mr. Thomas Holland (contractor support)

### Government Advisors

Dr. David Finkleman
Col. David Ross
Dr. Sydell Gold
Dr. Peter Pappas
Dr. Gene Sevin
Dr. Bruce Pierce

### Support

Mr. David Israel
Mr. Earl Reed
Col. Robert Swedenburg
Mr. George Blevins
Mr. Howard Bloomberg
Mr. John Geisinger
Lt. Col Kevin Moss
Mr. Jeffery Butler
Mr. Troy Crites
Mr. Mick Blackledge
Col. Gilbert Stieglitz
Mr. Warren Dickinson
Maj. Kevin O'Brian
Dr. Edward Gerry
Mr. Paul Lynch
Mr. Robert Purdy
Mr. Robert Cashion
Lt. Col. Roy Aydelotte

### Members Not Attending

Mr. Daniel Fink
Dr. Ashton Carter

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON**
**SDI COUNTERMEASURES**
**10 APRIL 1992**

**ATTENDEES**

**DSB Members**

**Mr. Robert Everett**
**GEN Donn Starry**
**Mr. Samual Tennant**
**Dr. Leon Cooper**

**Mr. Edwin Key**
**Dr. John Cornwall**
**Mr. Theodore Jarvis**
**Mr. John Walsh**

Executive Secretary

Col. Robert Swedenburg
Mr. Thomas Holland (contractor support)

DSB Secretary

Lt. Col. David Beadner

**Government Advisors**

Dr. David Finkleman
Col. David Ross
Dr. Sydell Gold

Dr. Peter Pappas
Cdr. Allan Topp
Dr. Bruce Pierce

**Support**

Col. Robert Swedenburg
Mr. Robert Millett
Mr. Michael Wheeler
Lt. Col. Kip Hansen

Mr. Martin Kenger
Lt. Col. Roy Millar
Maj. Francis Valentino

**Members Not Attending**

Mr. Daniel Fink

Dr. Ashton Carter

Attachment 1 (cont.)

**DEFENSE SCIENCE BOARD TASK FORCE ON**
**SDI COUNTERMEASURES**
**AGENDA**

**9 April 1992**

| | |
|---|---|
| Cheap and Easy Escort Jammer<br>Mr. Geisinger, SPC | 0800 - 0900 |
| Red - Blue Team Interaction<br>Mr. Crites, POET | 0900 - 1000 |
| THAAD Response to Escort Jammer<br>Mr. Lynch, USASDC | 1000 - 1100 |
| GBR Response to Escort Jammer<br>Mr. Dickenson, USASDC | 1100 - 1200 |
| Working Lunch | 1200 - 1215 |
| GPALS Architecture Trade-Offs<br>Dr. Gerry, SDIO/SA | 1200 - 1300 |
| Interceptor Discrimination Technology<br>Mr. Blackledge, SDIO/TNC | 1300 - 1345 |
| Brilliant Pebbles Response to Countermeasures<br>Lt. Col. Aydelotte, SDIO/SDG | 1345 - 1530 |
| Executive Session | 1530 - 1700 |

**DEFENSE SCIENCE BOARD TASK FORCE ON**
**SDI COUNTERMEASURES**
**AGENDA**

**10 April 1992**

| | |
|---|---|
| Executive Session | 0800 - 0900 |
| Summary of Third World Technology Workshop<br>Mr. Wheeler, SPC | 0900 - 0930 |
| Patriot Resopnse to Countermeasures<br>Lt. Col. Roy Millar, Patriot Program Office<br>Mr. Robert Stein, Raytheon Corporation | 0930 - 1200 |
| ERINT Response to Countermeasures<br>Lt. Col. Kip Hansen, SDIO/TDW | 1200 - 1245 |
| Working Lunch | 1245 - 1300 |
| Executive Session | 1245- 1500 |

Attachment 2

92-7

DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

# MINUTES FOR THE DEFENSE SCIENCE BOARD (DSB) TASK FORCE ON SDI COUNTERMEASURES

## 14 - 15 May 1992

The sixth meeting of the Defense Science Board on SDI Countermeasures was held on 14 - 15 May in Arlington Virginia. The agenda and list of attenders for both days are included as attachments to these minutes.

The May two day session was planned to be a DSB final report working session where each of the members brought to the session their concerns on the thoroughness of the Countermeasures Integration Program and their recommendations to the final report.

The May 14 meeting opened with a session in which each of the board members expressed their views on the completeness of the Countermeasures Program in addressing the spectrum of GPALS analysis and design issues as they were presented over the five preceding DSB meetings. A number of specific issues were discussed in a round table forum, and each of the board members presented their comments on the draft final report of the Defense Science Board which had been prepared and distributed to the board members two weeks prior to the May session.

Each of the members had prepared written comments and additions to the final report which were presented to the forum for discussion and inclusion. Agreement was reached on corrections to the final report, the afternoon of the May 14 session was conducted as a working session to provide the revisions to the final report and determine which points should be made to Dr. Gerry and Dr. Ward on the next day.

The May 15 session was dedicated to meeting with Dr. Gerry (SDIO System Architect) and Dr. Ward (Director of SDIO Security, Intelligence and Countermeasures) to present a preliminary discussion of the findings and recommendations that the DSB is making in its final report. Each issue was discussed together with the supporting information by the DSB members to both Dr. Gerry and Dr. Ward to gain from their insight and perspective on how the GPALS program could respond to specific issues. The session lasted throughout the morning with agreement that the DSB has brought valuable insight and recommendations to the process.

The May session was concluded with an executive session agreement to finalize the report and provide it to the Office of the Secretary of Defense by the first week of June 1992.

R L Swedenburg

Col. Robert Swedenburg
Executive Secretary

Mr. Robert Everett
DSB Task Force Chairman

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES**
**14 May 1992**

**ATTENDEES**

**DSB Members**

**Mr. Robert Everett**
**GEN Donn Starry**
**Mr. John Walsh**
**Mr. Edwin Key**
**Mr. Theodore Jarvis**

Executive Secretary

Col. Robert Swedenburg
Mr. Thomas Holland (contractor support)

**Government Advisors**

Col. David Ross
Dr. Sydell Gold

**Support**

There were no supporting personnel present.

**Members Not Attending**

Mr. Daniel Fink
Mr. Samuel Tennant
Dr. John Cornwall
Dr. Ashton Carter
Dr. Leon Cooper

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES**
**15 May 1992**

## ATTENDEES

### DSB Members

**Mr. Robert Everett**
**GEN Donn Starry**
**Mr. John Walsh**
**Mr. Edwin Key**
**Mr. Theodore Jarvis**

Executive Secretary

Col. Robert Swedenburg
Mr. Thomas Holland (contractor support)

### Government Advisors

There were no government advisors present.

### Support

Dr. Edward Gerry
Dr. Thomas Ward

### Members Not Attending

Mr. Daniel Fink
Mr. Samuel Tennant
Dr. John Cornwall
Dr. Ashton Carter
Dr. Leon Cooper

Attachment 1

**DEFENSE SCIENCE BOARD TASK FORCE ON SDI COUNTERMEASURES**

**AGENDA**

**14 May 1992**

| | |
|---|---|
| DSB Task Force final report working session | 0800 - 1700 |

**15 May 1992**

| | |
|---|---|
| Review of DSB final recommendations<br>Dr. Edward Gerry<br>Dr. Thomas Ward | 0930 - 1100 |

Attachment 2

92-7

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

# MINUTES FOR THE DEFENSE SCIENCE BOARD (DSB) TASK FORCE ON SDI COUNTERMEASURES

## 13 - 14 DECEMBER 1991

The first meeting of the DSB Task Force on SDI Countermeasures was held on 13 and 14 December in McLean Virginia. A list of attenders is included as Attachment 1 with the agenda as Attachment 2.

Mr. Robert Everett, Task Force Chairman, opened the December 13 session at 0900, stating that the mission of the DSB Task Force is to make recommendations on the overall area of SDI countermeasures. The emphasis should be on determining whether the completeness of the countermeasure activity within SDIO is sufficient to ensure the validity and technical integrity of the SDI Program. The completeness of the countermeasure effort should be viewed not only from a strategic context, but expanded to include ground forces and air breathing threats.

Dr. Edward Gerry, SDIO Chief Architect, presented the current baseline GPALS architecture, and a number of current concepts for the Initial Deployment Architecture. Dr. Gerry also discussed the implications that the Missile Defense Act of 1991 may pose to the architecture concepts.

Col. Robert Swedenburg, Countermeasures Program Manager, presented the current participants in the Red, Blue and Senior Review Teams. The highlights of the just completed TMD Round 1 Red/Blue Exercise was also presented. For the scenario investigated, there were approximately 25 countermeasures examined in the exercise with two stressing the architecture strongly. The Blue team's responses to mitigate the stressing countermeasures were presented.

Dr. Richard Wagner, chairman of the CMI Program Senior Review Panel (SRP), presented the SRP's methodology for determining how countermeasures are considered in the Red / Blue Activity. The current concern is that of ensuring that countermeasures include the clever, low-tech, scenario dependent implementations which are similar to the GPALS threat scenarios. Dr. Wagner presented the detailed taxonomy which the SRP uses for making these determinations.

Dr. Tom Ward, Director SDIO/SI, presented an overview of the SDIO Threat Program. Dr. Ward showed how the Intelligence Threat, Countermeasures Threat and Systems Threat are integrated under his direction to produce the Systems

Threat Assessment Report (STAR), Countermeasure Assessments (Red/Blue Reports) and Systems Threats (tapes and documents) which are used for SDI performance assessment and system design.

Mr. Robert Kranc briefed an overview of countermeasures activities. Mr. Kranc identified which organizations within SDIO are responsible for countermeasures design and test, countermeasures-related phenomenlolgy, and organizations which develop countermeasure responses. Mr. Kranc also briefed the budgets which are allocated throughout SDIO for countermeasure development and testing activities.

Capt Paul Tilson presented a detailed briefing on the Intelligence Threat Program. He identified the service organizations which participate and how they participate. He outlined each of the elements which compose the development of the intelligence threat and discussed the evolutions which were made in progressing from the Strategic Threat of 1991 to the GPALS Threat of 1992. In particular, how Rest of World Threats were determined and what adaptations were made in assessment of the Soviet Threat. Capt. Tilson also generally described the GPALS STAR and the six threat appendixes being produced in 1992.

Lt. Col. Dennis Patrick manages the system threat activities within SDIO and provided an overview of the system threat development process, the participants and the on-going and planned activities. LT. Col. Patrick presented a summary of each of the 91-2 GPALS Scenarios and described how they form a multidimensional threat space which stresses many aspects of the SDI Architecture.

The agenda for the December 14 meeting, also held in McLean Virginia, was organized as an in-depth view of the individual work areas within the CMI Program. The meeting was preceeded by a round table discussion by the task force members on some of the issues and concerns from the previous day.

Col. Robert Sweedenburg presented an introduction and overview of the Countermeasures Integration (CMI) Program. Col. Sweedenburg pointed out the major responsibilities of the CMI Program are to ensure completeness of CM assessment, investigate technical feasibility, determine adversarial propensity so as to prepare complete countermeasure assessments which can be implemented into blue system designs.

Dr. Kerry Patterson provided a briefing of the activities within Work Area 1 of the CMI Program which included countermeasure development, assessment and integration. Dr. Patterson also presented the key findings of the 15 Red / Blue activities which have been conducted since 1984.

Mr. Joe DiCamillo presented the CMI Program Test and Experiments Program (Work Area 2). This included a summary of the last five countermeasure flight tests, and a discussion of issues related to TMD countermeasures and how they are addressed in the current CMI test program. Much of the briefing also discussed details of the current test programs which are underway and the results to date.

Mr. Fred Wood briefed the Work Area 3 Technical Evaluation Oversight and Strategic Analysis functions. He presented a summary of the functions in strategic analysis which included Offensive-Defensive Analysis, Interactive Gaming and the Senior Level Review process. Mr. Wood also briefed the key findings of five major strategic studies since 1990.

An agenda will be drafted to outline the second DSB meeting, which will be a two day session in January 1992. Participants will be notified by Mr. Kranc.

Robert T Kranc

Mr. Robert Kranc
Executive Secretary

Robert R. Everett

Mr. Robert R. Everett
DSB Task Force Chairman

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(10)

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-2000

POLICY

April 30, 1991

FY 1991 Report of Closed Meetings of the
Defense Science Board/Defense Policy Board Task Force on
Ballistic Missile Defense
under Section 10(d) of the
Federal Advisory Committee Act

A meeting of the Task Force on Ballistic Missile Defense was held on April 23-24, 1991 at the Riverside Research Institute, Rosslyn, Virginia. It was co-chaired by Mr. Daniel J. Fink and Mr. Fred S. Hoffman.

The meeting was closed based on the determination that this meeting concerned matters listed in 5 U.S.C. and 522B(2) (1976). The determination was based on the consideration that the discussions involved classified matters of national security and were so intertwined with unclassified matters that they could not be reasonably segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received briefings and discussed technical matters in preparation for a sumary presentation of the findings to the Secretary of Defense.

Sincerely,

Daniel Goure
Director Competitive Strategies Office
Executive Secretary

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-2000

POLICY

June 5, 1991

FY 1991 Report of Closed Meetings of the
Defense Science Board/Defense Policy Board Task Force on
Ballistic Missile Defense
under Section 10(d) of the
Federal Advisory Committee Act

A meeting of the Task Force on Ballistic Missile Defense was held on May 30-31, 1991 at the Riverside Research Institute, Rosslyn, Virginia. It was co-chaired by Mr. Daniel J. Fink and Mr. Fred S. Hoffman.

The meeting was closed based on the determination that this meeting concerned matters listed in 5 U.S.C. and 522B(2) (1976). The determination was based on the consideration that the discussions involved classified matters of national security and were so intertwined with unclassified matters that they could not be reasonably segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received briefings and discussed technical matters in preparation for a sumary presentation of the findings to the Secretary of Defense.

Sincerely,

Daniel Goure
Director Competitive Strategies Office
Executive Secretary

DEFENSE SCIENCE BOARD

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

June 24, 1991

FY 1991 Report of Closed Meetings of the
Defense Science Board/Defense Policy Board Task Force on
Ballistic Missile Defense
under Section 10(d) of the
Federal Advisory Committee Act

A meeting of the Task Force on Ballistic Missile Defense was held on June 19-20, 1991 at the Riverside Research Institute, Rosslyn, Virginia. It was co-chaired by Mr. Daniel J. Fink and Mr. Fred S. Hoffman.

The meeting was closed based on the determination that this meeting concerned matters listed in 5 U.S.C. and 522B(2) (1976). The determination was based on the consideration that the discussions involved classified matters of national security and were so intertwined with unclassified matters that they could not be reasonably segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received briefings and discussed technical matters in preparation for a summary presentation of the findings to the Secretary of Defense.

Sincerely,

Daniel Goure
Director Competitive Strategies Office
Executive Secretary

DEFENSE SCIENCE
BOARD

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

July 29, 1991

FY 1991 Report of Closed Meetings of the
Defense Science Board/Defense Policy Board Task Force on
Ballistic Missile Defense
under Section 10(d) of the
Federal Advisory Committee Act

A meeting of the Task Force on Ballistic Missile Defense was held on July 23-24, 1991. The session on July 23 was held at the Riverside Research Institute, Rosslyn, Virginia; the session on July 24 was held at the Pentagon, Washington, DC. The meeting was co-chaired by Mr. Daniel J. Fink and Mr. Fred S. Hoffman.

The meeting was closed based on the determination that this meeting concerned matters listed in 5 U.S.C. and 522B(2) (1976). The determination was based on the consideration that the discussions involved classified matters of national security and were so intertwined with unclassified matters that they could not be reasonably segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received briefings and discussed technical matters in preparation for a summary presentation of the findings to the Secretary of Defense.

Sincerely,

Daniel Goure
Director Competitive Strategies Office
Executive Secretary

FY 1991 Report of Closed Meetings of the
Defense Science Board/Defense Policy Board Task Force on
Ballistic Missile Defense
under Section 10(d) of the
Federal Advisory Committee Act

A meeting of the Defense Science Board/Defense Policy Board was held August 12-23, 1991 at the Naval Ocean Systems Center, San Diego, California. The August 12-16 sessions were co-chaired by Mr. Daniel J. Fink and Mr. Fred S. Hoffman. The remaining sessions were co-chaired by Mr. Fred S. Hoffman and Mr. William P. Delaney

The meeting was closed based on the determination that this meeting concerned matters listed in 5 U.S.C. and 522B(2) (1976). The determination was based on the consideration that the discussions involved classified matters of national security and were so intertwined with unclassified matters that they could not be reasonably segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Boards received briefings and discussed technical matters in preparation for a summary presentation of the findings to the Secretary of Defense. Chairman John S. Foster was out-briefed at the conclusion of the meeting.

Sincerely,

for Daniel Goure
Director Competitive Strategies Office
Executive Secretary

11

**FY 1990 REPORT OF CLOSED MEETINGS**
**DEFENSE SCIENCE BOARD TASK FORCE ON SDIO TECHNOLOGY**
Under Section 10 (d)
of the Federal Advisory Committee Act

The first meeting of the Defense Science Board Task Force on SDIO Technology was held on 16-17 January 1990 at Sandia National Laboratory, Albuquerque, NM. It was chaired by Dr. Joseph F. Shea.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so intertwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

On 16-17 January the Task Force was briefed by various contractor entities on various phases of the subject SDIO Technology. On 17 January there was a panel discussions, regarding information presented in previous briefings, and ended with an Executive Session to wrap up the two-day meeting.

ROGER X. LENARD
Executive Secretary

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1990 Report of Closed Meetings of the
Defense Science Board Task Force on
SDIO Technology
under Section 10(d)
of the Federal Advisory Committee Act

The Task Force met on 7 March 1990, at Lynchburg, VA, and 8 March 1990 at the Pentagon, Washington DC. It was chaired by Dr. Joseph F. Shea.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so intertwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force met at Lynchberg to receive classified briefings on various phases of the subject of SDIO technology, to tour manufacturing facilities. Fabrication of state of the art hardware were observed as was conduct of materials experiments. The meeting at the Pentagon consisted of classified briefings and discussions.

David L Beal Lt Col USAF
for / Roger Lenard, Lt Col, USAF
Executive Secretary

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1990 Report of Closed Meetings of the
Defense Science Board Task Force on
SDIO Technology
under Section 10(d)
of the Federal Advisory Committee Act

The Task Force met on 20 March 1990, at Brookhaven National Laboratory and 21 March 1990, Grumman Aerospace Corp., Long Island, NY. It was chaired by Dr. Joseph F. Shea.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so intertwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force met to receive classified briefings on various phases of the subject of SDIO technology and to tour research facilities.

Lt Col USAF
for / Roger X. Lenard, Lt Col, USAF
Executive Secretary

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1990 Report of Closed Meetings of the
Defense Science Board Task Force on
SDIO Technology
under Section 10(d)
of the Federal Advisory Committee Act

The Task Force met on 7-8 June 1990, at the Pentagon, Washington DC. It was chaired by Dr. Joseph F. Shea.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so intertwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force met to prepare final recommendations, briefing, and the report of the Task Force.

Lt Col USAF

for / Roger X. Lenard, Lt Col, USAF
Executive Secretary

(12)

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1991 Report of Closed Meetings of the
Defense Science Board Task Force on
Strategic Defense Initiative Countermeasures
under Section 10(d)
of the Federal Advisory Committee Act

The Task Force met on 13 - 14 December 1991, in Arlington, VA. It was chaired by Mr. Robert Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b (1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and are so intertwined that they cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force met to receive a series of technical briefings and discuss related issues.

Robert T Kranc

Robert Kranc
Executive Secretary

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1992 Report of Closed Meetings of the
Defense Science Board Task Force on
Strategic Defense Initiative Countermeasures
under Section 10(d)
of the Federal Advisory Committee Act

The Task Force met on 16 - 17 January 1992, in Arlington, VA. It was chaired by Mr. Robert Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b (1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and are so intertwined that they cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force met to receive a series of technical briefings and discuss related issues.

Robert T Kranc

Robert Kranc
Executive Secretary

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
CY 1992 Report of Closed Meetings of the
Defense Science Board Task Force on
Strategic Defense Initiative Countermeasures
under Section 10(d)
of the Federal Advisory Committee Act

The Task Force met on 20-21 February 1992, in Arlington, VA. It was chaired by Mr. Robert Everett.

The Meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1) (1976). The determination was based on the consideration that the discussions involved classified matters of national security and are so intertwined that they cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force met to receive a series of technical briefings and discuss related issues.

Robert T Kranc

Robert Kranc
Executive Secretary

(13)

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1988 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The seventh meeting of the Task Force was held on February 1-2, 1988, in the SDIO MIC, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received the following briefings: an SDI program overview and update from LtGen Jim Abrahamson, the High Endoatmospheric Defense Interceptor from LTC Art Hurtada, Space Based Interceptor from Mr. Alfred Staessell, Space Based Lasers from Mr. Neil Griff, Treaty Issues from MAJ George Ash, Exoatmospheric Reentry Vehicle Interceptor System Program from CDR Pat Sullivan, Phenomenology from Dr. Barry Katz, and Midcourse Sensors from Col Garry Schnelzer. The two day meeting was capped by a member's meeting with Secretary Carlucci.

For Gerald R. Farney
Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1988 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The eighth meeting of the Task Force was held on March 9, 1988, in the SDIO MIC, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force meeting consisted of discussions with LtGen Jim Abrahamson and with Gen Robert Herres on an incremental approach for a Phase I development. The remainder of the meeting involved the structuring of preliminary recommendations for the Secretary of Defense.

For Donald R. Forney

Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1988 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The ninth meeting of the Task Force was held on March 31, 1988, in the SDIO MIC, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The meeting of the Task Force was devoted to drafting a letter report summarizing findings and recommendations.

For Gerald R. Farmer
Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1987 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The first meeting of the Task Force was held on April 3-4, 1987, in Room 3E869, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force was welcomed by Secretary Weinberger then received the following briefings: Zero One from Dr. Richard Joseph, ABM Treaty from Mr. Lee Minichiello, Experiment Results from Dr. Louis Marquet, Space Transportation from Col George Hess, and BM/C3 Experiment from Captain (USN) David Hart. A program discussion lead by LtGen Jim Abrahamson completed the two day meeting.

For Gerald R. Farrey
Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1987 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The second meeting of the Task Force was held on April 17-18, 1987, in Room 3E869, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received the following briefings: Milestone 1 Preparation from Col Jim Graham, Discrimination from LTC Lonny Larson, Component Technology from Col Schnelzer, JCS Requirements update from Gen Robert Herres, System Architecture Trade Studies from Col Jeff Schofield, and Restructured Test Program from Dr. Richard Bleach. Mr. Everett closed the two day meeting with an Executive Session.

For Gerald R. Farvey
Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1987 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The third meeting of the Task Force was held on April 27-28, 1987, in Room 3E869, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received the following briefings: Milestone 1 Preparation from Col Jim Graham, BM/$C^3$ Data Processing Technologies from LTC Dave Audley, Cost Estimating from MAJ Carlson, Supportability Logistics from MAJ Ed Tavares, Manufacturing Strategy from Mr. Greg Stattlemyer, Red Team Zero One from Mr. Barry Levere, Mission Effectiveness from Mr. Frank Gaffney and Acquisition Strategy from Gen Jim Abrahamson. Mr. Everett closed the two day meeting with an Executive Session.

For Gerald R. Farney
Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1987 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The fourth meeting of the Task Force was held on May 14-15, 1987, in Room 3E869, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received the following briefings: Aerospace review from Dr. Everhardt Rechtin, Threat from Col Jack Houlgate, Mission Effectiveness from Dr. Dino Larenzine, Milestone 1 Preparation from Col Jim Graham, Survivability from Col George Hess, Net Assessment from Mr. Andy Marshall, and Countermeasures from Bob Clem and Don Rigoli. Mr. Everett closed the two day meeting with an Executive Session.

Gerald R. Farvey
For Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1987 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The fifth meeting of the Task Force was held on June 1-2, 1987, in Room 3E869, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The Task Force received the following briefings: BM/$C^3$ from Captain (USN) David Hart, Program Description from Gen Malcolm O'Neal, BSTS Survivability/Sensors from Col Gary Schnelzer, KEW (Delta 180/181) from Col Raymond Ross, DEW from Dr. John Hammond and DAB planning from Mr. Frank Kendall. Gen Robert Herres and Gen Jim Abrahamson discussed the DAB, JCS requirements and organizational issues. Mr. Everett closed the two day meeting with an Executive Session.

Gerald R. Farney
For Robert R. Everett
Chairman

DEPARTMENT OF DEFENSE
Office of the Under Secretary of Defense
(Acquisition)
FY 1987 Report of Closed Meetings of the
Defense Science Board Task Force on
Subgroup to Strategic Air Defense
under Section 10(d)
of the Federal Advisory Committee Act

The sixth meeting of the Task Force was held on June 17-18, 1987, in Room 3E869, the Pentagon, Washington, DC. It was chaired by Mr. Robert R. Everett.

The meeting of the Task Force was closed based on the determination of the USD(A) that this meeting concerned matters listed in 5 U.S.C. and 522b(1)(1976). The determination was based on the consideration that the discussions involved classified matters of national security and is so interwined that it cannot reasonably be segregated into separate discussions without defeating the effectiveness and meaning of the overall meeting.

The meeting of the Task Force was devoted to drafting a letter report with results of the panel findings.

For Ronald R. Farney
Robert R. Everett
Chairman

# Report of the Defense Science Board 1981 Summer Study Panel on STRATEGIC DEFENSE (U)

## Volume 1

October 1981

Office of the Under Secretary of Defense
for Research and Engineering
Washington, D.C. 20301

Classified by USDRE
Declassify on 31 August 1987

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE
BOARD

15 October 1981

MEMORANDUM FOR SECRETARY OF DEFENSE

THROUGH THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: Final Report of Defense Science Board 1981 Summer Study on Strategic Defense - INFORMATION MEMORANDUM (U)

~~(S)~~ The attached report of the Defense Science Board 1981 Summer Study on Strategic Defense was prepared under the Chairmanship of Mr. Thomas C. Reed. The principal purposes of the study were, generally, to assess the U.S. and USSR capabilities to defend their respective homelands against strategic attack and, specifically, to re-examine U.S. strategic defense policies, missions, priorities, posture and capabilities in the face of ballistic, air-breathing and space-based threats.

~~(S)~~ The Panel members generally concluded that the USSR maintains a defense-in-depth against air-breathing threats, modest ballistic missile defense and anti-satellite systems, and a significant civil defense program. The Panel also concluded [redacted] (b)(1)

~~(S)~~ 2. Decide on a BMD system and its deployment [redacted] (b)(1)

~~(S)~~ 3. Improve CONUS air defense capability by proceding with programs for improvement of attack warning and assessment [redacted] (b)(1)

Classified by: USDRE
Declassify on: 31 August 1987

~~(S)~~ 4. Support the FEMA plans for evacuation and sheltering of the civilian population and for physical protection of military functions and industrial assets.

~~(S)~~ 5. Assure funding for adequate technology development in support of strategic defense, [redacted] (b)(1)

~~(S)~~ 6. Organize $C^3I$ responsibility and fund a $C^3I$ improvement program [redacted] (b)(1)

Other key recommendations to your staff, the OJCS, or the Services are spelled out in the Executive Summary of the report. I recommend that you read the entire report. I am sure that the implementation of the report's recommendations, consistent with Administration policies, is of prime concern to us all and I solicit your personal support in that regard.

(U) I plan to distribute this report as an official DSB report to the persons and organizations named on the attached list unless you wish a more restricted distribution.

for
Norman R. Augustine
Chairman

Attachment:
As Stated

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

1 October 1981

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of Defense Science Board 1981 Summer Study on Strategic Defense (U)

(U) Attached please find Volume I of the final report of the Defense Science Board 1981 Summer Study on Strategic Defense. The annexes contained in Volume II are being provided under separate cover.

(b)(1) [redacted]

~~(S)~~ The key recommendations of the Study are as follows:

~~(S)~~ 1. Organize $C^3I$ responsibility and fund a $C^3I$ improvement program (b)(1) [redacted]

~~(S)~~ (b)(1) [redacted]

~~(S)~~

~~(S)~~ 4. Improve CONUS air defense capability by proceeding with programs for improvement of attack warning and assessment (b)(1) [redacted]

~~(S)~~ 5. Support the FEMA plans for evacuation and sheltering of the civilian population and for physical protection of military functions and industrial assets.

~~(S)~~ 6. Assure funding for adequate technology development in support of strategic defense. (b)(1) [redacted]



~~SECRET~~

(U) I solicit your assistance in implementing the complete set of recommendations contained in the report. A copy of the detailed implementation plan is attached.

(U) I express my greatest appreciation for the diligent work provided by the Panel members and your support staff in San Diego in preparing this most crucial study. I add an additional word of thanks to your support staff in helping me to prepare outbriefings for key Administration officials. These efforts could not have been possible without the outstanding cooperation and dedication of all study group participants.

Thomas C. Reed

Thomas C. Reed
Chairman
Summer Study on
Strategic Defense

Attachments:
As Stated

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## STRATEGIC DEFENSE

| Area | Recommendations | Implementation Actions* |
|---|---|---|
| $C^3I$ | 1. Organize $C^3I$ responsibility as befits the seriousness of the crisis.<br>- Strong, centralized OSD leadership.<br>- Use Director, $C^3$ Systems, on Joint Staff<br>- Appropriate some $C^3I$ funds directly to CINCs<br>- Defend fiscal integrity of $C^3$ program<br>- Organize strategic $C^3$ SPO if possible | Action by SEC DEF.** |
| | 2. Execute, on highest priority, $C^3I$ improvement program to achieve assured connectivity and endurance. | No action required. Planning and implementation is in progress under direction of PDUSDR&E. |
| | 3. Test strategic $C^3$ systems regularly and frequently with high level participation. | Memorandum to Secretary of Defense and CJCS summarizing recommendation and proposing specific test form and schedule. |
| Space Defense | [redacted] | (b)(1) |

SECRET

| Area | Recommendations | Implementation Actions |
|---|---|---|
| | [redacted] (b)(1) | |
| Air Defense | 7. Assure that the probability of detection of a Soviet air raid is raised to deter precursor attacks by [redacted] (b)(1) | Memorandum to Secretary of the Air Force to incorporate these recommendations into the Master Plan for review by OSD Master Plan Review Group and by DUSDR&E(S&TNF). |
| | 8. Improve air defenses by acquisition and assignment of general purpose aircraft ( 100 F-15 type, 12 AWACS). Return Army HAWK batteries no longer required in Europe to CONUS and assure optimal utilization of HAWK and PATRIOT batteries in the U.S. | Include in memorandum described under item 7. In this case, include Army participation under Air Force planning lead to assure integration of all CONUS Air Defense efforts. |
| | 9. Pursue new ideas and planning for development of enduring capabilities for air defense. Include consideration of novel approaches such as the "armed surveillance mobile platform" (eg: C-130V). | Memorandum to Secretary of the Air Force to develop a plan for enduring air defenses for review by OSD Master Plan Review Group and DUSDR&E(S&TNF). |
| BMD | 10. Design optimized, deceptively-based, integrated ICBM/defense system as low cost as possible to use in deployment decisions. | No action required. Joint Army/Air Force design is in progress and will be reviewed by DUSDR&E(S&TNF). |
| | 11. Decide on BMD deployment only as part of larger decision package involving MX basing, ABM Treaty policy, dollar cost (versus alternative expenditures on offense) and warhead resources. | Action by SEC DEF.** |

SECRET



SECRET

| Area | Recommendations | Implementation Actions |
|---|---|---|
| | [redacted] (b)(1) | |
| Civil Defense | | |
| Technology | | |

* All actions to be initiated by DUSDR&E(S&TNF) unless otherwise indicated.

** Actions, needed by SEC DEF, are listed in transmittal letter from Chairman, DSB to Secretary of Defense. Secretary of Defense briefed August 27 and September 17, 1981 by the Chairman of the Strategic Defense Panel.

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TABLE OF CONTENTS (U)

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TABLE OF CONTENTS (U) (Continued)

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TABLE OF CONTENTS (U) (Continued)

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LIST OF FIGURES (U)

LIST OF TABLES (U)

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# I. EXECUTIVE SUMMARY (U)

(U) The Defense Science Board undertook a major study of Strategic Defense during the summer of 1981. Its conclusions may be summarized as follows:

~~(S)~~ (b)(1) [redacted]

~~(S)~~ The Soviets have deployed an in-depth defense against U.S. bomber attack. It has vulnerabilities which are being addressed by the Soviets. As a result the U.S. must continue to improve its offense to exploit the next generation of Soviet vulnerabilities. The Soviets also have a modest operational ballistic missile defense but an ongoing development program that may well be able to "break out" to provide a good ballistic missile defense of Soviet assets by the late 1980's. The Panel was of the view that the Soviets will do this when it is in their political and military interest to do so, regardless of the ABM Treaty. The Soviets also have an operational anti-satellite (ASAT) system and a significant civil defense program.

~~(S)~~ U.S. strategic defenses, [redacted] (b)(1)

(b)(1) [redacted]

~~(S)~~ The Panel adopted a schedule of priorities for defense. The highest priority was to assure our ability to utilize the present forces [redacted] (b)(1) [redacted] These solutions are urgently recommended.

~~(S)~~ A moderate level of post-attack endurance could be provided [redacted] (b)(1) [redacted]

~~(S)~~ A ballistic missile defense (BMD) system, consisting of the preferential defense of either deceptively based or existing silo based ICBM's by means of a low-altitude (b)(1) [redacted] interceptor missile, was found to be technically feasible on a time frame compatible with M-X. [redacted] (b)(1) [redacted] whether the benefits are worth the political, financial, and nuclear materials price was considered to be a policy decision of the highest order.

~~(S)~~ Specific Panel recommendations, listed by category rather than priority, are as follows:

COMMAND, CONTROL, COMMUNICATION AND INTELLIGENCE $C^3I$ (U)

1. The Secretary of Defense should organize $C^3I$ responsibility as befits the seriousness of the crisis in that arena.

2. USDR&E should, with highest priority, execute a $C^3I$ improvement program to achieve assured connectivity and endurance.

3. The Secretary of Defense should assure that strategic $C^3$ systems are tested regularly with high level participation.

SPACE DEFENSE (U)

(b)(1),(b)(5)

[redacted]

AIR DEFENSE (U)

(b)(1)

7. [redacted]

8. The Air Force should improve air defenses by acquisition and assignment of general purpose aircraft (100 F-15 type, 12 AWACS). The Army should return HAWK surface-to-air missile (SAM) batteries no longer required in Europe to CONUS and should assure optimal utilization of HAWK and PATRIOT SAM batteries in the U.S.

9. USDR&E should pursue new ideas for the development of enduring capabilities in air defense (e.g., the C-130 Variant).

BALLISTIC MISSILE DEFENSE (U)

10. The Army and Air Force should jointly design an optimized, deceptively-based and defended ICBM system, which is as low-cost as possible. Use this design in making a deployment decision.

11. The Secretary of Defense should decide on a ballistic missile defense deployment only as part of a larger decision package also involving MX basing, ABM Treaty policy, dollar cost

(versus alternative expenditures on offense), and warhead cost (versus other uses).

(b)(1) [redacted]

CIVIL DEFENSE (U)

(b)(1) [redacted]

TECHNOLOGY (U)

(b)(1) [redacted]

## II. BACKGROUND (U)

(U) This DSB Summer Study was initiated in May of 1981 under the Terms of Reference included at page 56 of this Report. Extensive preparation was done during July to enable the Panel to reach some conclusions and recommendations at the August meeting, useful at once in deliberations on strategic force structure.

(U) The leadership and makeup of the Panel is at page 59 of this Report. It was a uniquely qualified group, and the Chairman expresses his deepest thanks to that team for their prompt and comprehensive efforts.

~~(S)~~ The problem considered by the Panel, simply stated, [redacted]

(b)(1)

[1]See Annex 1, "A History of U.S. Strategic Defense".

(b)(1)

(U) By now U.S. security has been seriously endangered as the concept of Mutual Assured Destruction is overtaken by events -- specifically, the steady Soviet arms buildup over two decades.

(U) The Soviet offense, coupled with their massive defense system, far outweighs anything the U.S. might consider. Nonetheless, it is instructive to first look at Soviet defenses for lessons we might learn and vulnerabilities we might exploit.

## III. SOVIET DEFENSE SYSTEMS (U)[2]

### A. AIR DEFENSE (U)

~~(S)~~ In the postwar years the Soviets have developed a massive air defense system. It is characterized by the continual introduction of new equipment and upgrades while seldom, if ever, throwing anything away. [redacted] (b)(1)

~~(S)~~ The Soviets have addressed these vulnerabilities by the development of look-down, shoot-down (LDSD) radar, an AWACS, the SA-10 low altitude SAM, and by internetting their air defense radars. Figure 2 illustrates the growth of one of these capabilities (LDSD interceptors).

~~(S)~~ Appropriate U.S. countermeasures [redacted] (b)(1)

[2] See Annex 2, "Soviet Strategic Defense Systems".

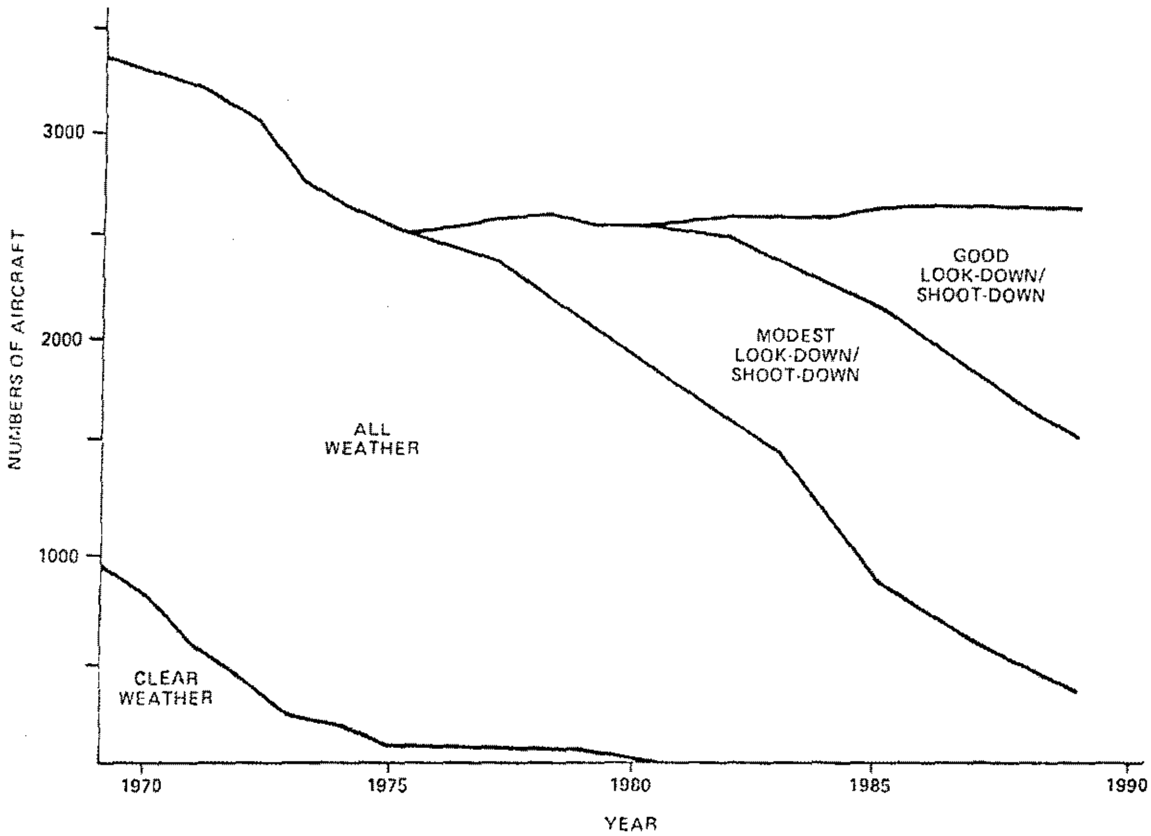


Figure 2: ~~(S)~~ Capabilities of Soviet Air Defense Interceptors (Source: 1975 & 1981 Defense Intelligence Projections for Planning (DIPP) Best Estimate)

B. SOVIET BALLISTIC MISSILE DEFENSE (U)

~~(S)~~ The Soviets also have [redacted] (b)(1) The resulting Soviet and corresponding U.S. expenditures on ballistic missile defense are shown in Figure 3.

~~(S)~~ There exists an ABM Treaty, but by their ongoing expenditures the Soviets have in all likelihood developed an ability to "break out" of the Treaty limits whenever it is in their interest to do so. Any proposed U.S. modifications to the ABM Treaty, no matter how trivial, could provide the Soviets an excuse to break out. In such an event the Soviets could probably give their military and industrial assets substantial ABM protection by the mid to late 1980's.

(b)(1) [redacted]

(b)(1)

[redacted]

Figure 3: ~~(S)~~ Ballistic Missile Defense Expenditures

C. SOVIET ASAT AND $C^3$ (U)

(b)(1)

[redacted]

(U) In every area the Soviets deploy something useful and then upgrade it. They do not await the "perfect" system.

## IV. U.S. STRATEGIC DEFENSE OPTIONS AND PRIORITIES (U)

(U) The question which arises is whether the U.S. should do something about its strategic defenses. This Panel concluded, "Yes", that the U.S. should rebuild some modest level of active and passive defense.

~~(S)~~ The reasons are fourfold.

1. (b)(1),(b)(5) [redacted] strategic defense adds to the credibility of U.S. deterrence.

2. Strategic defense can be effective:

(b)(1) [redacted]

3. The technology for modest strategic defense is in hand.

4. Post nuclear attack endurance is deemed to be important. [redacted] (b)(1),(b)(5)

~~(S)~~ What might we defend?[3] The panel recommends protection of assets in the following order:

(b)(1) [redacted]

The priorities are not intended to be absolute. Funds should be invested where they are most incrementally effective. As a result of reasonable expenditures in these areas we should be able to defend vital assets during civil disturbance, theater wars, and limited strategic attacks.

[3]See Annex 3, "Role of Strategic Defense".

~~(S)~~ Going beyond that, defending against full scale nuclear war is very difficult and expensive. It can be done, but at a tremendous cost. [redacted]

(b)(1)

(U) Next consider some specific solutions.

## V. COMMAND, CONTROL, COMMUNICATIONS & INTELLIGENCE (U)[4]

~~(S)~~ The Panel overwhelmingly agreed that Command, Control, Communications, and Intelligence Systems ($C^3I$) are

(b)(1)

[redacted]

[4]See Annex 4, "$C^3I$".

(b)(1)

[redacted]

~~(S)~~ The Panel made two specific recommendations in this area of $C^3I$.

1. Secretary of Defense should organize the $C^3I$ function on his staff and in DoD in a forceful and centralized manner, as befits the seriousness of the crisis.

   - Identify one individual office in OSD, responsible for $C^3I$ policy and acquisition, with the full authority of the Secretary of Defense behind him, to enforce discipline on the system, i.e., to budget for needed capabilities.

   - Use the Director, $C^3$ Systems, on the Joint Staff to establish priorities, coordinate CINC and service positions.

   - Appropriate some $C^3I$ funds directly to the CINC's for their rapid acquisition of needed capabilities.

   - Institute the best procedures possible to effectively "fence" $C^3$ funding from intra-Service trade-offs.

   - Organize a Strategic $C^3$ System Program Office, if possible.

2. Fund the $C^3I$ improvement program described above. If a genuine endurance capability is desired, the total price would appear to be

about \$11 billion of acquisition costs and \$4 billion of 10-year O&S costs, all in 1982 dollars. It should be recognized that significant additional funding may be required in the $C^3$ area beyond the figures quoted here, both as a result of completion of the detailed analysis by the current OSD review (Wade Study) and to solve additional problems recognized as a result of the testing and exercising recommended.

## VI. SPACE DEFENSE (U)[5]

~~(S)~~ Space is important for other than immediate $C^3$ programs. [redacted] (b)(1)

(U) Space is also important because it's a "big ocean". Assets in space can survive, if they have been hardened, against anything but a one-on-one attack.

(b)(1),(b)(5) [redacted]

(U) In recognizing these characteristics the Panel reached some further conclusions.

(b)(1),(b)(5) [redacted]

[5] See Annex 5, "Space Defense".

(b)(1),(b)(5)

[redacted]

~~(S)~~ As far as hardware is concerned, we recommend:

1. Defending our space assets by

   - Reducing their dependency on specific ground terminals. This means more on-board processing as well as mobile/redundant terminals.

(b)(1),(b)(5)

[redacted]

2. (b)(1),(b)(5) [redacted]

(U) The cost of these latter hardware programs are $10 billion of acquisition and $7 billion of ten-year operations and support (O&S) funds. Half of the former and three quarters of the latter, for a total of about $10 billion, are properly allocated to strategic defense.

## VII. AIR DEFENSE (U)[6]

~~(S)~~ The Soviet Union possesses a small inventory of older, long range bomber aircraft (i.e., about 100 Bears) and a growing inventory of supersonic, refuelable Backfires. The current Backfire inventory is about 125 aircraft, growing at the rate of 30 per year.

~~(S)~~ The current Soviet cruise missile capability centers around older, large, high altitude, short range missiles. Low altitude, longer range weapons are under development, however, and should be expected in the inventory by the late eighties.

~~(S)~~ Attacks of concern to the Panel by air-breathing vehicles from the Soviet Union are:

(b)(1) [redacted]

~~(S)~~ To meet these challenges the U.S. has:

(b)(1) [redacted]

[6] See Annex 6, "Air Defense".

(b)(1)

(b)(1)

[redacted]

~~(S)~~ These problems are being made worse by the ongoing Soviet Backfire production and the potential introduction of new, low observable, Soviet cruise missiles.

~~(S)~~ The panel found the solutions to these problems to be straightforward with the technology in hand. The underlying philosophy of the solution is to:

(b)(1)

[redacted]

target coverage that is "virtually" the same as our shooting down some of his planes;

2. provide a flexible and adaptable defense;

3. use general purpose force elements. Do not try to rebuild a major, special purpose, strategic defense establishment.

~~(S)~~ Specifically, the Panel recommends a matrix of solutions shown in Table 1. They are sorted by timeliness and objective, and include the following.

(b)(1)

1. [redacted]

2. [redacted]

3. [redacted]

4. Improve our defenses by adding general purpose force elements, useful elsewhere.

- Acquire about 100 new F-15 type fighters with look-down, shoot-down radar.

(b)(1)

- [redacted]

| | NEAR TERM → 1985 | MID TERM 1985 - 1990 | LONGER TERM HIGH PAYOFF OR NEED |
|---|---|---|---|
| WARNING | (b)(1) [redacted] | | |
| CONTROL ACCESS | | | |
| LIMIT DAMAGE | | | |
| ENDURING | | | |

Table 1: ~~(S)~~ Air Defense Recommendations

(b)(1) [redacted]

(U) Our specific procurement recommendations are as shown in Table 2.

| | (FY82 $ Billions) | |
|---|---|---|
| | Investment Cost | 10-Year O&S Cost |
| 1. For near-term and mid-term capabilities to warn, control access, limit damage, and provide very limited endurance: | | |

(b)(1),(b)(5)

[redacted]

2 [redacted]

Table 2 ~~(S)~~

Specific Air Defense Procurement Recommendations ~~(S)~~

## VIII. BALLISTIC MISSILE DEFENSE (U)[7]

(U) Defense against ballistic missiles has long been considered "too tough". Some things have changed to render defense more feasible, but the basic constraint remains the evolving Soviet threat.

~~(S)~~ Figure 5 shows the [redacted] (b)(1)

~~(S)~~ Soviet SLBM RV's currently do not threaten U.S. [redacted] (b)(1)

~~(S)~~ From the U.S. point of view things are also changing. [redacted] (b)(1) The explosive growth of computer technology has vastly increased traffic handling and discrimination capabilities. Phased array radars are now in production and their cost has dropped accordingly.

[7]See Annex 7, "Ballistic Missile Defense".

(b)(1)

[redacted]

(b)(1) [redacted]

(U) The offense must be sure his attack will succeed. The defense need only raise reasonable doubt that a significant portion of his forces may survive.

A. DEFEND WHAT? (U)

~~(S)~~ What should we try to defend against ballistic missile attack? [redacted] (b)(1) In the process we should bear in mind the Soviet experience: deploy simple, plan for growth. "Perfect" systems never make it.

B. DEFEND HOW? (U)

(U) A subcommittee of this panel worked closely with the Army's BMD office during July to sort out proposed rapidly deployable defense concepts.

(b)(1) [redacted]

~~(S)~~ Airbase defense, along with protection of a "flyout corridor" is feasible, but a larger missile for higher altitude intercepts is necessary.

~~(S)~~ The Panel did look at some other alternative BMD schemes. The simplest ones were not cost effective. [redacted] (b)(1)

~~(S)~~ The resulting defense philosophy, therefore, is to use preferential defense of either deceptively based or

(b)(1)

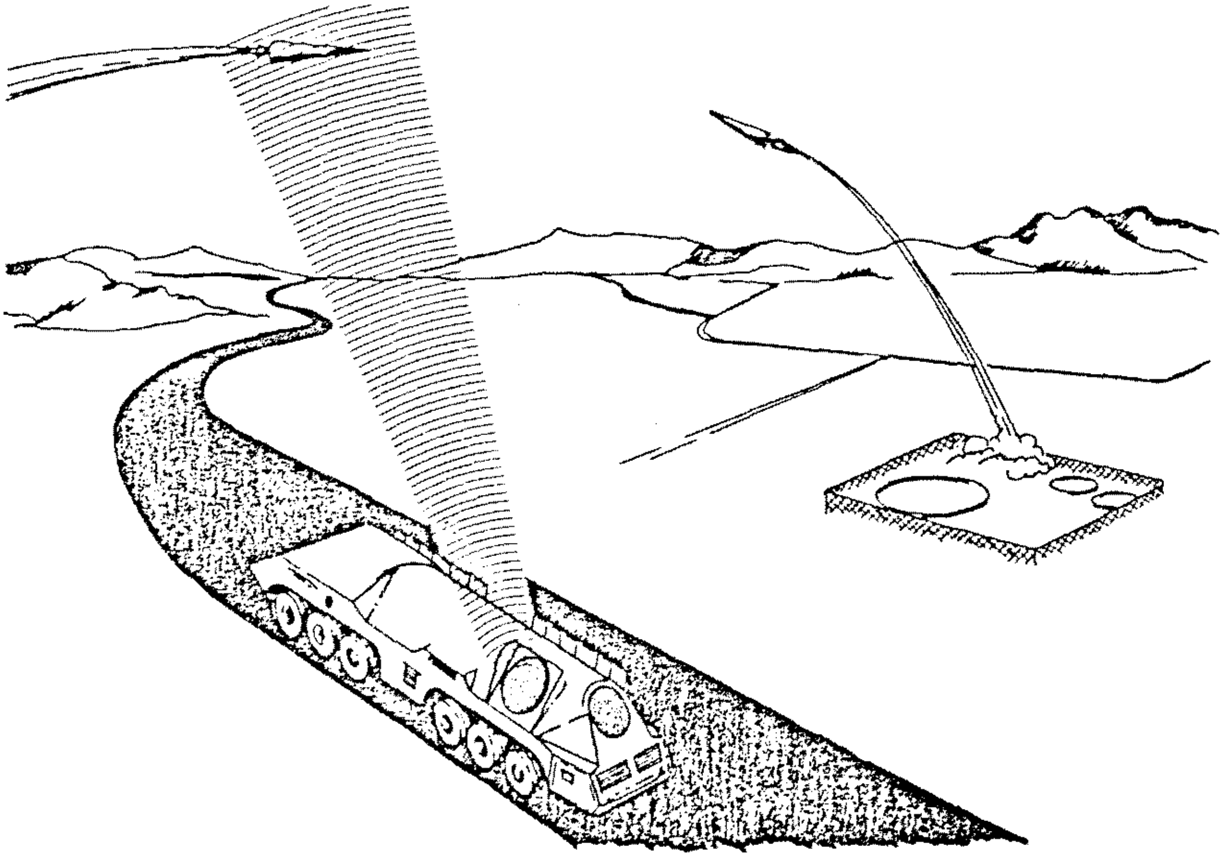

Figure 7: ~~(S)~~ Concept for Defense of Silo's with Interceptors Inside Fence and Road Mobile Radar

existing silo based ICBM's (b)(1) [redacted] (b)(1) [redacted]

~~(S)~~ In considering the deployment of such a scheme, there are five alternatives:

(b)(1) [redacted]

(U) Any defense decision must be made in the context of the IBM basing mode selected, ABM Treaty considerations, and cost.

C. ABM TREATY (U)

(U) The ABM Treaty limits each side to one ABM site, 100 interceptors, and 18 fixed radars. It is of indefinite duration but is subject to regular review. The next such review is scheduled for 1982, but proposed changes can be introduced at any time.

(U) Any full ballistic missile defense deployment would require modification of the Treaty and could result in its abrogation. Before starting down that road, therefore, it is important to consider:

- The political storm that would result from abrogation.
- The program delays that will arise from the Treaty debate.
- Soviet reactions.

~~(S)~~ The Soviets may welcome the opportunity to end the ABM Treaty. The Panel felt, based on past Soviet performance, relative ABM expenditures shown on Figure 3, and the current Soviet posture, that the Soviets will abrogate and "break out" anyway, when it is in their political and militay interest to do so.

(U) The Soviets may also respond to a U.S. BMD deployment with a major burst of fractionation, abandonment of the SALT limits on the numbers of MIRV carriers (conversion of more SS-11 silos to SS-19), or additional silo and missile deployments.

(U) Fortunately, there are U.S. deployment solutions that substantially comply with the ABM Treaty and that work as long as the Soviets also stay within the SALT limits.

## D. DEPLOYMENT OPTIONS (U)

(U) The panel studied several basing and defense options. The results are mapped in Figures 8 and 9.

(b)(1)

(b)(1)

[redacted]

(U) The case for defense of Minuteman silos with no M-X, 200 M-X replacing MM II's, and a full replacement of Minuteman with M-X is shown as three separate lines.

(U) The case for MPS basing and its subsequent defense is shown as a band of optimum solutions for 200 M-X in MPS, with defense initially applied to the MPS and eventually to the original Minuteman silos as well.

(b)(1),(b)(5) [redacted]

~~(S)~~ Some observations:

1. While defense of silos may be the cheapest way to protect against the current Soviet ICBM threat, there is no growth path to match a continuing Soviet fractionation without (b)(1) [redacted] (b)(1) [redacted]

2. (b)(1) [redacted]

3. There is a defense solution, as a subset of (2) above, that complies with the substance of the ABM Treaty and works if the Soviets stay within their SALT limits.

4. (b)(1) [redacted]

5. All of these figures are preliminary, and a final decision to defend should be based on a more concrete analysis. We believe the services are now undertaking that work.

E. DEPLOYMENT CONSEQUENCES (U)

~~(S)~~ If the decision is made to deploy a BMD system the Panel found that an IOC of four years from decision to proceed is possible if unique management procedures are brought to bear and there are no delays due to ABM Treaty debate. An FOC of 6 years from decision, (b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ Deployment dates that could impact the ABM Treaty are as follows:

| | |
|---|---|
| Announcement of decision to develop/deploy | Oct 81 |
| Initiation of development program | Jun 82 |
| Groundbreaking outside protocol limits | Jun 84 |
| Testing of mobility | Feb 85 |
| First deployment of proscribed system | Jan 86 |

(b)(1) [redacted]

(U) Before proceeding with a Ballistic Missile Defense, however, one should take a hard look at some of the downside problems.

(U) First is the issue of treaty abrogation -- the political flap and program delays which will inevitably result.

(U) Second, Ballistic Missile Defense is hard to explain to the public. [redacted] (b)(5) Consider how <u>The New York Times</u> or <u>Rolling Stone</u> might report the announcement of an ABM system.

~~(S)~~ Third, one must consider Soviet response to a U.S. BMD deployment. The Soviets might introduce countermeasures, such as:

(b)(1) [redacted]

~~(S)~~ The Soviets could shorten their intelligence cycle time, requiring our mobile radars to move more frequently or hide in sheds.

(U) They could build more silos and the arms race would really be on.

~~(S)~~ They could deploy their own ABM.

(U) Another problem with BMD is the requirement for endurance. Surviving several waves of attacks, especially if the Soviets have a working reconnaissance system, is difficult.

(b)(1),(b)(5)

[redacted]

(U) It's a difficult decision, and the best the Panel could do was come up with some recommended guidelines.

F. RECOMMENDATIONS (U)

(U) First, decide on a BMD deployment only as part of a larger package involving

- M-X Basing Mode
- ABM Treaty Policy
- Dollar Cost (vs. Offensive Forces)
- Warhead Cost (vs. Other Uses)
- Which BMD Plan.

(U) Second, make the DoD produce an optimum design for MPS basing and defense, and evaluate those costs versus Minuteman silo defense in making a decision.

(U) Third, if it is decided to deploy a BMD, do so fast and hard. Deploy a good system as rapidly as possible and pursue other technologies off-line for product improvement. The political heat will be intense, and a BMD should be deployed on a schedule to match M-X.

~~(S)~~ And fourth, as part of the process [redacted] (b)(1)

~~(S)~~ The reason for this is that the scenarios most dangerous to the U.S. involve [redacted] (b)(1)

(b)(1) [redacted]

(U) Figure 10 shows the impact on the strategic "bathtub" if such measures are in place by January of 1983.

(U) On the other hand, we should not use such plans as an excuse to do nothing about ICBM vulnerability.

(b)(1)

## IX. CIVIL DEFENSE (U)[8]

(U) When it comes to the defense of large areas, civil defense is the most cost effective solution and is an essential first step in any more extensive defense. A modest program of evacuation planning and some sheltering is worth doing so long as the government limits its intrusion into the people's lives in peacetime.

(b)(1) [redacted]

(U) The Panel recommends that the Secretary of Defense support the FEMA basic plan of evacuation and some sheltering. The cost of about $5.5 billion ($100 per life saved) does not come out of the DoD budget.

[8]See Annex 8, "Civil Defense".

(U) At the same time DoD should undertake a program for the passive defense of key military functions that are necessary for reconstitution of the forces. Such a program, estimated to cost about $1 billion, would assure the survival of some key technicians and a logistics base, would show that DoD cares about its people, and would set an example for the rest of the country.

(U) DoD should also support continuing FEMA research on protection of industrial assets.

## X. SUPPORTING TECHNOLOGY (U)[9]

(U) The Panel reviewed the status of the technical base necessary for a sound strategic defense. Key programs were graded by feasibility and component availability, and some recommended actions emerged.

~~(S)~~ Technology always shows up as a laundry list, but some highlights follow:

- The technology for OTH-B radars and DEW improvements are in hand. Proceed.

(b)(1)
[redacted]

- The possible evolution of a low-observable stealth bomber and cruise missile threat to

[9]See Annex 9, "Supporting Technology".

the U.S. should be recognized and a vigorous R&D program in countering stealth platforms carried out.

- Both exo- and endoatmospheric (b)(1) [redacted] may be important growth paths for BMD, but there are questions that must be answered about their potential effectiveness before committing to serious development.

## XI. ISSUES NOT CONSIDERED (U)

(U) The Panel did not examine the defense of SLBM launchers (submarines) for several reasons.

(U) First, the subject is highly classified and is under regular review by other DSB panels (Fubini).

(b)(1)

[redacted]

~~(S)~~ Likewise, the Panel did not examine the defense of

(b)(1)

[redacted]

## XII. IN SUMMARY (U)

~~(S)~~ The 1981 DSB Summer Study reviewed the entire strategic defense posture of the U.S.

- $C^3I$ is the most serious problem and merits urgent, top level attention.
- The solutions to the problems of strategic defense require both policy and procurement actions.[10] The policy actions can be accomplished within a year, and the hardware problems can be solved during this decade. (See Table 3.)
- To assure the availability and execution of the (b)(1) [redacted] above the current POM is needed over the next ten years. We strongly urge this be done.
- A reasonable level of [redacted] (b)(1)

[10]See Annexes 10-12, "Proposal for an Integrated Strategic Defense System", "Arms Control Implications", and "Nuclear Release and LUA Considerations".

(b)(1),(b)(5)

(b)(1)

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APPENDIX A

TERMS OF REFERENCE

THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

23 JUN 1981

RESEARCH AND
ENGINEERING

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: DSB Summer Study: Strategic Defense

You are requested to undertake a Summer Study on Strategic Defense, addressing U.S. and Soviet capabilities to defend their respective homelands and their allies against strategic attack.

The political and technical environments relating to the defense of the U.S. and its allies have undergone significant change in the past few years. These changes include:

- A marked increase in the number and capability of re-entry vehicles in the Soviet offensive force, and their ability to fractionate their SS-18s.
- Significant advances in target acquisition, tracking, and discrimination, as well as in information processing, and the ability to net their radar defenses.
- The advent of the modern long-range cruise missile, and the existence or potential existence of cruise missile defenses.
- Production of the Soviet Backfire bomber, and its utilization.
- The growing importance of U.S. and Soviet space systems.
- Soviet development of an ASAT capability.
- Proposed basing modes for M-X which allow a small number of ABM interceptors to provide significant leverage.
- Growing proliferation of nuclear weapons.

As a result, a re-examination of strategic defense policy, missions, priorities, posture, and capabilities is needed. This review should include defense against ballistic missiles (IRBM, ICBM, and SLBM), air-breathing vehicles (cruise missiles and bombers), and space systems.

Specific findings and recommendations for U.S. strategic defense policy and programs are needed in answer to the following questions:

1. What is the present and projected capability of Soviet strategic defensive systems? What are the combined effects of the several elements (civil, air, and ABM) of Soviet defense and the several layers (barrier, overflight, and terminal) of air defenses. Are there vulnerabilities that the U.S. could reliably count on?

2. What should be the role of U.S. strategic defense capability vis-a-vis offensive retaliation as a deterrent to nuclear war? Can the U.S. meet the objectives should deterrence fail if there is an imbalance in defenses?

3. What should be the mission priorities for a strategic defense system? What should we try to consider defending: NCA, $C^3I$ assets, ICBM forces, bombers, urban-industrial targets, population?

4. What is the present and projected state of the art in U.S. strategic defensive systems? What sort of raids can be defended against at reasonable cost?

5. Ballistic missile defense. What is the history, what are the alternatives, and what BMD program(s) should be pursued, at what level of funding? How do these recommendations change if M-X is deployed in a multiple aim point basing mode?

6. Bomber defense. What is the history, alternatives, and recommended program?

7. Cruise missile defense. What alternatives are available? What programs should be pursued?

8. ASAT. What are the alternatives and recommended programs? Should the U.S. allow uninhibited Soviet reconnaissance in the aftermath of an attack?

9. What should the U.S. position be on the ABM treaty? What are the arms control implications of the alternative programs discussed above?

10. What contribution to strategic defense do $C^3I$ systems make? What improvements or additions are needed to improve their survivability, endurance, and reconstitution?

11. Are there synergistic effects between civil, air and ABM defenses and what, for the U.S., is the best combination of these?

12. What nuclear release procedures are dictated by the strategic defense alternatives recommended?

13. Are the basic technologies needed for future strategic defense systems being pursued with appropriate priority and resources? If not, what changes should be made?

This Summer Study topic will be sponsored by Dr. James P. Wade, Jr., Principal Deputy Under Secretary of Defense for Research and Engineering. Mr. Thomas C. Reed has agreed to serve as Chairman and Mr. Verne L. Lynn, Director, Defensive Systems, OUSDRE/S&TNF, will serve as Executive Secretary.

(b)(6)

[redacted]

~~SECRET~~

Log No. 81-0892

# Report of the Defense Science Board 1981 Summer Study Panel on STRATEGIC DEFENSE (U)

## Volume 1

October 1981

Office of the Under Secretary of Defense
for Research and Engineering
Washington, D.C. 20301

Classified by: USDRE
Declassify on: 31 August 1987

~~SECRET~~

# Report of the Defense Science Board 1981 Summer Study Panel on STRATEGIC DEFENSE (U)

## Volume 2

October 1981

Office of the Under Secretary of Defense
for Research and Engineering
Washington, D.C. 20301

Classified by USDRE
Declassify on 31 August 1987

~~"NATIONAL SECURITY INFORMATION"~~
~~Unauthorized Disclosure Subject~~
~~to Criminal Sanctions~~

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

15 October 1981

MEMORANDUM FOR SECRETARY OF DEFENSE

THROUGH THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: Final Report of Defense Science Board 1981 Summer Study on Strategic Defense - INFORMATION MEMORANDUM (U)

~~(S)~~ The attached report of the Defense Science Board 1981 Summer Study on Strategic Defense was prepared under the Chairmanship of Mr. Thomas C. Reed. The principal purposes of the study were, generally, to assess the U.S. and USSR capabilities to defend their respective homelands against strategic attack and, specifically, to re-examine U.S. strategic defense policies, missions, priorities, posture and capabilities in the face of ballistic, air-breathing and space-based threats.

~~(S)~~ The Panel members generally concluded that the USSR maintains a defense-in-depth against air-breathing threats, modest ballistic missile defense and anti-satellite systems, and a significant civil defense program. The Panel also concluded that U.S. strategic defenses are [redacted] (b)(1)

~~(S)~~ To bolster U.S. strategic defense posture, the following key recommendations were made:

(b)(1) [redacted]

~~(S)~~ 2. Decide on a BMD system and its deployment [redacted] (b)(1)

~~(S)~~ 3. Improve CONUS air defense capability by proceding with programs for improvement of attack warning and assessment

(b)(1) [redacted]

Classified by: USDRE
Declassify on: 31 August 1987

~~(S)~~ 4. Support the FEMA plans for evacuation and sheltering of the civilian population and for physical protection of military functions and industrial assets.

~~(S)~~ 5. Assure funding for adequate technology development [redacted] (b)(1)

~~(S)~~ 6. Organize $C^3I$ responsibility and fund a $C^3I$ improvement program [redacted] (b)(1)

Other key recommendations to your staff, the OJCS, or the Services are spelled out in the Executive Summary of the report. I recommend that you read the entire report. I am sure that the implementation of the report's recommendations, consistent with Administration policies, is of prime concern to us all and I solicit your personal support in that regard.

(U) I plan to distribute this report as an official DSB report to the persons and organizations named on the attached list unless you wish a more restricted distribution.

for
Norman R. Augustine
Chairman

Attachment:
As Stated

DISTRIBUTION: Approved __________

Disapproved __________

Other__________

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE
BOARD

1 October 1981

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of Defense Science Board 1981 Summer Study on Strategic Defense (U)

(U) Attached please find Volume I of the final report of the Defense Science Board 1981 Summer Study on Strategic Defense. The annexes contained in Volume II are being provided under separate cover.

(b)(1) [redacted]

(S) The key recommendations of the Study are as follows:

(S) 1. Organize $C^3I$ responsibility and fund a $C^3I$ improvement program [redacted] (b)(1)

(b)(1) [redacted]

(S) 4. Improve CONUS air defense capability by proceeding with programs for improvement of attack warning and assessment [redacted] (b)(1)

(S) 5. Support the FEMA plans for evacuation and sheltering of the civilian population and for physical protection of military functions and industrial assets.

(S) 6. Assure funding for adequate technology development in support of strategic defense, [redacted] (b)(1)

(U) I solicit your assistance in implementing the complete set of recommendations contained in the report. A copy of the detailed implementation plan is attached.

(U) I express my greatest appreciation for the diligent work provided by the Panel members and your support staff in San Diego in preparing this most crucial study. I add an additional word of thanks to your support staff in helping me to prepare outbriefings for key Administration officials. These efforts could not have been possible without the outstanding cooperation and dedication of all study group participants.

Thomas C. Reed

Thomas C. Reed
Chairman
Summer Study on
Strategic Defense

Attachments:
As Stated

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ANNEXES

TABLE OF CONTENTS (U) (Continued)

Annex 1

## HISTORY OF STRATEGIC DEFENSE

The first two Secretaries of Defense (James Forrestal and Louis Johnson) assigned very little priority to strategic defenses. During their terms, a radar screen was planned and civil defense options were evaluated, but there was no threat to the U.S. that justified a major strategic defense program. U.S. strategic deterrence vis-a-vis the U.S.S.R. relied on the offensive threat of the U.S. Air Force Strategic Air Command (SAC).

The Soviet detonation of a nuclear weapon in the fall of 1949 and intelligence community projections concerning Soviet long-range bombers capable of delivering a nuclear weapon lent some urgency to the development of a strong air defense system. The advent of hostilities in Korea also contributed to intensified congressional interest in defenses. As indicated in Figure 1, this interest was translated into more substantial levels of program funding in the early 1950s. The Air Defense Command began to procure interceptor aircraft and aircraft control and warning systems and the Federal Civil Defense Administration (FCDA) began evaluating shelter and evacuation options. However, SAC remained the preeminent U.S. strategic force in the early 1950s--neither air defense nor civil defense contributed significantly to the military balance.

Under the Eisenhower Administration, Secretaries of Defense Charles Wilson and Neil McElroy continued to stress continental air defense capabilities. An effective defense of the North American continent required the cooperation of the U.S. Air Force (interceptors and land-based radars), the U.S. Navy (picket ships), and the U.S. Army (antiaircraft guns and missiles) as well as the Canadian armed forces. To achieve U.S. and Canadian air defense objectives, the bilateral U.S./Canadian North American Air Defense Command (NORAD) was established in 1957. By that time, the Army was deploying Nike air defense missile units and the Air Force long-range

(b)(1)

surveillance radar systems were becoming operational. By the mid-1950s, strategic defense research, development, and acquisition expenditures reached their maximum levels, approximately 8 billion dollars in Fiscal Year (FY) 82 dollars. As both the funding and objectives of strategic defense expanded, the inter-service (e.g., the Army air defense programs versus the Air Force air defense programs) and intra-service (e.g., Air Force SAC programs versus Air Force Air Defense Command programs) rivalries over dollars, missions, and roles also increased.

As the U.S. air defense capability was beginning to mature, a new threat to U.S. national security appeared--the intercontinental ballistic missile (ICBM). Antiballistic missile (ABM) defense concepts--now called ballistic missile defense (BMD) concepts--were developed concurrently with the ICBMs as both the U.S. and U.S.S.R. ICBM programs grew in the late 1950s. Consequently, when the Atlas missile became the first operational U.S. ICBM in 1960, the U.S. Army Nike Zeus BMD system was already undergoing field testing. In the late 1950s, the Department of Defense (DoD) conducted a major review that concluded that air defense systems would not be survivable in a ballistic missile threat environment. Moreover, the intelligence community and the DoD were beginning to realize that the estimates of Soviet bomber force levels and capabilities as projected in the early- and mid-1950s overstated the Soviet strategic bomber programs. Consequently, Secretary of Defense Thomas Gates noted in his FY 60 Annual Report that, because of the shift in the threat, funding priorities for strategic defense systems would also shift--from air defense towards ballistic missile defense. These program shifts resulted in constructing the Ballistic Missile Early Warning System (BMEWS), assigning the highest national priority to development and testing of Nike Zeus and city defense BMD systems, and significantly reducing air defense funding. The Office of Civilian and Defense Mobilization (OCDM) replaced FCDA in 1958 as the organization with the principal responsibility to provide civil defense. In the late 1950s, continuity of government emerged as a priority civil defense objective, but national-level population sheltering and crisis relocation options were never funded.

Under the Kennedy and Johnson Administrations, Secretary of Defense Robert McNamara continued to accelerate BMD research and development programs and deemphasize air defense programs. The Berlin Crisis in 1961 and the Cuban Crisis in 1962 spurred U.S. interest in (and funding of) civil defense programs, but the momentum and increased funding quickly eroded. Secretary McNamara also recognized the potential of a future space threat, particularly the then near-term threat of orbiting or fractional orbiting nuclear bombs. Space surveillance and satellite interceptor programs were formulated to address this contingency and a limited antisatellite capability was proclaimed by President Johnson in 1964.

Secretary of Defense Robert McNamara viewed strategic deterrence in terms of a strategic policy based on the concept of "assured destruction." Arms controls were viewed as consistent with this strategy while strategic defenses, particularly BMD, were not. Moreover, it appeared that Secretary McNamara was not convinced that a BMD was technically feasible for defending population against a Soviet threat. By the mid-1960s, the Peoples Republic of China had initiated testing of nuclear weapons and was developing strategic nuclear delivery systems. In late 1967, Secretary McNamara announced deployment of the Sentinel BMD system whose rationale was to defend against a projected modest Chinese ballistic missile threat rather than a larger, more sophisticated Soviet threat. This was the first official shift away from the original Nike-Zeus and Nike-X mission objective of protecting U.S. cities, their people, and their industries against a Soviet ICBM threat.

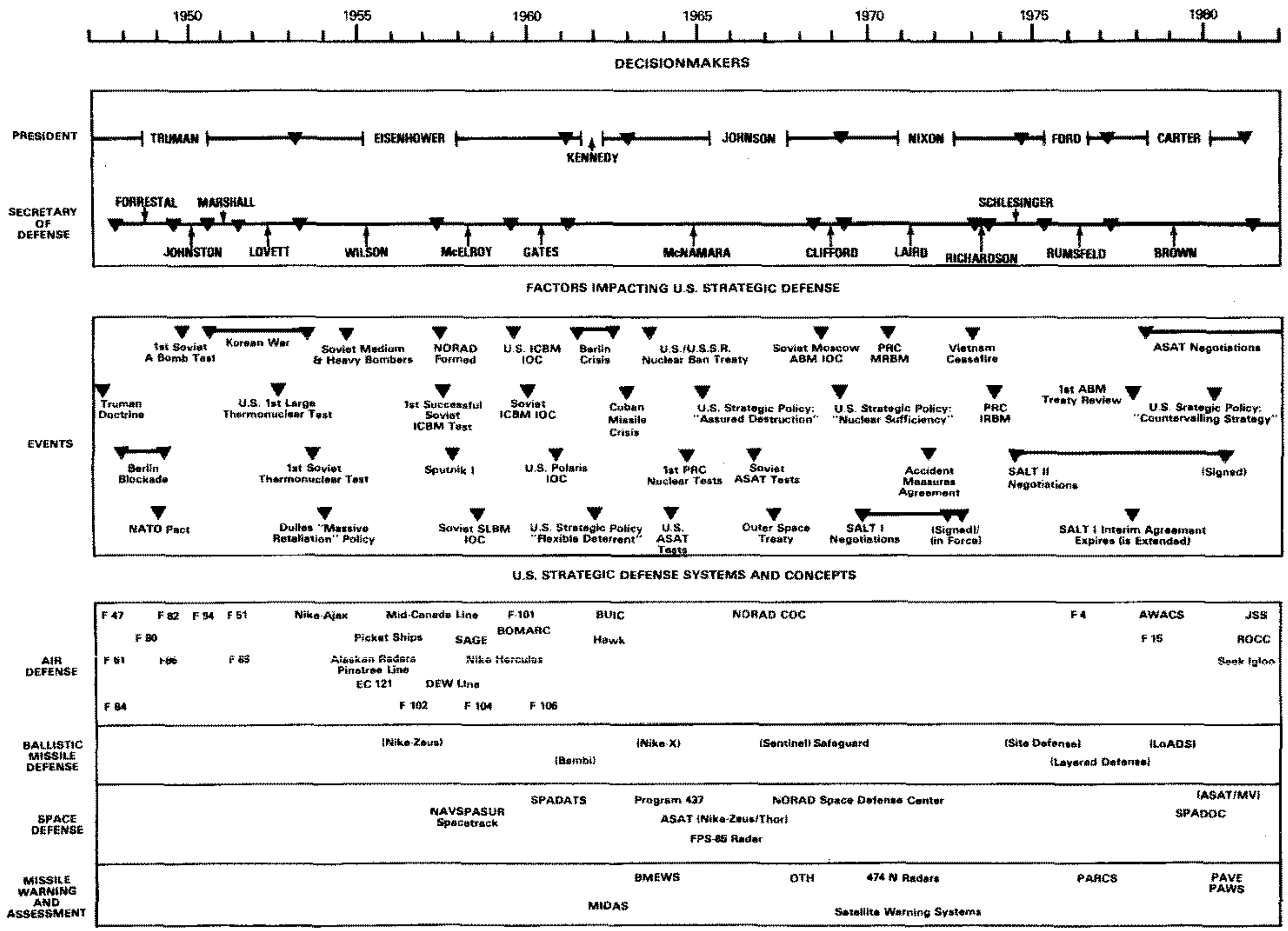
The rapid deemphasis of U.S. continental air defense, the fiscal and political pressures on the DoD budget resulting from U.S. involvement in Viet Nam, and the commencement of Strategic Arms Limitation Talks (SALT) in the late 1960s all contributed to a significant decrease in U.S. strategic defense expenditures under the Nixon Administration and Secretary of Defense Melvin Laird. As SALT I negotiations proceeded, there was increasing U.S. public, congressional, and DoD debate concerning the technical feasibility and cost of BMD. Early in 1969, Secretary Laird evaluated the U.S. BMD program. As a result of the evaluation and the ongoing

BMD debate, the Sentinel system evolved into the Safeguard system whose primary mission was defense of the U.S. Minuteman ICBMs. The U.S. also began to explore limitations on BMD systems.

From a U.S. congressional perspective, the signing of the Antiballistic Missile Treaty in May 1972 precluded an extensive BMD deployment; significantly reduced the sense of urgency for BMD research and development, and, hence, provided a rationale for significantly reducing the U.S. BMD budget. Actually, U.S. BMD research and development (R&D) budgets had been decreasing since the late 1960s. By comparison, the Soviet BMD program appears to have grown at a steady rate since the signing of the ABM Treaty. SALT I--the ABM Treaty and the Interim Agreement With Respect to Limitations of Strategic Offensive Arms--solidified U.S. dependency on a policy and force posture based on the concept of mutual assured destruction and, in effect, also minimized the perceived requirement for both air and civil defense. Working within those strategic policy guidelines, Secretaries of Defense Schlesinger, Rumsfeld, and Brown concentrated on strategic offensive and attack warning and assessment programs and relegated other strategic defense efforts to relatively low funding levels (e.g., on the order of 5 to 10 percent of the total strategic forces budget, and 1 percent of the total DoD budget).

This history is illustrated in Figure 2 and is detailed in the following five sections.

**FIGURE 2.**
**HISTORY OF STRATEGIC DEFENSE — 1947 TO 1981**




NOTE: ( ) denotes a system concept rather than an operational system.

AIR DEFENSE

After World War II the U.S. became increasingly aware of the potential of a Soviet nuclear threat and U.S. intelligence community and Department of Defense estimates in this period consistently projected an extensive Soviet long-range bomber capability. The U.S. decision to develop new jet bomber aircraft for intercontinental nuclear delivery missions probably influenced this U.S. perception of Soviet program objectives. Air defense forces had been minimal in the 1940s and early 1950s, but the outbreak of the Korean War in 1950, coupled with Soviet atomic testing and some real evidence of Soviet long-range aviation bomber development programs, brought about increased congressional interest in strategic air defense and a sharp upturn in U.S. air defense preparedness. A large and elaborate North American air defense system, designed primarily to defend against a postulated massed attack by Soviet long-range bombers, was built in the 1950s as a cooperative effort between the U.S. and Canada.

During the early- and mid-1950s, North American anti-bomber defenses expanded from the defense of a few vital areas to an air defense system that covered, at least to some extent, the whole continent. During the early 1950s, the emphasis was on developing air defense weapon and warning systems. An integrated air defense did not exist. By fiscal year 1955, Secretary of Defense Charles Wilson noted a considerable increase in the defense of North America. U.S. air defense zones were being deployed principally along the U.S. borders because there was better peripheral radar coverage, many major U.S. cities and strategic assets were located near the border, and intercept missiles utilizing nuclear weapons could be employed in places where the intercept area was not located over populated areas (e.g., over water in the Atlantic or Pacific).

Throughout the remainder of the Eisenhower Administration, the U.S. strategic air defense systems underwent continuous modernization. The U.S. and Canada integrated operational control of their air defense forces in 1957 by jointly establishing the North American Air Defense Command. By the end of 1959, all-weather supersonic aircraft made up the bulk of the manned interceptor force; every important urban-industrial area of the U.S.

was defended by Army Nike surface-to-air missiles (SAMs), which had replaced antiaircraft gun units; and Air Force BOMARC SAMs were being introduced at air bases along the northern periphery of the United States. Command and control of these air defense elements was exercised through Semi-Automatic Ground Environment (SAGE) Regional Control Centers. The number of radar stations on the North American continent had increased from 65 in 1951 to over 300. In addition, networks of long-range surveillance radars--the Distant Early Warning (DEW) Line, the Mid-Canada Line, the Pinetree Line, and an Alaskan network--had been built to provide early warning in the north, the direction from which a bomber attack was considered most likely to come. A fleet of Airborne Early Warning radar aircraft, Navy picket ships, and "Texas Towers" provided extensions of this early warning coverage on the eastern and western overwater flanks.

As the U.S. air defense system was maturing in the late 1950s, the U.S. perception of the Soviet threat to the Continental U.S. (CONUS) was changing. In 1957, the U.S.S.R. launched the first completely successful ICBM (i.e., the huge SS-6 Sapwood) and later in the year they launched Sputnik I using the same booster. By 1960, the U.S.S.R. had elevated the Strategic Rocket Forces to the status of an Armed Service, deployed (albeit in small numbers) the SS-6, and initiated development of the second generation of ICBMs (SS-7 and SS-8). By this time, it had also become clear to the U.S. that the Soviet Union did not intend to deploy large numbers of long-range bombers (as had been projected since World War II) and that the predominant threat to the continental U.S. was shifting to Soviet ballistic missiles.

As a result of the shift in the Soviet threat, U.S. air defense programs were reoriented and improvements to the existing anti-bomber defenses during the 1960s were limited primarily to reducing their vulnerability to ballistic missile attack. In this context, a semi-automated backup system for the SAGE control centers, termed Backup Intercept Control (BUIC), was established and manned interceptor squadrons were dispersed. In the same period, the number of radars, radar sites, control centers, manned interceptor squadrons, and SAM units was substantially reduced.

In November 1967, Secretary of Defense McNamara approved a plan for modernizing continental air defenses, which called for additional major reductions in air defense forces. The plan called for the replacement in the mid-1970s of the then-current system with a force of Airborne Warning and Control System (AWACS) aircraft, over-the-horizon radars, and an improved interceptor. This modernized force would pay for itself in about ten years through lower operating costs, which were to be achieved mainly through reductions in the air defense ground-based command and control structure.

Reductions in active air defense forces continued into the 1970s as a result not only of the modernization plan, but also as a result of the dramatic growth in the ballistic missile threat and the decision not to deploy ballistic missile defenses. According to the rationale that prevailed in the 1960s and 1970s, if the greatest threat to the U.S. was from ICBMs and submarine-launched ballistic missiles (SLBMs), and these were not defended against, then the maintenance of substantial and expensive anti-bomber defenses could not be justified. In addition, highly vulnerable air defense installations would be unlikely to survive a ballistic missile attack on the U.S. As a result, during the 1960s and 1970s, the number of DEW Line radars had been reduced by approximately 60 percent, other long-range radars by 70 percent, and control centers by over 80 percent, from the numbers existing in 1959.

The low priority and resources accorded to continental air defense by the U.S. since the early 1960s are reflected by the thin and penetrable aircraft defenses it currently maintains. The remaining limited continental air defense forces were and are maintained to control peacetime access to North American airspace and to provide some minimum level of air defense in the event of war. The current NORAD mission is to provide warning and characterization of a bomber attack against U.S. and Canadian strategic assets and, hence, to deny the U.S.S.R. a no-warning attack option against targets such as the U.S. strategic offensive forces and command, control, and communications ($C^3$) sites. In contrast, the Soviet Union, faced with a formidable bomber threat from the U.S., Europe, China, and other surrounding geographic areas, has committed enormous resources to air defense since the mid- to late 1950s. The Soviet air defense system that has evolved is characterized by in-depth barrier, area, and point defenses made up of massive numbers of radars and increasingly sophisticated SAMs and manned interceptors.

Throughout the 1960s and 1970s, the U.S. has maintained several air defense system technology programs to provide warning and defense against both bomber and potential future cruise missile threats. Early warning of bomber attacks from northern approaches to North America continues to be provided primarily by the DEW Line, which was designed in the early 1950s to provide warning of medium- and high-altitude bomber attacks and thus has gaps in its low-altitude coverage. The old Alaskan radar network and the Pinetree Line (consisting of 24 long-range surveillance and height finder radars stretching across Southern Canada) remain operational but also have significant gaps in their radar coverage, particularly at low altitudes. Each of these systems has become increasingly more expensive to maintain. The Mid-Canada Line ceased operation in 1965. New, more effective, replacement line-of-sight radar systems have been designed and developed. Over-the-Horizon Backscatter (OTH-B) radar has been under development since the 1960s for bomber detection and warning. These systems have not yet been deployed.

The fixed radar complex, which has been performing CONUS air surveillance, is being phased down through implementation of a Joint Surveillance System (JSS) of 46 radars to be operated jointly by the Federal Aviation Administration (FAA) and the Air Force for both air traffic control and air defense purposes. Seven obsolescent and costly SAGE and BUIC centers within CONUS are being replaced with five Regional Operations Control Centers (ROCCs). Installation of the ROCCs, which utilize modern solid-state computer technology to perform command and control, will permit reduced manning and save operating and maintenance costs.

A major advance in the air defense posture is the E-3A AWACS aircraft, which offers mobility and low-altitude look-down radar capability. However, while there are AWACS designated for NORAD in peacetime, the Joint Chiefs of Staff (JCS) would determine the allocation of the AWACS in a period of crisis. All dedicated SAMs have been phased out of continental air defense roles and no new dedicated strategic air defense interceptors have been added to the NORAD forces.

Development of technology and concepts for space-based detection and tracking of a bomber threat (and, eventually, a cruise missile threat) has been under way as an alternative to ground-based radar. Space-based radar and infrared sensing concepts offer the potential of increased warning time and perhaps reduced vulnerability.

The Air Force completed a major reorganization in 1980, transferring management responsibilities for the Air Defense Command to the Tactical Air Command, the Strategic Air Command, and the Air Force Communications Command, while maintaining NORAD in a position of operational control.

BALLISTIC MISSILE DEFENSE

After World War II, both the U.S. and the U.S.S.R. established research programs to develop intercontinental missile systems. However, the early missile programs experienced technical problems. The primary strategic defense issue was bomber defense, particularly after the first Soviet fission bomb test in 1949 and fusion bomb test in 1952. As U.S. intermediate-range ballistic missile (IRBM) system technology improved and intelligence concerning Soviet IRBM and ICBM programs became available, interest in U.S. antiballistic missile system (or ballistic missile defense) concepts increased.

The decision to fund an aggressive BMD research and development program was made during the Eisenhower Administration and the U.S. BMD program evolved as both the U.S. and the Soviet Union developed the capability of delivering thermonuclear weapons with ICBMs. By the mid-1950s the U.S. was developing the Atlas ICBM; the U.S.S.R. was developing the SS-6 Sapwood ICBM; and both the U.S. and U.S.S.R. were evaluating the feasibility of extending existing air defense weapon system technology to achieve the capability to intercept ICBM reentry vehicles.

In 1955, the U.S. Army initiated a study program to evaluate and develop new missiles and radars capable of countering ballistic missiles as well as future air-breathing threats. This effort, called the Nike II Study, led to a decision to develop the Nike-Zeus system. The primary mission objective of the Nike-Zeus system was the defense of U.S. cities (i.e., people and industry). Defense of other strategic systems, the national command authority, and key command and control assets were also considered. Major components of this system--the Zeus Acquisition Radar, the Discrimination Radar, the Target Tracking radar, and the Zeus interceptor--were being developed in the late 1950s by the Army while the Advanced Research Planning Agency (ARPA), Air Force, and the Navy were studying alternative BMD concepts and the U.S.S.R. was developing its first BMD systems.

Two Soviet missile successes--the first completely successful ICBM test (August 1957) and the launching of Sputnik I (October 1957)--accelerated

DoD interest in BMD. In 1958, Secretary of Defense Neil McElroy assigned top priority to Nike-Zeus research and development. After becoming Secretary of Defense in 1959, Thomas Gates requested an evaluation of U.S. defense objectives and missions. As a result of this evaluation, air defense was deemphasized, BMD was recognized as the most stressing, and hence, primary strategic defense requirement and the Army was assigned primary responsibility for BMD development, thus reducing, but not eliminating, the interservice competition. Field testing of the Zeus missile started in 1959; tracking data from U.S. ICBMs first became available in 1961; and the first partially successful intercept of an Atlas D missile occurred on 19 July 1962 at the Kwajalein Test Range. These tests permitted ARPA and the Army to conduct early reentry physics and related measurements programs at the Kwajalein Range in an attempt to improve the ability of the BMD system to discriminate between the incoming reentry vehicles and other possible objects (e.g., booster fragments and penetration aids) within the view of the BMD radars.

The U.S.S.R. conducted several research and development programs in the early 1960s that the U.S. intelligence and DoD communities assessed to have potential BMD capabilities. [redacted] (b)(1) ABRES programs established a better understanding of the implications of defense penetration techniques to both offensive and defensive system capabilities, but this understanding proved fatal to the Nike-Zeus system. While the Nike-Zeus system appeared to have a potential capability against contemporary ICBMs such as the Soviet SS-6 and SS-7, the ability of the Nike-Zeus system to handle projected large, complex threat environments including both reentry vehicles (RVs) [redacted] (b)(1)

In January 1963, Secretary of Defense Robert McNamara directed the priority development of a BMD system incorporating the most advanced technology available. This system, designated Nike X, included a large, hardened, electronically steered, multi-function radar (the MAR), and the high-performance Sprint interceptor, which utilized smaller warheads and relatively small missile tracking radars. Nike X was to be capable of tracking and discriminating between thousands, and engaging hundreds, of targets--a feasible objective against simple targets. However, the ability of ABRES designers to develop new penetration concepts more rapidly than BMD radar and data processor designers could respond to each new threat soon made the Nike X objectives appear to be unrealistic. The cost of the MAR soon became prohibitive, leading to the development of two other radar systems--the Perimeter Acquisition Radar (PAR) and the Missile Site Radar (MSR). Also, the Nike X primary mission objective--city defense against a Soviet attack--was perceived as inconsistent with Secretary McNamara's concept of deterrence (i.e., assured destruction). Consequently, for both political and technical reasons, BMD missions other than city defense and threats other than Soviet ICBMs and SLBMs began to receive serious attention.

By 1964, two additional factors affected U.S. BMD options. A new type of defensive warhead permitted the use of a large-payload, long-range interceptor capable of destroying RVs within a relatively large volume of space and thus reducing the effectiveness of chaff (b)(1) [redacted] Also, the Peoples Republic of China began testing nuclear weapons and was developing its first medium-range ballistic missile. U.S. experts projected a Chinese ICBM threat to the U.S. by the early- to mid-1970s. This additional "requirement" for area defense against an Nth country threat as well as the new exoatmospheric capability contributed to justification for developing of the Spartan missile.

In September 1967, Secretary of Defense McNamara announced the deployment of a limited defense of the U.S. for protection against a potential Chinese threat and an option to expand this defense to protect Minuteman against a Soviet threat. The system utilized components that had been developed in the Nike X Program--Sprint, Spartan, and MSRs--plus the PAR.

This system was to be known as Sentinel. McNamara's announcement formalized the shift away from city defense against a Soviet threat. Meanwhile, the Soviet ABM-1 system was deploying at Moscow and both the U.S. Air Force and ARPA, in addition to the Army, were pursuing BMD concepts.

Early in 1969, the Nixon Administration revised BMD mission priorities and objectives to be: (1) defense of U.S. land-based retaliatory forces against a Soviet threat, and (2) a growth option to provide area defense against an Nth country threat. The system components were the same as the Sentinel components, but the system name was changed to Safeguard. While 12 Safeguard sites were planned, construction was initiated at only 2 of these sites, Malmstrom in Montana and Grand Forks in North Dakota. By this time, the U.S.S.R. had deployed its ABM-1 System (64 Galosh interceptors) around Moscow and was trying to develop a second generation system. However, Soviet BMD-related technology lagged comparable U.S. technology and appeared to provide little capability against the U.S. ICBM/SLBM threat.

The ABM Treaty, signed in May 1972, was intended to preclude a significant territorial or regional BMD capability. The ABM Treaty and its 1974 Protocol have the following attributes:

- Each side is permitted ABM defenses at one site: either centered on its national capital (the U.S.S.R. choice), or centered more than 1300 km from the national capital and containing ICBM silo launchers (the U.S. choice). The radii of the deployment areas are each 150 km. Each side is permitted to exchange its deployment site location to the other choice, one time.
- The ABM system will consist of no more than 100 ABM launchers and no more than 100 ABM interceptor missiles at launch sites, and:
  - In the case of a national capital defense, ABM radars within no more than six complexes having a diameter no greater than 3 km each. (The Soviet Try-Add radars are not applicable.)
  - In the case of a silo defense, two large, phased-array radars (power-aperture equal to or greater than 3 million watt-meters$^2$) and no more than 18 smaller ABM radars.
- The treaty specifically prohibits:
  - Development, testing, and deployment of ABM systems or components (present or "future" types) which are sea-based, air-based, space-based, or mobile land-based.

- -- Development, testing, and deployment of launchers for launching more than one ABM interceptor missile at a time.
- -- Development, testing, and deployment of systems for rapid reload of ABM launchers.
- -- Development, testing, and deployment of ABM interceptor missiles for the delivery of more than one independently guided warhead per missile.
- -- Giving non-ABM missiles, launchers, or radars capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and testing such components in an ABM mode.

- Deployment of ABM systems based on other physical principles and including components capable of substituting for missiles, launchers, or radars. Agreed Statements provide that limitations on such systems and their components would be subject to discussion in the Standing Consultative Commission (SCC) and agreement via amendment.
- By the terms of the Treaty, the sides will conduct a review of the Treaty every five years after entry into force (3 October 1972). However, amendments may be proposed at any time.
- A party may withdraw, with 6 months notice, if it decides that extraordinary events related to the subject matter of the Treaty have jeopardized its supreme interests, (e.g., the U.S. stated unilaterally on 9 May 1972 that its supreme interests could be so jeopardized if an agreement providing for more complete strategic offensive arms limitations than those contained in the SALT I Interim Agreement were not achieved within five years. This is reinforced in the legislative history of the instrument of ratification).

To achieve compliance with the provisions of the Treaty, the U.S. continued work at the Grand Forks site, terminated work at the Malmstrom site, and decided not to build a BMD at Washington, D.C. When the Treaty was revised in 1974 to permit only one BMD deployment site for each Party, the U.S. chose Grand Forks; the U.S.S.R. chose Moscow. The Grand Forks site achieved initial operational capability (IOC) in March 1975, but this system provided a limited defense capability against contemporary or projected Soviet threats, was very expensive to maintain, and had no growth potential within the provisions of the ABM Treaty. Consequently, Congress redirected the U.S. BMD program to emphasize advanced technology and system component technology rather than the development of prototype BMD systems. Specifically, Congress directed (FY 76 Appropriations Bill) that all Safeguard operations, less those associated with the PAR, be expeditiously terminated and that the Army transfer the PAR to the Air Force (FY 77 Appropriations Act). These initiatives permitted Congress to significantly reduce the U.S. BMD budget.

In addition to the Safeguard/Sentinel programs, the U.S. was conducting research on both advanced system concepts and advanced technology programs. These efforts, which continue through today, have produced BMD concepts that, if deployed, would be smaller, cheaper, and more capable of coping with responsive threats. Beginning in the early 1970s, considerable effort was devoted to the Site Defense program, a terminal BMD system concept capable of protecting the Minuteman force or other high value targets in the face of a larger and more sophisticated threat than Safeguard was designed to handle. This program was authorized by the Secretary of Defense to develop and demonstrate prototype versions of hardware and software suitable for further development and deployment as a system, if required. The Site Defense concept envisioned autonomous modules consisting of three interactive phased-array radars, their associated data processors, and modified Safeguard Sprint interceptors. The radar would have been similar to the Safeguard MSR but smaller, less powerful, and more versatile. Commercial data processors were to be used. The interceptor missile would have had increased nuclear hardness and maneuverability. Reduced operational and maintenance costs were principal design objectives of the Site Defense concept. Ultimately, the effort was reoriented by Congress to concentrate on components and subsystems. However, a single multifunction battle management and engagement radar, the data processor, and the software were installed at Kwajalein and successfully tested. (Software for and interactive operation capability of the three radar modules were never developed.)

ARPA and the Army Ballistic Missile Advanced Technology Program also studied a broad spectrum of BMD-related technology issues. These included the High-Acceleration Boost Experiment (HIBEX) program that developed the basis for a more advanced interceptor now being considered, the Designating

Optical Tracker (DOT) program that provided the basis for much of exoatmospheric Long Wave Length Infrared (LWIR) sensing and discrimination knowledge, the Homing Overlay Experiment (HOE) that is developing the non-nuclear kill intercept technology, various directed energy studies that evaluated particle beam and high energy laser BMD system concepts, and numerous other missile, discrimination, radar, optics, and data processing technology programs related to U.S. BMD system concepts.

There is currently no operational U.S. BMD system, but the Site Defense System technology is "on the shelf." The Low Altitude Defense System (LoADS) concept includes smaller radars and interceptors designed to be deployed in a mobile basing mode with MX and to intercept RVs at very low altitude. These LoADS components are now in the preprototype demonstration phase of development. Tests to demonstrate exoatmospheric BMD optics technology options are scheduled for 1982.

SPACE DEFENSE

The potential of space for national security missions was realized long before either the U.S. or U.S.S.R. had the ability to exploit space. However, the launching of Sputnik in 1957 and the subsequent growth of both the U.S. and Soviet military as well as non-military space programs, focused the attention of military planners on the requirement for space surveillance, the ability to assure the survivability of friendly space assets, and the ability to negate hostile space systems. Subsequently, the U.S. space defense program grew under Secretary of Defense Thomas Gates (Eisenhower Administration) and the early years of Secretary of Defense Robert McNamara (Kennedy Administration).

Space surveillance, particularly the detection, tracking, and identification of satellites in orbit, was the earliest concern of the U.S. in the area of space defense. Two networks of ground-based radar sensors were established in the 1950s: the Navy's Space Surveillance System (NAVSPASUR) and the Air Force Spacetrack system. NAVSPASUR operated a "fence" of detection devices across the southern U.S. designed to indicate new space objectives passing through its field. The Spacetrack system, made up of a number of worldwide sensors, was designed for the detection and tracking of objects in space. NORAD, in 1960, was assigned operational control of these two surveillance networks, which, with other systems such as the Ballistic Missile Early Warning System and the Smithsonian camera network, together were called the Space Detection and Tracking System (SPADATS). Data from SPADATS were fed into a surveillance center at NORAD where a catalog of all space objects was maintained. Smithsonian-type ground-based optical systems (e.g., Baker-Nunn cameras) for satellite surveillance beyond effective radar range, were added to Spacetrack beginning in 1962 at sites around the globe. A large FPS-85 phased-array space detection and surveillance radar was also installed in 1965 at the Eglin Air Force Base, Florida.

In the area of antisatellite (ASAT) weapons, schemes for negating satellites predated the satellites themselves. The first study of ASAT systems commissioned by the Air Force was undertaken in the mid-1950s, before the Soviets had launched Sputnik. The earliest U.S. studies of ASAT systems focused on two basic approaches: either a co-orbital, "killer satellite" interceptor that would be placed in orbit and then maneuvered to its target, or a direct-ascent interceptor that would rise from the earth and intercept the target when it passed overhead. With either technique, the target could be destroyed by a nuclear warhead or some non-nuclear means.

By the mid-1960s, the potential role for a U.S. ASAT capability had expanded to include countering orbital or fractional orbit bomb delivery schemes. United States ASAT capabilities were tested and established in 1964. Initially they comprised a small number of Nike-Zeus ABMs, deployed on Kwajalein Island in the Pacific, complemented and later superseded by an adaptation of the Air Force Thor IRBM deployed at Johnston Island. ASAT tests were disclosed in 1964 by President Johnson, and in early 1965 Secretary of Defense McNamara publicly stated: "We have a capability to intercept and destroy hostile satellites within certain ranges." The "Outer Space Treaty," which entered into force in October 1967, prohibited the use of space for orbiting weapons of mass destruction. Consequently, the threat of orbiting bombs decreased. The Soviet Union had begun preliminary tests of a non-nuclear, co-orbital interceptor by 1968. In 1971, the Soviets ceased flight tests of the interceptor.

Support for the U.S. space defense program was decreased in the early- and mid-1970s including phasing out the Thor ASAT system. However, the U.S.S.R. resumed ASAT tests in 1976. Subsequently, President Carter announced in 1977 that research and development on a new U.S. ASAT system would be undertaken, although he expressed the hope that arms control negotiations would lead to agreement with the Soviet Union to ban such systems. Principal U.S. space defense efforts during this period included completing the NORAD Space Defense Operations Center (SPADOC) to provide command, control, and communications for space defense operations; improving the high altitude surveillance capabilities with systems such as the Ground-based Electro-Optical Deep Space Surveillance (GEODSS) system; developing technology for space-borne LWIR sensors; and developing a new direct ascent, low-altitude ASAT system utilizing a non-nuclear warhead. The United States and the Soviet Union entered into negotiations on arms control measures for ASAT weapons in June 1978. Negotiating problems (e.g., Soviet insistence that the U.S. halt testing of the space shuttle because it possessed ASAT capabilities) and, eventually the Soviet invasion of Afghanistan in December 1979, reduced U.S. interest in this arms limitation initiative. The ASAT negotiations are currently in abeyance. The Soviet Union, which had not tested any ASATs while the talks were in progress, resumed testing in April 1980 and is credited by the U.S. with an operational ASAT capability against low earth orbit satellites.

MISSILE WARNING AND ATTACK ASSESSMENT

Since the emergence of the Soviet ICBM threat, the U.S. has had a requirement for missile attack warning and a desire to have a missile attack assessment capability. During the Eisenhower Administration, Secretary of Defense Thomas Gates first addressed ballistic missile early warning. However, it was the Kennedy Administration and Secretary of Defense Robert McNamara that first highlighted ballistic missile early warning and attack assessment. An attack assessment capability was, and is, needed to better define the attack (i.e., size, type of system, probable targets, time remaining) to maximize the information available to the national command authority, and to provide sufficient time to assure survivability of the strategic bombers, implement appropriate civil defense options for the U.S. population and industry, and permit ICBM retaliatory options (e.g., launch under attack).

As the Soviet ICBM threat materialized in the late 1950s and early 1960s, the U.S. developed and constructed a ground-based, ballistic missile attack warning capability. The Ballistic Missile Early Warning System was initially operational in 1961 and fully operational in 1963. This system employed radar stations in Greenland, Alaska, and the U.K. to provide warning against the primary threat--the northern ICBM approaches.

Development of a system of "forward scatter," over-the-horizon (OTH) radars to complement BMEWS was also undertaken in the early 1960s. These radars provided remote detection of a ballistic missile attack from the Eurasian land mass on any trajectory. The OTH system reflected radar signals off the ionosphere, and echo signals from rising ballistic missiles were picked up by remote receiving stations. This OTH system, which became operational in the late 1960s, consisted of four transmitter sites in the Far East and five receiver sites and a data correlation center in Europe.

As the U.S.S.R. developed their SLBM systems, additional U.S. missile warning systems were required. The "474N" system was developed in the 1960s and became operational in 1970. The system, designed to provide an indication of SLBM launch, consisted of seven FSS-7 "dish" radars, three each on the East and West coasts and one in Texas.

Advances in infrared technology made early warning satellites attractive. The MIDAS satellite system, equipped with sensors to detect infrared emanations from missiles shortly after their launching, was first tested in 1960. It never achieved operational status. The BMEWS, OTH, and 474N radars remained the primary means of obtaining reliable warning of an ICBM or SLBM attack until the early 1970s. However, there were steady improvements in technology throughout the 1960s and a follow-on to the MIDAS satellite system was tested during the 1967 to 1970 period. The Nixon Administration and Secretary of Defense Melvin Laird were particularly interested in the development of this "new," much more advanced strategic satellite surveillance system, which promised a good early warning capability against SLBMs and fractional orbiting bombs (FOBs).

The U.S. ballistic missile warning and attack assessment capability evolved to dependence on two very different types of systems--ground-based and satellite-based warning systems. These programs supported a "dual phenomenology" concept. This refers to a policy of covering all potential ballistic missile approach corridors with at least two different types of warning sensors.

The forward scatter OTH radar system in the Far East and Europe was phased out in 1975-76 because it was considerably less reliable than the satellite and BMEWS systems for ICBM attack warning and was sensitive to atmosphere disturbances.

The BMEWS mission became increasingly demanding as a result of the tremendous growth in the ICBM threat. Following deactivation of the Grand Forks BMD site in 1976, the BMD Perimeter Acquisition Radar located in North Dakota was converted (mostly software changes) to the Perimeter Acquisition Radar Attack Characterization System (PARCS) and retained to act as a backup for BMEWS coverage to provide a detailed ICBM attack characterization capability. PARCS was, and is, fundamentally more accurate than BMEWs although it has less extensive and less timely coverage.

The limited SLBM detection range and low reliability of the 474N "dish" radars led to their replacement by two new PAVE PAWS phased-array radars. The PAVE PAWS radars, which became operational in 1980 at sites in

Massachusetts and California, provide confirmation of any SLBM launch warning transmitted by the early warning satellites. The older FPS-85 phased-array space surveillance radar and one FSS-7 radar have been retained in Florida to partially cover possible SLBM launch areas southeast of the U.S.

BMEWS, PARCS, PAVE PAWS, FPS-85, and FSS-7 ground radars back up the satellite warning sensors, providing a second and independent verification of launch events. However, many missile warning and attack assessment problems are still unresolved. Foremost among these problems is the vulnerability of the system to hostile actions. For example, research and development programs during the Carter Administration addressed warning and attack assessment issues. Such issues included the vulnerability of segments in the warning and $C^3$ system, as well as operational problems such as false indications resulting from system malfunctions.

By comparison, the U.S.S.R. also has deployed both ground-based missile warning and attack assessment radars and space-based early warning sensors. Current Soviet ballistic missile warning, in contrast to that of the U.S., is estimated to rely more on larger numbers of BMEWS/PARCS-type ground radars (Hen House, Dog House, Cat House) and less on satellite-based sensors.

U.S. CIVIL DEFENSE

During the Truman Administration, the Civil Defense Board was created to determine War Department policies for civil defense. The Board concluded that civil defense was ultimately a state and local responsibility and recommended that a federal civil defense organization be established to guide and advise local activities. Initially the Office of Civil Defense Planning (OCDP) was established in the newly created DoD; later, President Truman placed responsibility for civil defense in the National Security Resources Board (NSRB), and on January 12, 1951, President Truman signed the Federal Civil Defense Act of 1950 (PL 920), which established the Federal Civil Defense Administration (FCDA). Under President Truman, civil defense programs emphasized in-place sheltering but these programs never progressed beyond the planning stages.

President Eisenhower promoted a rapid deployment program for evacuation and stockpiling. Congressional interest in sheltering, however, was not dead. Following development and testing of the hydrogen bomb by both the U.S. and U.S.S.R., new emphasis was placed on sheltering. A shelter versus evacuation debate in Congress resulted and the FCDA came under heavy criticism. During Eisenhower's second term, new emphasis was placed on civil defense, especially in government survival. FCDA began the first Continuity of Government (COG) program late in 1957. In July 1958, the Office of Defense Mobilization (ODM) and the FCDA were merged, creating the Office of Civil and Defense Mobilization (OCDM).

In May 1961, President Kennedy outlined to Congress new objectives for civil defense emphasizing an in-place shelter program; changed OCDM to the Office of Emergency Planning (OEP) charged with advising the President on long-range civil defense planning; assigned primary responsibility for civil defense to the Secretary of Defense; created within DoD the Office of Civil Defense (OCD); and named an Assistant Secretary of Defense to head OCD in the Pentagon. Spurred by the Berlin Crisis and increasing U.S./Soviet tension, President Kennedy again emphasized the importance of civil defense and called for a nationwide community shelter program. By 1963, the momentum for civil defense seemed to be failing, even after the Cuban Missile Crisis. After

Kennedy's death, under President Johnson, civil defense appropriations continued to drop. By April 1964, the OCD had been removed from the Office of the Secretary of Defense and placed under the Army. By the mid-1960s, the civil defense program and program objectives had become linked to the U.S. BMD program since both programs were striving to develop population and industry defense concepts. Various concepts combining active defense systems (i.e., BMD) and civil defense concepts were studied in an attempt to identify potential synergism between the two programs, but no major DoD or Congressional support emerged for the active/passive concepts. As Secretary of Defense McNamara shifted U.S. strategic policy towards the concept of assured destruction, both civil defense and active/passive concepts suffered. Both civil defense and BMD were viewed as provocative and destabilizing by the U.S. assured destruction community.

On May 5, 1972, President Nixon abolished the OCD and created a semi-autonomous agency under DoD called the Defense Civil Preparedness Agency (DCPA), responsible for population protection. In 1974, Nixon abolished the OEP and created the Federal Disaster Assistance Administration (FDAA), placing it under HUD, and the Federal Preparedness Agency (FPA) under GSA. From 1972 to 1976, the appropriations for civil defense increased modestly and, if inflation is considered, the funding support actually decreased slightly.

Secretary of Defense Harold Brown directed the Assistant Secretary of Defense for Program, Analysis, and Evaluation and DCPA to develop more credible options for civil defense in October 1977. Secretary Brown's objectives were to identify a civil defense program that, at a reasonable cost, would save at least one-half to two-thirds of the population in the event of a massive Soviet attack. Secretary Brown chose a program for crisis relocation and expedient sheltering of the risk populations within a 1- to 2-week warning or "surge" period. In September 1978, President Carter issued Presidential Directive (PD) 41 directing that a new civil defense policy be implemented. However, appropriate funding was not included, so no significant action has occurred.

President Carter initiated a reorganization effort to consolidate emergency planning functions of the FDAA, FPA, and DCPA, the Federal Insurance Agency (FIA), and the U.S. Fire Administration (USFA). In April 1979, the President incorporated these agencies into the Federal Emergency Management Agency (FEMA).

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Annex 2

SOVIET DEFENSIVE CAPABILITIES (U)

OVERVIEW (U)

(U) Tradition, doctrine and history have made homeland defense against all forms of attack a central preoccupation of the Soviet polititcal and military leadership. Thus, measures for both active and passive strategic defense have been aggressively pursued both in deployment and R&D by the Soviet state.

(U) Many generations of surface-to-air missile systems, air defense radars, interceptor aircraft and air-to-air missile systems have been developed and deployed since World War II. Contrary to the situation in the U.S., the advent of strategic ballistic missiles has not diminished, in any way, the pace of Soviet programs in strategic air defense.

(U) Major programs in ballistic missile defense have also been pursued by the S.U. since the infancy of the strategic ballistic missiles. The ABM Treaty of 1972 limited deployments, and, to a lesser extent R&D, but the Soviets have continued both R&D and deployment programs at least to the full extent permitted by the Treaty; by contrast, the U.S. has phased out even the deployed ABM system permitted by the Treaty and scaled down R&D efforts on ABM as well. Soviet R&D, since the signing of the ABM Treaty, has been at a much higher level than U.S. efforts and has been directed much more strongly toward system development than the U.S. program, which centers on technology and concept demonstration. Thus, a major modernization program is currently under way in the deployed ABM system situated around Moscow.

(U) The Soviets have an operational anti-satellite system effective up to orbial altitudes of 1,000 miles. They are pursuing an active development and test program to improve these capabilities.

(U) Large Soviet investments have also been made and are currently being increased in a large peripheral ballistic missile warning and attack assessment radar system and satellite electro-optical launch detection system, which may also have roles in ABM battle management. And civil defense, which has been virtually moribund in the U.S. since the early 1960's, has been actively and continuously pursued in the Soviet Union based on the dual concepts of protective sheltering and evacuation. Although there is signficant disagreement in the intelligence community conerning the effectiveness of Soviet civil defense, there is little doubt that there is a large imbalance between Soviet and U.S. postures in this area.

(U) Newly emerging technologies, such as directed energy beams, are being vigorously pursued for strategic defense applications. While progress toward specific system applications is difficult to assess accurately at present, the scale of the effort is large, many times larger than the corresponding U.S. effort. To the extent the pace of technological development permits, it is to be expected that the Soviet Union will be in a position to proceed toward operational systems earlier than the U.S.

~~(S)~~ The Soviet ballistic missile defenses operational today are not formidable. The large perimeter radars are soft and undefended. The Moscow system is soft, vulnerable to self balckout, and has few interceptors. However, we can take little comfort from these deficiencies when the PUSHKINO radar is under construction outside Moscow and a new SPRINT-type interceptor is well along in the development cycle. In addition, the ABM-X-3 BMD system, which is capable of rapid deployment beginning as early as 1984, is being tested.

(U) All in all, there is a heavy commitment to strategic defense in the S.U. and there are continuing large investments in all operational systems areas as well as in R&D. Significant interrelated improvements in the technological levels of the S.U. in fields such as electronics, integrated circuits, signal processing computers and radars have taken place in recent years. These are already greatly enhancing the effectiveness of their new strategic defensive systems and, as deployment of these new systems proceeds, will substantially improve operational capabilities in all areas of strategic defense.

AIR DEFENSE (U)

(S) Soviet air defense has been maintained at a high level for the past thirty years. About 8,000 Early Warning (EW) and Ground Control Intercept (GCI) radars underpin the system. These have overlapping and redundant coverage and are diverse in type and frequency, although there is a large concentration in the VHF. Surface-to-air missiles, deployed at 1,200 sites (10,000 launchers), include mainly SA-2, SA-3 and SA-5 systems. These missile sites are deployed in both barrier and terminal defense configurations. The interceptor force numbers about 2,500, comprising Fishpot (SU-9 and SU-11), Firebar (YAK-28P), Flagon (SU-15), Flogger (MIG-23) and Foxbat (MIG-25).

~~(S)~~ Although concentrations of radars and SAM's are dense in the high value target area of the western Soviet Union, and the weapons themselves are reliable and effective within their performance envelopes, including a high degree of ECM resistance (such as use of monopulse), radar coverage and lethality envelopes of SAM's do not close all gaps for [redacted] (b)(1)

~~(S)~~ Soviet air defense systems, thus, have hardly been optimized [redacted] (b)(1)

~~(S)~~ To explain the continued maintenance of a large expensive Soviet air defense system [redacted] (b)(1)

(b)(1) [redacted]

(U) However, in recent years the Soviets have turned a number of technological corners in electronics, integrated circuits, signal processing and computers leading to radar systems with pulse-Doppler modulation, phased-array antennas and computer processing and control, and these are being introduced across the entire spectum of weapon systems, especially in air defense systems. The SA-10, surface-to-air missile system, has just been made operational and as these systems are widely deployed, low-altitude terminal defense effectiveness should markedly improve. A modified version of the Foxbat interceptor with look-down, shoot-down capability is in the advanced stages of development and should eventually similarly enhance low-altitude area defenses in concert with the Soviet version of the AWACS, which is also currently in development.

(U) Along with the development of air defense weapons systems effective against low-altitude penetrators, there has been an increase in acitivity in improving $C^3$ and internetting defenses required to maintain surveillance and tracking of such targets. Also, the Soviet strategic air defense organization, PVO, has been integrated with the tactical air defense organization. This would enhance planning and force operational effectiveness in utilizing tactical mobile SAM units, surveillance and GCI radars in support of strategic defense when available. Mobile tactical SAM's and associated acquisition radars with anticipated low-altitude capability are also now in the process of being deployed and extensive utilization of these and other mobile tactical SAM's could complicate manned bomber and cruise missile defense avoidance tactics, although the effectiveness of such systems against the lower radar cross-sections of cruise missiles (immersed in ground clutter) should be considerably lower than against bombers, at least for the assessed current levels of clutter rejection of these systems.

(b)(1)

[redacted]

SOVIET RADARS (U)

Big Soviet Radars (U)

~~(S)~~ The Soviet Union has deployed several tiers of defense radars, each tier having a different frequency and geographical coverage. These tiers include:

- the OTH early warning radars,
- the perimeter early warning radars (U.S. Missile Launch), and
- the large battle management radars in the Moscow area.

~~(S)~~ These large radars can be used for both early warning and attack assessment against a strategic missile attack and for battle management of the Moscow ballistic missile defense system.

~~(S)~~ They have deployed three Over-The-Horizon (OTH) radars (b)(1) [redacted] for ballistic missile launch detection (not aircraft detection) backscatter. The first of these was deployed at Nikoliev and is boresighted toward the eastern Soviet Union and China. Then the Soviets constructed the Kiev OTH which is boresighted on the center of the U.S. looking westerly around the North Pole. This was followed by a third OTH radar at Komsomolsk, near their eastern border, which is also boresighted on the center of the U.S., but looks easterly around the North Pole. Kiev and Komosomolsk provide the Soviets with early warning against a U.S. ICBM attack. (b)(1) [redacted]

~~(S)~~ The next tier of defense radars, shown in Figure 2-1, are the HEN HOUSES (including their upgrades at Pechora, Lyaki, Olenegorsk, and Sary Shagan), which provide early warning against ICBM and SLBM attacks. They are outward

(b)(1)

looking from the perimeter of the Soviet Union [redacted] (b)(1) In the mid-1970's, the Soviets began deploying two upgrades of the early warning network with additional radars: one type is a passive array working with the Olenegorsk dual HEN HOUSE and the other type is an active dual aperture array deployed at Pechora, Lyaki, and Sary Shagan. These new radars [redacted] (b)(1)

(U) When these new radars are complete, estimated to be in mid-1980's, the Soviets will be able to predict the future position of any object threatening a large area around Moscow (b)(1) [redacted]

(U) This new generation of early warning radars [redacted] (b)(1) None of these radars is estimated to have any dicrimination capability. However, they should be able to classify threats and count widely spaced objects such as (b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ The Moscow ABM defense system includes the DOG HOUSE and CAT HOUSE, which are first generation battle management radars [redacted] (b)(1) The CAT HOUSE provides some coverage against SLBM and Chinese attacks. [redacted] (b)(1)

(b)(1) [redacted]

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ In summary, the Soviets have made an enormous investment in big radars [redacted]

(b)(1)

(b)(1) [redacted]

(b)(1) [redacted]

Moscow ABM System (U)

(b)(1) [redacted]

(U) Another battle management radar called the CAT HOUSE was later added at Checkhov (southwest of Moscow) and provides some coverage of U.S. SLBMs and Chinese ICBM threat corridors. (b)(1) [redacted]

(b)(1)

[redacted]

(U) The first generation Moscow ABM system has the following vulnerabilities:

(b)(1)

[redacted]

(U) In spite of these vulnerabilities, the Soviets have continued to maintain and operate this system for the last 12 years (IOC 1969). They have continued to train TRY ADD

(b)(1) [redacted]

operators by tracking satellites, among other things and launch an average of twelve GALOSH/ABM-1B interceptors per year (six for training flights and six for continued R&D).

(b)(1) [redacted]

(U) Even though new system elements are being deployed at Moscow, concurrent development is continuing at SSMTR. The final configuration of the Moscow ABM system has certainly not yet been observed. It might logically include more than one PUSHKINO-type radar around Moscow. They will probably also fill out the interceptor complement to 100, as long as the SALT agreement is in force. If the SALT agreement is either abrogated or not renewed, the Soviets will be in an excellent position to rapidly deploy many more interceptors around Moscow.

(U) It is clear that the Soviets have a large investment in ballistic missile defense of the Moscow area and it is expected that they will continue to improve that system's capability even though their deployment pace has lagged the U.S development [redacted] (b)(1)

(b)(1) [redacted]

| SYSTEM ELEMENT | NOW | NEAR-TERM IMPROVEMENT |
|---|---|---|
| Early Warning Radar | NEW HOUSE | HEN HOUSE<br>New Perimeter Phased Arrays |
| Battle Management | DOG HOUSE,<br>CAT HOUSE | DOG HOUSE<br>CAT HOUSE |
| (b)(1) [redacted] | | |
| Interceptor | GALOSH ABM-IB | Improved GALOSH<br>SPRINT - type (?) |
| Interceptor | ABOVE GROUND - SOFT | SILO |

Figure 2-2: ~~(S)~~ Moscow ABM - Defense Elements (U)

(U) As a further upgrade the Soviets have been replacing some of their GALOSH above-ground launchers with silos. It is expected that a new GALOSH-type interceptor will be emplaced in these silos and that it might even contain LWIR optics sometime in the future. There is no evidence at this time to say that the Soviets have such a sensor for the GALOSH; however, circumstantial evidence suggests that the Soviet Union will continue to attempt to operate an exoatmospheric defense layer wherein they need some discrimination capability (b)(1) [redacted]

(b)(1) [redacted]

(U) The Soviets are also emplacing new ABM interceptor silos near the PUSHKINO radar and in other locations around Moscow. It is expected that their new SPRINT-type interceptor, now being developed as a part of the ABM-X-3 system, may be launched from these silos. This high performance interceptor has been in development for about 10 years and has been under flight test for about 5 years. The PUSHKINO radar could perform interceptor tracking and guidance functions for this interceptor and for exoatmospheric defense interceptors, as the U.S. MSR radar was built to do. This combination of the PUSHKINO radar and the two interceptors (the SPRINT-type, and the GALOSH AMB-1B) could provide a layered defense capability at Moscow.

7.3.3 The Soviet ABM-X-3 System (U)

(b)(1) [redacted] The development at the Sary Shagan Missile Test Range (SSMTR) of a new ABM system began in approximately 1969. The original ABM-X-3 system was perceived to consist of a FLAT TWIN radar, a van with three dish radars for interceptor tracking and guidance, and the SH-04 cannister-launched high-altitude interceptor.

(U) The FLAT TWIN radar is a single-face phased array mounted such that it can be mechanically steered in both azimuth and elevation. It has dual flat phased array apertures, one for transmit and the other for receiving. The system was assessed to require handover from external sources, such as the early warning radar network located on the perimeter of the Soviet Union. Once a threatening object was acquired, the FLAT TWIN would track and discriminate, and the SH-04 interceptor would be launched against the threat in order to make a high endoatmospheric intercept. [redacted] (b)(1)

(b)(1) [redacted] Then in the mid-1970's, the Soviets began testing a SPRINT-like interceptor. [redacted] (b)(1)

(b)(1)

(b)(1)

*The information on this page is Unclassified.*

(b)(1) [redacted]

(b)(1) [redacted]

(b)(1) [redacted] Based on the slow development of the SPRINT-like interceptor, the terminal underlay intercept capability of the ABM-X-3 system is not estimated to be deployable until approximately 1984. [redacted] (b)(1)

(b)(1) [redacted] ABM-X-3 system R&D is continuing at Sary Shagan, and there is a FLAT TWIN radar at Kamchatka, which is apparently used to track incoming Soviet RV's from their over land test range. [redacted] (b)(1)

[redacted] (b)(1)

~~(S)~~ The ABM-X-3 system is expected to be [redacted] (b)(1)

7.3.4 <u>Soviet Breakout Potential</u> (S)

~~(S)~~ The Soviets have capability for two kinds of ABM breakout [redacted] (b)(1)

(b)(1) [redacted]

~~(S)~~ On the other hand, breakout by deployment of the (b)(1) [redacted]

~~(S)~~ The ABM SALT agreement prohibits nationwide deployment of any ABM system such as the ABM-X-3. Furthermore, the Soviets selected to maintain the Moscow ABM system in defense of their national capital region as the one regional system allowed by the Treaty. However, as ABM-X-3 development nears completion, the U.S. must be concerned that the Soviets could [redacted] (b)(1)

[redacted] (b)(1) However, it is logical to assume that they would first defend [redacted] (b)(1)

(b)(1) [redacted]

(S) The ABM-X-3 defense would be quite effective, [redacted] (b)(1) In the three-year period, 1985-1987, the Soviets could deploy 150 to 300 radars and about 1500 to 3000 interceptors, depending on the deployment rate. [redacted] (b)(1)

(b)(1)

(b)(1)

## SOVIET STRATEGIC OFFENSE CAPABILITIES (U)

### Soviet Force Posture (U)

[redacted] By far the strongest leg of the Soviet TRIAD is the ICBM force which is currently deployed in hardened silos widely dispersed throughout the European U.S.S.R and along the trans-Siberian railroad. There are five different ICBMs deployed as summarized in Table 2-1, each with several modifications. [redacted] the SS-17, SS-18 and SS-19 were all initially deployed in 1974 and are now being replaced by modifications of the original missiles. The SS-17 is not assessed to be accurate enough to be effective against Minuteman silos and may be inteneded as a reserve type weapon capable of riding out an attack and being launched in a hostile nuclear environment. The SS-18 MOD 4, and SS-19 MOD 3, [redacted]

(b)(1)

(b)(1) [redacted]

Table 2-2

(S) Projected ICBM Systems (U)

| System | IOC |
|---|---|
| SS-17 Follow-On A | 1983 |
| SS-17 Follow-On B | 1986 |
| SS-17 Follow-On C | 1988 |
| Large Follow-On A | 1985 |
| Large Follow-On B | 1989 |
| SS-19 Follow-On A | 1985 |
| SS-19 Follow-On B | 1988 |
| Medium Solid MOD A | 1983 |
| MOD B | 1985 |
| MOD C | 1985 |
| MOD D | 1988 |

(b)(1) [redacted]



(b)(1) [redacted]

(b)(1)

[redacted]

(b)(1)

(b)(1)

(b)(1)

(b)(1)

[redacted]

~~(S)~~ The Soviet submarine launched ballistic missile force currently deployed includes the short range SS-N-6 and the long range SS-N-8 and SS-N-18. The SS-N-18 is the only multiple independently targetable re-entry vehicle, or MIRV capable SLBM currently in the inventory. [redacted]

(b)(1)

[redacted] The number of threat systems currently deployed are:

| SSBN | Missiles | Number of Launch Tubes |
|---|---|---|
| Yankee Class | SS-N-6 | 432 |
| Delta I, II Class | SS-N-8 | 280 |
| Delta III Class | SS-N-18 | 208 |
| Total 62 | | 920 |

~~(S/NF)~~ The Soviets have a number of new and modified SLBMS in various stages of development as summarized in Table 2-4. [redacted] The modification to the SS-N-8 is expected to be a single RV system while the others are expected to be MIRVed. [redacted] The SS-NX-20 is the first long-range Soviet solid propellant SLBM. [redacted] Despite its problems the system is expected to reach an operational capability in 1984. The SS-NX-20 will be carried by the large TYPHOON submarine, [redacted] Although approximately the same length as the U.S. TRIDENT, it is nearly 50% larger overall and unlike other ballistic missile submarines, its 20 launch tubes are located forward of the sail. The incorporation of the SS-NX-20 into the SLBM force will significantly increase the number of deliverable warheads in the next decade. [redacted]

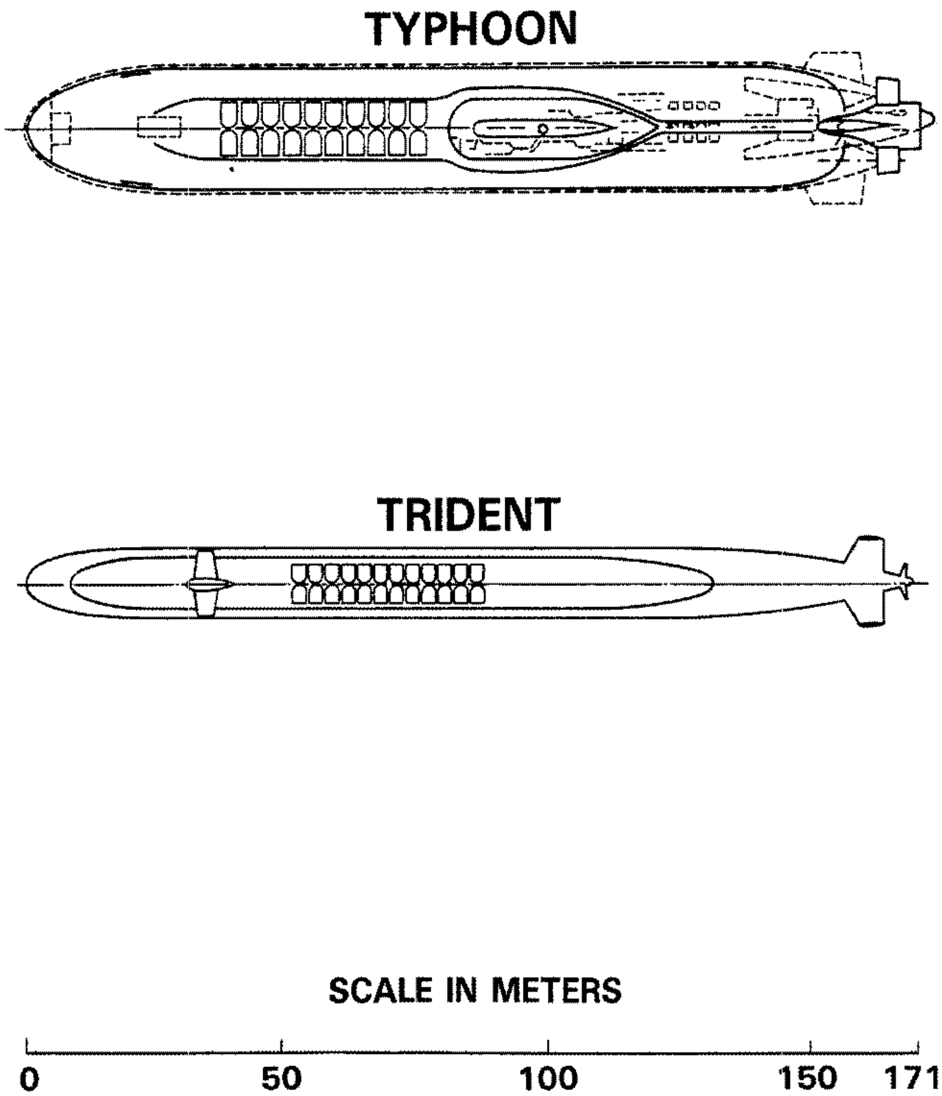


Figure 2-5: ~~(S)~~ Comparison TYPHOON & TRIDENT SSBNs (S)

Table 2-4

(b)(1) [redacted] Projected SLBM Systems (U)

| | SS-NX-20 | SS-N-8 MOD | SS-N-18 MOD | SS-NX-20 Follow-on |
|---|---|---|---|---|
| Warheads (RVs) | (b)(1) [redacted] | (b)(1) [redacted] | | |
| Booster Range (km) | | | | |
| IOC | 1984 | 1984 | Late 1980s | Late 1980s |

(U) Figure 2-6 presents a summary of the projected ICBM and SLBM threat over the next decade, with and without the proposed SALT II launcher and MIRV limits, and with and without ICBM fractionation.

Soviet Penetration Capabilities (U)

Soviet RV Technology (U)

(b)(1) [redacted]

(b)(1)

[redacted]

(b)(1)

while this system is not accurate, it illustrate that the Soviet RV technology will already support small RV's suitable for a fractionation threat. There is no reason to believe that such RV's could not be made accurate with a reasonable amount of further development.

Penetration Aids (U)

(b)(1) [redacted]

(b)(1) [redacted]

(b)(1)

(b)(1)

(b)(1)

(b)(1)

(b)(1) [redacted]

Soviet Potential for Post-Attack Reconnaissance (U)

(b)(1) [redacted]

(b)(1)

(b)(1)

[redacted]

SOVIET OFFENSE/DEFENSE AND RESPONSES (U)

Offensive (U)

(U) Soviet responses to the U.S. deployment of an expanded strategic defense are likely to include both an offensive (defense penetration) response and, if ABM Treaty renegotiation or abrogation is involved, an expanded Soviet defense deployment.

~~(S)~~ Soviet ICBM throw weight gives them a great deal of flexibility in penetration responses to any ABM deployment [redacted] (b)(1)

~~(S)~~ [redacted] (b)(1) In the long-term, the Soviets can probably develop counterforce capable SLBM's as well.

(b)(1) [redacted]

(b)(1)

(b)(1)

[redacted]

(b)(1)

(b)(1) [redacted]

Defensive (U)

~~(S)~~ As already discussed under "Breakout Potential", an expanded defense [redacted]

(b)(1)

ATTACHMENT A ANNEX 2

EXECUTIVE SUMMARY

OF DSB TASK FORCE

ON SOVIET BMD

JANUARY 1980 (A. FLAX)

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

31 January 1980

MEMORANDUM FOR THE SECRETARY OF DEFENSE

THROUGH: UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: Review of the Army BMD Program (U)

(U) As you remember, we asked Dan Fink to chair a Task Force to review the Army BMD program. His final report is attached and so is his memorandum to me that serves as a supercondensed executive summary. We also asked Al Flax to chair a Task Force on Soviet Ballistic Missile Defense. The two efforts are related and I shall report on both with this memorandum.

"MATERIAL DELETED TO

REDUCE CLASSIFICATION TO ~~SECRET~~"

(b)(1)



Classified by: ATSD(AE)
Declassify on: 31 Jan 1990
Review on: 31 Jan 1986
Extended by: ATSD(AE)
Reason: 3

(b)(1) [redacted]

"MATERIAL DELETED TO

REDUCE CLASSIFICATION TO ~~SECRET~~"

(b)(1) [redacted]

I also endorse the areas the Task Force identifies for emphasis in continuing an advanced technology base.

(U) I have attached, for your signature, memorandums to the Secretary of the Army, the Chairman of the Joint Chiefs of Staff, and the Director of Central Intelligence requesting appropriate action if you agree with the above views.

Gene

Eugene G. Fubini
Chairman

Without Attachments

OFFICE OF THE UNDER SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

RESEARCH AND ENGINEERING

14 December 1979

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Report of the DSB Task Force on Soviet Ballistic Missile Defense (BMD) (U)

(U) I am pleased to submit to you the report of the DSB Task Force on Soviet Ballistic Missile Defense (BMD).

(U) Many issues are raised by the Soviet deployment of an extended network of large phased-array radars with potential for BMD battle management and the renewed vigorous Soviet R&D program on new ABM system components. Of these, the most troublesome, although not necessarily the most likely, is the possibility of a rapid breakout from the restrictions of the ABM treaty. Particular attention was given to this problem by the Task Force and a series of U. S. hedging responses time-phased to the evolution of the Soviet BMD program is recommended. These responses included reduction of lead times in both R&D and procurement for actions to deal with BMD breakout contingencies. Initially, the recommended actions are neither revolutionary in policy nor do they require significantly large expenditures. They do, however, require closer integration of operational targeting planning with R&D and procurement lead-time actions to counter the contingent threats, and specific measures to accomplish this in a timely fashion are recommended.

(U) We are very much indebted to the staffs of USDRE, DIA, NSA, CIA, and the Air Force and Navy strategic missile program offices for their strong support and participation in Task Force activities. Special acknowledgement must be given for the extensive analytical assistance provided on a quick response basis by the Army Ballistic Missile Defense Program Office and the Air Force ABRES program through their system engineering support organizations and contractors. Their efforts were essential to the work of the Task Force and are reflected throughout our report.

(U) The complete report of the Task Force involves some sections with high levels of security classification, including special access. However, a ~~"Secret/Noforn"~~ version is being issued to permit wider distribution and thereby increase the potential utility of much of the material.

Alexander H. Flax
Chairman
DSB Task Force on Soviet Ballistic
Missile Defense

## EXECUTIVE SUMMARY (U)

Introduction (U)

~~(S/NOFORN)~~ The appearance of a network of large phased-array radars on the periphery of the Soviet Union, along with continuing development and flight testing of a new Soviet ABM system designated ABM-X-3, has been highlighted (b)(1) [redacted]

(b)(1) [redacted] A Task Force on Soviet Ballistic Missile Defense was established ty the Under Secretary of Defense for Research and Engineering to review the available intelligence data on evolving Soviet ABM capabilities, assess the potential impact on U. S. strategic force capabilities, evaluate offensive system responses which would be available to the U. S. in the event of a rapid deployment (termed "breakout") of a new Soviet ABM system and consider the implications for SALT, U. S. ballistic missile defense (BMD) programs and intelligence collection.

Large Phased-Array Radars (U)

~~(S/NOFORN)~~ Phased-array radars of size and power in excess of those otherwise limited by the ABM treaty are permitted by that treaty if the radars are "for early warning of strategic ballistic missile attack except at locations along the periphery of its national territory and oriented outward."

The new large Soviet phased-array radars seem largely to fall under this provision. However, modern radars of this kind with suitable data processing can be used not only for warning but also for accurate and detailed attack assessment of large raids. Such capabilities in turn may be used with appropriate command, control and communications ($C^3$) in a network to carry out a battle management function for widely-deployed ABM systems. Such capabilities are already provided for a large area of the Soviet Union centered roughly around Moscow by the DOG HOUSE and CAT HOUSE radars.

(b)(1)
[redacted]

(U) Although local area or terminal point ABM systems which are autonomous and do not require large battle management radars can be devised, a more effective ABM system for large area defense can be implemented with support from battle management radars, and previously deployed U. S. and Soviet systems have employed them. Construction of large battle management radars is the single longest lead time element of an ABM system. Once emplaced, a system of such radars constitutes an infrastructure within which a variety of ABM system capabilities could be deployed to a significant number of strategic targets and activated [redacted] (b)(1) depending on the details of the defensive mode chosen and the weight of attack it is designed for. Such defense system modes could range from point-in-space intercept using battle management radar data alone (no terminal system radar target tracking) or through mid-course handover to low altitude terminal defense (with a SPRINT-like interceptor).

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REDUCE CLASSIFICATION TO ~~SECRET~~"

<u>ABM-X-3</u> (U)

(b)(1)

[redacted]

[redacted] Although the capabilities of the ABM-X-3, [redacted] are not entirely defined, and performance estimates by the intelligence community are subject to considerable ranges of uncertainty, the Task Force concludes that the basic design characteristic of ABM-X-3 components and the general system architecture are such that the system could be developed to have [redacted]

Breakout Potentials (U)

[redacted]

(b)(1) [redacted]

U. S. Response Options (U)

(U) There are a number of U. S. measures which can be used to buy lead time against a breakout contingency at relatively modest cost, requiring mainly some operational system planning and support, substantial reemphasis on penetration technology, [redacted] (b)(1)

~~(S/NOFORN)~~ In considering the options for U. S. response to a Soviet ABM breakout, a key factor is the confidence level which can be attached to the

(b)(1) [redacted]

and rate of progress as attained in the U. S. over the past decade. (b)(1) [redacted] Compounding any issue of defense penetration is the fact that quite different perceptions of the same set of facts may be arrived at depending on whether they are looked at from an offense-conservative or defense-conservative point of view. Both points of view were well represented on the Task Force and the various arguments pro and con are given in some detail in the body of the report. On balance, the Task Force concluded that R&D (b)(1) [redacted] should be continued since decisions on the degree of reliance to be placed on them can only be made in the future in light of better assessments of whatever Soviet ABM systems characteristics and deployment configurations may actually be encountered and in consideration of the strategic situation which would exist at that time.

~~(S)~~ Problems of targeting to counter the large phased-array battle management radars, as well as the local ABM defenses, were considered and certain possibilities (b)(1) [redacted]

(U) It was the belief of the Task Force that the JCS and JSTPS should be involved well in advance of any breakout situation in concert with the R&D and intelligence communities in considering the targeting and operational questions which would arise from a Soviet ABM breakout. There are both procurement and development actions which would have to be taken with appropriate lead times to make available selected U. S. strategic attack options in the event of a Soviet ABM breakout which call for contingency planning on a much longer range basis than the usual SIOP planning process.

(U) The U. S. BMD program provides valuable information in support of assessments of both U. S. penetration capabilities and Soviet ABM system capabilities. This function will assume increasing importance as Soviet BMD developments proceed to the point where deployment can be initiated. The Task Force felt that specific attention and priority should be given in the U. S. BMD program to those activities supporting development and assessment of U. S. penetration capabilities against the possibility of a Soviet BMD breakout.

~~(S)~~ U. S. emphasis in BMD development for many years has been on ICBM and other hard point defense rather than on area defense systems such as Soviet ABM-1 and (potentially) the ABM-X-3 would provide. The Task Force did not believe that redirection of U. S. BMD efforts toward readying for deployment of an ABM area defense system as a possible "tit for tat" response to a Soviet breakout would be a practical or effective way to assure preservation of the strategic balance in the near term. BMD for ICBM silos becomes especially attractive for multiple aiming point systems such as the M-X. However, the M-X will not be a significant fraction of our ICBM force until the late 1980's and the Task Force concentrated its attention on strategic contingencies in the nearer term, leaving M-X defense for further consideration as the system evolves. A broad assessment of U. S. BMD objectives and programs has recently been completed by another DSB Task Force; some of their findings and recommendations are related directly or indirectly to our future strategic posture vis a vis potential Soviet developments in both offensive and defensive forces. In view of this effort, the possible broader role of U. S. BMD activities in affecting the long-term strategic balance was not addressed in our more specific review of current Soviet BMD activities.

General (U)

(U) The overall utility of any ABM defensive system to the Soviets cannot be viewed in isolation but must, in the first instance, be related to objectives as noted above and also to related active and passive damage-limiting programs such as improved counterforce potential of the Soviet ICBM force, and improved civil defense measures. In the larger strategic context, improved defenses against aircraft and cruise missiles and SALT initiatives to eliminate MIRV's would also contribute significantly to the damage-limiting objective.

Major Recommendations (U)

(U) The major recommendations of the Task Force follow:

(b)(1)

~~(S/NOFORN)~~ 6) The intelligence community should continue to give high priority to collection on development and deployment of ABM systems and components including large phased-array radars with special effort on (b)(1)

(b)(1)

~~(S/NOFORN)~~ 7) The U. S. BMD program should be tasked to maintain continuing technical analysis on the evolving Soviet ABM-X-3 program (b)(1)

~~(S)~~ 8) Consideration should be given in formulating U. S. SALT positions to the importance of relating BMD postures and breakout potentials to offensive missile force levels.

Annex 3

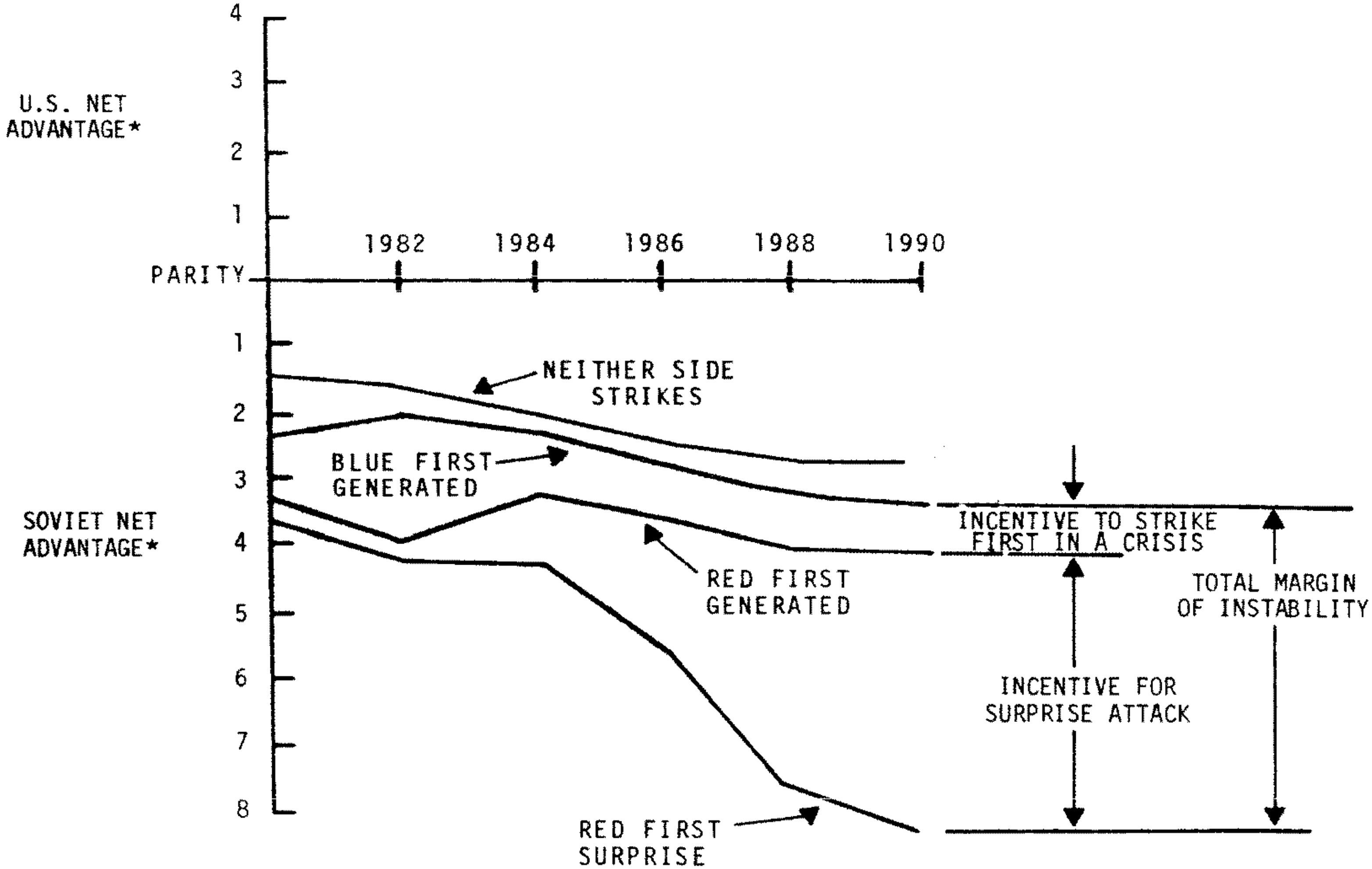
## ROLE OF STRATEGIC DEFENSE (U)

### BASIC OBJECTIVES AND ASSUMPTIONS (U)

(U) The primary objective of both defensive and offensive nuclear systems is to enhance deterrence. Deterrence has several aspects. One is the direct influence exercised by our forces on the adversary to constrain him from initiating hostilities. Another aspect is the interactive relationship between the two sides in terms of the advantages to be gained by striking first. This aspect of deterrence relates to the stability or instability in a crisis of the relationship between the forces of the two sides.

(U) Powerful offensive systems are necessary to satisfy the first aspect of deterrence. All necessary elements of a deterrent system, including the NCA and $C^3$ network, must be survivable to satisfy the second aspect: crisis stability. Systems with a potential for doing great damage to adversary targets but subject to being destroyed before reaching them do not enhance deterrence. More specifically, systems which could be rendered inoperable by an attack employing some small portion of adversary systems and thus leaving the adversary with formidable residual capabilities, do not deter war; they increase the probability of war.

(U) The calculations shown in Figures 3-1a, 3-1b, and 3-1c illustrate this point. Figure 3-1a compares the relative force structure of the U.S. and Soviet Union (in terms of a parameter "equivalent weapons") over the next ten years, assuming no U.S. force improvements. Four cases are shown:




* THOUSANDS OF EQUIVALENT WEAPONS
DOES NOT INCLUDE SOVIET RELOAD MISSILES

FIGURE 3-1a - CURRENT BLUE FORCE STRUCTURE
NO IMPROVEMENTS



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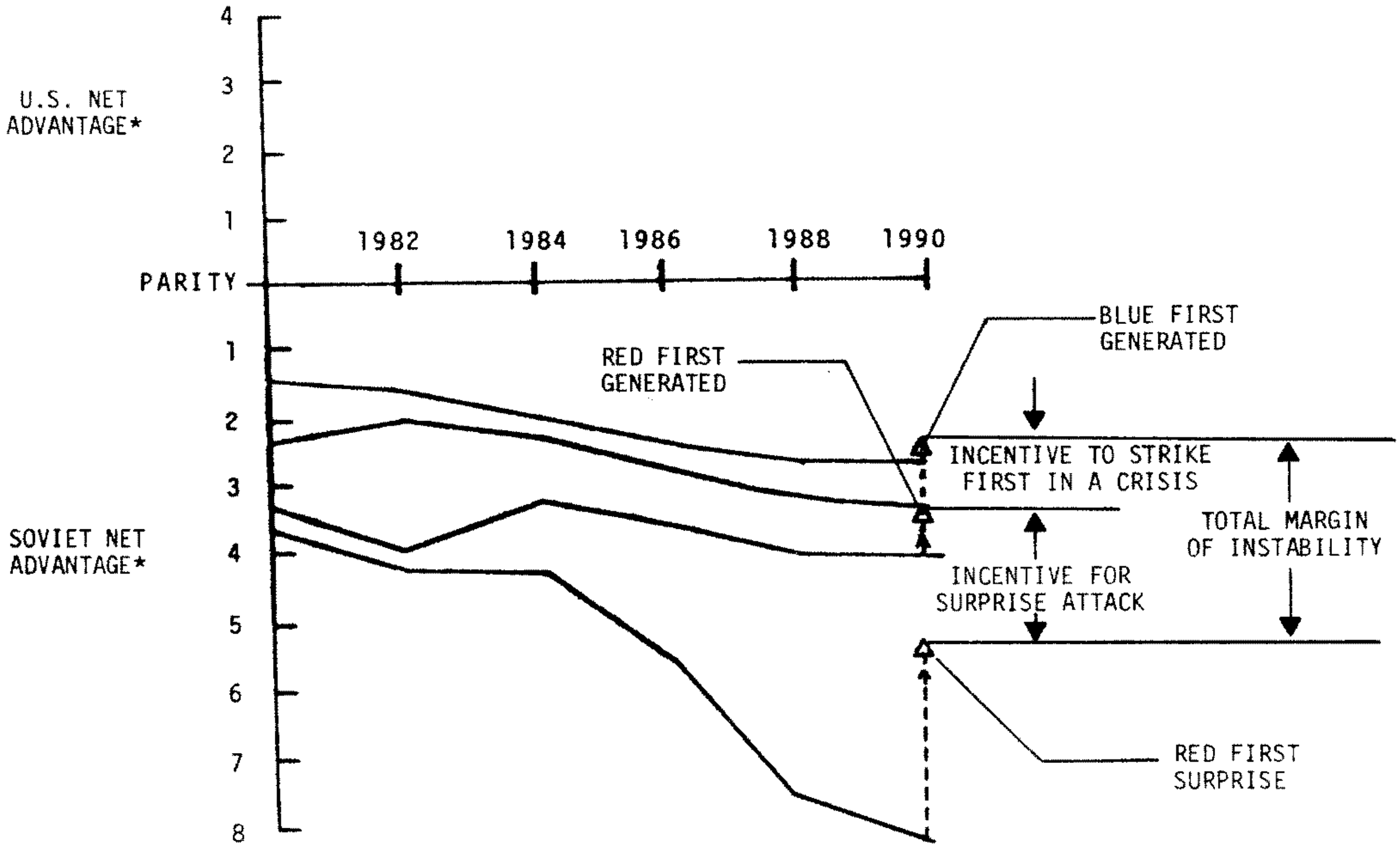


* THOUSANDS OF EQUIVALENT WEAPONS
DOES NOT INCLUDE SOVIET RELOAD MISSILES

FIGURE 3-1b - BLUE FORCE IMPROVED
200 MX IN 4600 SHELTERS



UNCLASSIFIED

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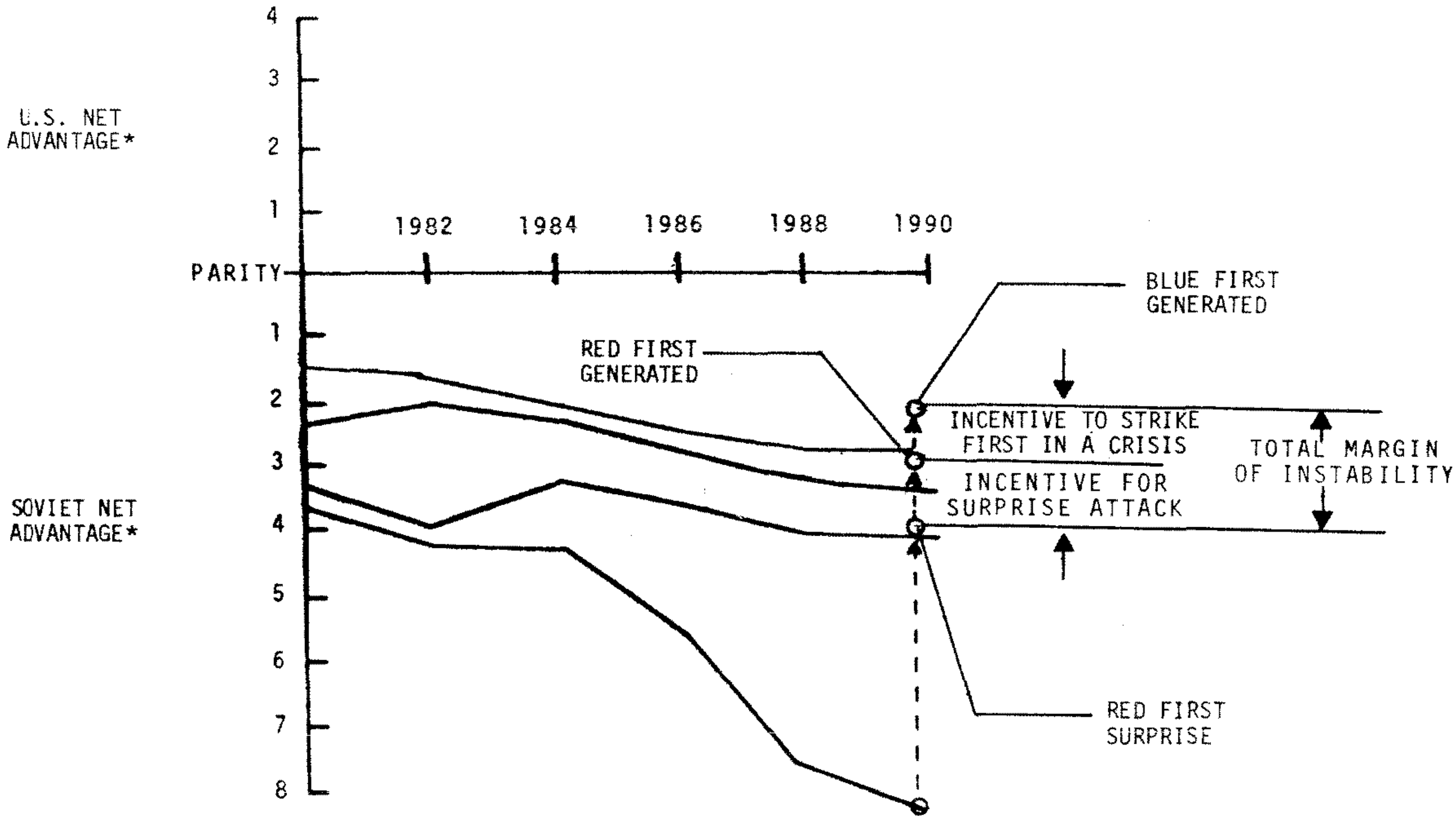


* THOUSANDS OF EQUIVALENT WEAPONS
DOES NOT INCLUDE SOVIET RELOAD MISSILES

FIGURE 3-1c - BLUE FORCE IMPROVED
200 MX IN 4600 SHELTERS
EACH DEFEND 3X

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neither side attacks, Red (Soviet Union) strikes first with Blue generated; Blue strikes first with Red generated; and Red strikes first in a surprise attack. In all cases the side attacked first strikes back and the figure shows the different states after this strike/counterstrike. The incentive for either a surprise attack or for a first attack in a crisis situation is measured by the increased advantage attained after the strike/counterstrike scenario.

(U) Figure 3-1b shows the effect of a specific improvement in Blue's force structure, namely, the addition of 200 M-X missiles deceptively based in 4600 shelters. Similarly, in Figure 3-1c, Blue's forces have been improved by defending each of the 200 missiles three times. Notice in both cases, Figures 3-1b and 3-1c, the total margin of instability, measured by incentive to strike first, has decreased. Of particular interest is the dramatic decrease in the incentive to strike from a surprise state.

(U) In the algorithm used for the example shown the attack is structured so as to maximize the net advantage to an attacker. In the case of the unimproved force, Figure 3-1a - Red attacks Blue's ICBMs with 1900 RVs. In the case shown in Figure 3-1b, Red uses 1900 + 4600 = 6500 RVs. In the case shown in Figure 1c the price to Red is so high he attacks only the portion of the Blue force based in fixed silos with 1600 RVs. In this case, Red has been deterred from attacking Blue's ICBM force.

(U) Estimates projecting beyond the initial phases of a nuclear war in event of a hypothetical failure of deterrence are also relevant. A probability of the adversary side having substantial advantage in relative war-fighting capability and destructive power after the initial exchanges -- thereby coming into position to control escalation and to achieve an outcome favorable to the adversary -- diminishes the quality of deterrence. The endurance of offensive systems is therefore another requirement of deterrence.

(U) Although stated as a requirement for U.S. strategic forces crisis stability has been accorded a second priority to equivalence. PD-59 (and PD-58 and 53) calling for enduring forces, $C^3I$, and NCA not only makes improved survivability a necessary part of the system of strategic offensive forces, but also implicity requires each element of the total force to have a degree of survivability that contributes to stability. Therefore, survivability and endurance are necessary conditions for crisis stability.

(U) Defensive systems, both active and passive will have a major impact on deterrence and crisis stability. The ability to retaliate (at various levels) to an aggressive act is central to deterrence. Thus, actions which deny an adversary's confident prediction of a successful outcome from his attack contribute positively to both deterrence and crisis stability. Active and passive defense designed under rules less demanding than those associated with a defense conservative posture are such actions and do make significant and positive contributions to deterrence and crisis stability.

(b)(1) [redacted]

(b)(1) [redacted]

(U) Such a defense conservative approach is appropriate in certain circumstances. Consider the scenarios shown in Figures la, lb, and lc. If Red strikes first and then relies upon his defense to neutralize Blues retaliatory strike - Red must be sure his defense works. That is, Red as the aggressor should design his defense under defense conservative assumptions.

(b)(1) [redacted]

(b)(1)
[redacted]

(U) Precise definitions do not exist, in a general sense, for the terms discussed above. For each particular system, however, personal or corporate judgment is exercised to choose the appropriate design conditions. Suffice it to say offense reasonable is a state between offense and defense conservative - something that one expects will work "but perhaps not perfectly."

(b)(1)
[redacted]

(U) Admittedly this change in rules has the effect of making BMD, particularly hard point defense, appear more attractive by most measures of merit. That is, a "paper change" makes the same hardware perform more effectively. Nonetheless, this shift of criteria appears quite proper.

POSSIBLE SOVIET ATTACKS (U)

(U) The growth of Soviet military power has had the cumulative effect of substantially augmenting the variety and sophistication of possible strategic nuclear attacks on U.S. territory. For most of the first two decades of the nuclear era, technology and resource constraints limited the strategic attack alternatives available to the Soviet leadership to massive strikes with a protracted period of highly visible warning. Soviet alert procedures and other measures associated with generating its strategic attack forces were sufficiently cumbersome to permit the U.S. to take a variety of offensive and defensive countermeasures that served to significantly degrade advantages which might otherwise accrue to a Soviet first strike.

(b)(1)

[redacted]

(b)(1) [redacted]

(U) Focus on this class of attacks deflected attention from the most plausible class of attacks, namely those which would arise out of a protracted period of "adequate" strategic warning* that would culminate in a pre-war intense political crisis leading to the generation of U.S. strategic nuclear forces. The generation of U.S. forces substantially reduces the pre-launch vulnerability of existing forces, thereby augmenting the number of post strike surviving warheads. The limitation of relying solely on the single "generated-case" model of possible Soviet attacks is its ommission of concerns related to the interaction of ambiguous warning and enduring forces.

(U) The entire strategic nuclear retaliatory chain (NCA, $C^3I$, and the strategic forces themselves) rely for their efficiency on their ability to act on warning and to endure protracted periods of pre- and post-exchange alert.

(U) Even with <u>impeded access to programmed enhancements</u> to current U.S. intelligence and warning sensors, tactical warning is likely to be ambiguous making it necessary for the U.S. retaliatory chain to endure protracted periods of alert in a generated mode prior to a nuclear exchange. In addition, the need to have residual forces (including the NCA and

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* History is replete with examples of "adequate" (in retrospect) warning, both strategic and tactical which was not acted upon owing to its separate treatment because of demanding requirements it places on <u>generated</u> forces. This will be discussed below.

$C^3I$) capable of coping with a protracted series of nuclear exchanges combine to pose highly stressful requirements on forces not now well-configured for protracted conflict.

(U) This dimension of the spectrum of possible Soviet attacks can be effectively augmented by strategic defense in a manner that would diminish the burden the current retaliatory chain would have to carry. Strategic defense (both active and passive) would enable the U.S. to obtain the benefits of generated force levels (in the pre-exchange case when warning is ambiguous) without necessarily needing to maintain high alert rates. Moreover, even if a "surprise" attack should occur when U.S. forces are in a generated posture, the existence of active defense, especially of the retaliatory chain would diminish the confidence of the Soviet leadership in the effectiveness of its attack. The case may be even more strongly advanced under non-generated circumstances where the advantages of "surprise" against U.S. non-alert forces to the Soviets would be signifcantly increased. Passive measures would contribute to the sustainability of the retaliatory chain in a post-exchange environment.

ENDURANCE (U)

(U) In structuring response strategies to counter the possible Soviet atack it becomes apparent that nuclear conflicts may last for more than "hours." In fact, to ensure that no aggressor perceive a weakness in the ability of the defender to sustain a long term nuclear exchange, <u>enduring</u>

capability is needed. The primary purpose is once again deterrence - i.e., present no weak link that can be attacked.

(U) Endurance is a relatively new thought in U.S. strategy and for the most part is lacking in current active BMD constructs. Preferential defense may lose its leverage after the first attack and other BMD systems are generally exhausted in a protracted conflict (i.e., they run out of interceptors).

(U) Active air defense, on the other hand, can provide some measure of endurance, assuming interceptor aircraft have sufficient warning time and reconstitution facilities and the detection and tracking systems have an equal measure of survivability or can be reconstituted. An issue in enduring air defense is the nature of the threat. What is the Soviet air breathing threat in a protracted conflict? Is there a strategic bomber threat months after conflict initiation? Is the cruise missile threat (ground, air, and sea launched) the most stressing of the enduring air breathing threat? What is the threat to supporting $C^3I$ systems?

(U) There is a synergistic effect between air defense and active BMD. Active BMD depends upon leverage factors resulting from deceptive basing and/or preferential defense. Such tactics lack endurance if the aggressor can adopt shoot-look-shoot strategies. Aircraft reconnaissance may be an important part of an adversary's shoot-look-shoot strategy and denying this through air defense could increase the enduring capability of active BMD.

(U) The endurance of passive defense raises other issues. How long will the measures taken to protect civilian and military population remain effective? Will a "false alarm" followed by the real thing be the most effective Soviet strategy; and how does defense cope with this tactic?

(U) Assets which "disappear" slowly such as satellites can be reconstituted, but only if replacements are available. Critical ground nodes, especially those which are not based on CONUS face the same problem. Do we have to plan our forces so that they can act in a high state of warning over protracted times <u>without</u> the replacement of key assets? What posture do we assume, especially for passive defense over periods of months and under conditions in which non-CONUS based surveillance and $C^3$ assets have "disappeared"? We need to plan reasonable and achieveable strategies <u>before</u> initiating implementation.

(U) If we fail in our primary objective of deterrence but are able to deny the Soviets the ability to "win" then what is the post-nuclear environment that each side must contemplate? There are two decided advantages the U.S. has e in this respect - all other things being equal. First, the U.S. political system does not fear overthrow and is confident of its ability to reconstitute along similar political lines. The Soviets have a minority government which fears for its ability to maintain control and may be unable to reconstitute if that control is lost. Second, the U.S. does not have 800 million hostiles on one of its borders as the Soviets have in the PRC. A significantly weakened Soviet Union has to fear being literally overrun by China.

(U) Consequently, the Soviets cannot permit a strategy which permits an outcome of significant damage to their political and military institutions. Population is less important to the Soviets and Western Europe can provide for their economic recovery. Political and military weakness, however, is unacceptable in light of both internal problems and the ever present Chinese threat. They are likely, therefore, to provide the means in terms of damage limiting offense and active and passive defense to avoid this outcome regardless of U.S. action vis-a-vis defense.

MISSION PRIORITIES FOR STRATEGIC DEFENSE (U)

(U) The missions and priorities of strategic defense are as illustrated in Figure 3-2. Four missions are considered: (1) the retaliatory chain consisting of the NCA, $C^3I$, and forces; (2) the enduring retaliatory chain consisting of (1) above, and the necessary assets to reconstitute those parts in need; (3) military population, other forces and facilities; and (4) the civil population and industry.

(U) Clearly, highest prioirty belongs to the retaliatory chain. Deterrence is the primary mission and the threat of retaliation is at the heart of deterrence. The other three missions - which speak to the issue of endurance are judged to be of approximately equal importance.

(U) From the perspective of political feasibility (column 2, Figure 3-2) there is sufficient evidence to support the contentions listed. Defense of the retaliatory

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| | IMPORTANCE | POLITICAL FEASIBILITY | TECH. FEASIBILITY ACTIVE | TECH. FEASIBILITY PASSIVE | COST ACTIVE | COST PASSIVE |
|---|---|---|---|---|---|---|
| RETALIATORY CHAIN | 1<br>DETERRENCE | 1 | H<br>(SYNERGISM) | H | H<br>($10-20B) | H<br>($10-20B) |
| RECONSTITUTED RETALIATORY CHAIN | 2<br>ENDURANCE | 2 | POP H<br>FORCES M-H<br>FAC L-M | VH<br>H<br>M-H | IS M | IS L |
| MILITARY POPULATION FORCES FACILITIES | 2<br>ENDURANCE | 3 | POP VL-L<br>FORCES L-M<br>FAC L | H-VH<br>M-H<br>L-M | H-VH | $1.0B<br>(BLAST/FALLOUT)<br>UNCERTAIN |
| CIVILIAN POPULATION RESOURCES FACILITIES | 2<br>ENDURANCE | 4 | POP V-L<br>RES L-M<br>FAC VL-L | (EVAC) VH<br>(UNEVAC) M<br>M-H<br>L-H | H-VH | $3.5B<br>(FALLOUT)<br>UNCERTAIN |

VL = VERY LOW; L = LOW; M = MODERATE; H = HIGH; VH = VERY HIGH

FIGURE 3-2 - CONSIDERATIONS FOR STRATEGIC DEFENSE PRIORITIES

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chain was permitted, at least to some degree in the ABM Treaty and defenses thus applied are considered "in the spirit" of long estblished doctrine.

(U) Enduring survivability now a stated requirement of U.S. policy, envisions the existence of the functional ability to carry out retaliatory attacks for both deterrence of further aggression and for war-fighting. This extended retaliatory chain may consist of surviving elements of the orginial chain augmented by reconstituted assets as required. In addition to the NCA, the $C^3I$ and weapons, either military personnel or retrained civilian personnel capable of performing the relevant functions are required. Protection of these assets implies some form of population defense, both active and/or passive, applied to military forces plus the ability to locate, mobilize, and train surviving civilian population.

(U) Protection of essential parts of the military population forces and facilities, by active and/or passive means offers the opportunity to both preserve a needed asset and set an important precedent. Most of the military population especially those who are part of the retaliatory chain are particularly vulnerable even to counterforce attacks. A little bit of defense (e.g., shelters) pays a large return in terms of survivors.

(U) The precendential value of such defense should not be underestimated. Military population defense, paid for by the military, is probably a prerequisite to civilian population defense. (If the military won't do it why should we?) Equally important is the deterrent value of the message it would send to the Soviet Union.

(U) There are two points worth noting with respect to the passive defense of civilian population and industry. First, the marginal return from the first dollars spent on both industrial hardening and civilian population defense is large in terms of recovery capabilities and lives saved during protracted nuclear conflicts.

(U) Second, the motivation problem lies predominantly with the Executive Branch. A strong commitment by the President is necessary and probably sufficient. Civilian resistance is of less importance than is generally perceived. The FEMA program, paid for by FEMA ($\sim$\$5 billion) should be implemented. No other solution offers the prospect of saving as many lives as this program.

OFFENSE VS. DEFENSE (U)

(U) The allocation of resources between offense and defense is a complex issue. Cost-effectiveness, etc., needs to be taken into account. <u>The use of other than defense conservative rules to achieve deterrence would be an important new consideration</u>. The questions are simple -- given X dollars, which deters more, X dollars of offense or X dollars worth of offense and defense? Which contributes more to crisis stability, offense alone or offense plus defense? And, how important is crisis stability? It appears on the surface that conditions are such that offense alone is less crisis stable than offense and defense. If deterrence fails, which has more endurance and which is better able to control escalation and terminate the conflict?

(U) There appear to be persuasive arguments for the implementation of a mixed offense/defense system. This is most easily illustrated with reference to the simple example of the land-based ICBM. In a position of offense only, MIRV'd forces with ever-increasing accuracy threaten surviv-ability and lead to a state of crisis instability: i.e., a state wherein the incentive to strike first is high. On the other end of the spectrum, a force consisting mostly of defense does not serve the "big stick" deterrence mission well. Between those two is a balance of enough offense for deterrence and enough defense for crisis stability.

(U) All evidence suggests that active defense of hard points such as ICBMs lacks long term endurance. Either mul-tiple attacks (shoot-look-shoot) defeat those effects which provide leverage, or interceptors are exhausted. The best strategy to devise in this instance may be one which denies the adversary the use of withholds. Prompt counterforce capability launched <u>after</u> an attack accomplishes this. Hard point defense in combination with prompt counterforce works best in such scenarios.

(U) Air defense can be made enduring and if enduring, can mitigate the effects of shoot-look-shoot scenarios de-signed to defeat ICBM and other hard point active defenses.

(U) Passive defenses can be made enduring. They have a large role to play especially in maintaining the critical personnel, NCA and military, and $C^3I$.

IMBALANCE OF STRATEGIC DEFENSE (U)

(U) If deterrence fails, escalation control and conflict termination are the principle objectives. To implement these requires people, communications, and forces. If one side has all three and the other doesn't, the advantage is clear. Although the Soviets may protect their political and military people assets for reasons which are not applicable to U.S. requirements (e.g., their concerns about survival of their political systems in the post-nuclear environment), the U.S. should not ignore the impact of such an imbalance in the post-nuclear environment.

ALLIED CONCERNS (U)

[redacted]

(b)(1)

ACTIVE DEFENSE OPTIONS (U)

(U) Both technical and political issues affect the choice of applicable solutions and the strategies involved in their implementation. The technical issues are relatively straight-forward and involve feasibility and cost questions. The political issues fall into two distinct areas: (1) the ABM Treaty; (2) the ICBM basing decision. With this in mind consider the following options.

Option I - ABM for Existing Assest (U)

(U) Under Option I, $C^3$ nodes, air-bases, MM silos, ec., would be defended by active means. New, high value assets such as M-X are defended as they enter the inventory. Controls over numbers and locations of ABMs, become impractical if not impossible, and prospects for treaty modification are slim, i.e., it is more likely that not constraint is the operative mode under Option I.

Option II - ICBM Defense (U)

(U) Hard point defense of an ICBM wing (or a national command region) appears to be within the "spirit" of the ABM Treaty. The total number of BMD components, their basing mode, and geographic location are details which while not insignificant may be the basis for negotiated modifications. At any rate political acceptance in this country, an important factor, is likely to be highly affected by the degree to which proposed modifications appear negotiable. Within this group of hard point defenses there is an interesting "break- point." A defensive system which deploys only 100 interceptors as currently limited by the treaty remains not only in the spirit of protecting the retaliatory chain, but also in the spirit of limiting defensive deployments.

(U) The ICBM basing decision and the size of the threat to be countered, in principle if not in fact, are important considerations in this option. Figure 3-3 is designed as a road map to illustrate the possiblities.

(U) At the left margin of Figure 3-3 start with the new ICBM, M-X. At the right margin is the final system of deployed weapons whose numbers and composition are such that it has the potential to counter the different threat possiblities. The offense/defense mix, the basing mode, the cost and the treaty implications are parameters displayed in Figure 3-3.

(b)(1)

[redacted]

(b)(1)

(b)(1)

(b)(1) [redacted]

(b)(1) [redacted] Surely the defense mission is simpler the fewer the interceptors required. The regrets are less should the defense fail and deterrence arguments require a reasonable level of <u>offense</u>, e.g., defense alone does not deter.

(b)(1) [redacted]

SOVIET RESPONSE (U)

(U) Any decision to implement a U.S. ABM system must take into consideration possible Soviet Union response.

(U) One such reaction is quite obviously a Soviet ABM deployment. Unless specifically agreed to by them, there is no reason to believe the Soviet Union would limit ABM deployment in a non-treaty world to hard-point defense. The only operational ABM system in the world today is the Soviet/Moscow ABM.

(U) It can be shown that in a mixed offense/defense world, deterrence objectives and crisis stability can be maintained. The fundamental reason for this revolves about the proposition, easily proved, that defense of hard point targets, such as the retaliatory force, is easier than defense of the softer area targets, like recovery assets and population, that make up the retaliatory target set.

(U) For equal levels of total deployed active defense (hard point and area) the defender can choose to protect enough of his more easily defended retaliatory assest (e.g., ICBMs) to penetrate the more difficult to defend retaliatory targets (e.g., urban/industrial population, etc.) of the aggressor. Both deterrence, through threat of retaliation and crisis stability are positively served under these assumptions of equal levels of deployed active defense.

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Annex 4

# COMMAND, CONTROL, COMMUNICATIONS & INTELLIGENCE ($C^3I$)

## $C^3I$ FOR STRATEGIC DEFENSE (U)

(U) Strategic $C^3$ consists of information gathering (surveillance, intelligence, and information on friendly force status), command facilities (equipment, people, and procedures), and communications linking the above. It is intended to provide information, options, plans, direction, and control of the strategic force to accomplish its mission. The essential functions must work reliably before a conflict, during the first stages of conflict, and throughout the period of conflict and recovery.

(U) Because there is considerable overlap in the functions of offensive and defensive $C^3$ systems, and because this overlap occasionally leads to confusion, it is worthwhile to delineate the changes in function and expectation as we proceed from assured second strike, enduring strategic offense, and finally enduring strategic defense, as follows:

(U) $C^3$ for assured second strike is relatively simple conceptually. The surveillance portion of $C^3$ consists of a tactical warning system that will permit the bombers, tankers, airborne command posts, and other important aircraft to disperse before SLBMs arrive, and an attack-assessment system (which includes the basic warning sensors such as DSP that will provide data to the surviving decision-makers in order to help select among response options. Command consists of a surviving NCA and military command structure. Communications ties the commanders together, provides them with warning and attack assessment information, and transmits orders to the strategic forces.

(U) $C^3$ for enduring strategic offensive operations implies, in addition, surveillance of enemy areas plus an enormously more extensive command and communications structure in order to make use of conventional forces, assist in reconstitution, and to cope with uncertainties of nuclear war.

(U) $C^3$ for strategic defense consists of the same basic elements but places additional demands on them. The defensive forces must be protected from precursor attacks, and provided with warning sufficient for their dispersal (in the case of air defense), nuclear release (BMD), or immediate attacks on the enemy (ASAT). In some ways air defense is the most stressing because of the difficulties of identifying enemy aircraft among the large number of friendlies likely to be airborne pre-, trans-, and postattack, and the need for netting surviving air defense assets in the post-attack period. BMD, post-attack, may require a survivable warning system for alerting, especially if it goes dormant or requires the lofting of IR sensors. ASAT, post- attack, requires a surviving space surveillance system, a difficult problem.

(U) In general, defensive strategic $C^3$ demands first that the offensive strategic $C^3$ system be made capable and enduring, and then that enduring surveillance and warning capabilities be provided post-attack.

(U) Another problem that arises in designing defenses is the two-sided nature of the encounter. When faced with defense, an attacking force has need to know how the attack

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[redacted]

(U) This report will discuss the general character of strategic $C^3$, comment on some of the implications of adding strategic defensive systems, and make some recommendations on organization and procedures for creating $C^3$ capabilities.

CURRENT STATE OF STRATEGIC $C^3$ (U)

(U) Strategic $C^3$ has been studied extensively in the last few years. The deficiencies of the current capability are well known and a large number of improvement programs are now under way or contemplated. The 1979 Defense Science Board Task Force on Enduring Strategic $C^3$ considered the entire subject with special attention to enduring or post-attack $C^3$. The Task Force concentrated on $C^3$ for offensive weapons and did not consider intelligence systems, but its conclusions and recommendations still appear sound and relevant to $C^3$ for strategic defense. Attached as annexes to this report are the Executive Summary from the Task Force Report and an up-to-date comparison of its detailed recommendations and subsequent actions.

(U) The Task Force Report emphasized proliferation, dispersal, redundancy, and flexibility as opposed to specialization. The Report urged the importance of capabilities instead of things, and strongly recommended the use of realistic tests and exercises as design and training tools and as aids to decision. The Report viewed strategic $C^3$, not as a collection of command centers and point-to-point communications, but as a pervasive, distributed general-purpose communications system to which are connected whatever command centers, weapons, and sensors are surviving and active at the time. The Task Force pointed out that enduring strategic $C^3$ must deal not only with the residue of the strategic forces but with the conventional forces worldwide. The demands placed on the strategic $C^3$ by such activities would, however, be compensated for by the availability of conventional $C^3$ assets. [redacted]

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(U) These recommendations seem just as valid for strategic $C^3$ with the addition of active defenses as without. If anything, they seem even more pertinent if we are to convert our current strategic massive retaliatory system into a true war-deterrent posture, since to deter we must be able to fight. To fight, reliable and capable $C^3$ is absolutely necessary and must be carefully thought through, integrated with the weapon systems, and exercised continually under realistic conditions.

(U) The Task Force report contained many detailed discussions and recommendations for programs to improve our strategic sensors and communications, and it is not necessary to repeat them all even though they continue to be relevant and important. In a few cases it seems proper to briefly repeat some proposed actions which form the context for our present defensive $C^3$ interests, and to expand slightly on some issues which received only passing attention in the earlier report. In addition, we shall include here some new topics for which we have particular concern or which we believe are useful to consider as part of the general subject of defensive strategic $C^3$.

(U) In what follows, we assume that a network will be established within CONUS to ensure the availability of at least narrowband communications throughout the trans- and post-attack period. As has been described many times before, such a network must be proliferated and self-healing, and will undoubtedly be composed of numerous types of communication links, including hard-wire lines, line-of-sight radio, HF radio, ground-wave radio, and perhaps airborne relays. Certainly, numerous provisions ought to be made for entry into whatever satellite communications remain useable. The Wade Committee on Strategic Connectivity has included recommendations for this kind of network in its draft report.

(U) The subpanel was briefed by the Strategic Connectivity Review Committee, better known as the Wade Committee and had access to an early draft of its final report. The Strategic Connectivity Review makes many recommendations for programs to improve the survivability and endurance of Strategic $C^3$, ranging from a few million dollars to develop a system for automatically disseminating an EAM throughout an ICBM Missile Wing, to almost $3 billion for an EHF satellite system. The subpanel has not had the time to review and comment on the detailed recommendations, but strongly supports the general approach and the major programs elected. The Wade Study in its final version recommends, we understand, a total investment in Strategic $C^3$ in the five years from FY83 through FY87 of about $12.5

billion, which is about $5 billion more than is in the current POM. We understand the Study also suggests that another $15 billion may be needed for programs not yet defined. The subpanel believes this is a reasonable estimate for planning purposes. O&S costs are not included, nor are the substantial costs of test and exercise, developing procedures, and planning and training for the use of conventional and civilian assets.

(U) The subpanel notes that the lion's share of the Wade Committee recommendations in the draft are for space-based systems: DSP approximately $2 billion, EHF COMSAT approximately $3 billion, and R&D for space-based sensors approximately $3 billion. Airborne command posts at approximately $2 billion, SSBN communications at approximately $2 billion, and miscellaneous improvements in communications at approximately $1.5 billion make up most of the rest.

(U) We must remember that defense of CONUS is not our only concern. We have large forces of our own overseas, substantial numbers of ships at sea, and many allies. All of these should be considered in the context of defense: our defense of their assets, and the assistance they can give to the defense of CONUS. As a minimum, we should use our warning assets to their benefit, by implementing reliable and rapid communications to deliver early warning when possible. In some cases, the forces outside CONUS may be in good position to deliver early warning to our NCA, and these opportunities should not be lost. Furthermore, the forces deployed overseas have considerable $C^3$ capability of their own, which might be brought to bear on the general problem of post-attack reconstitution if proper intercontinental communications can be found.

(b)(5)

where data retrieval and machine-aided decisions could greatly help a commander.

(U) As will be discussed in later sections on air defense and civil defense, it is desirable to implement an enduring system for the monitoring of airfields and of post-attack fallout patterns. This information is needed in support of our strategic offensive $C^3$ as well, and provides additional motivation for the development of a monitoring capability.

(U) The subsequent sections of this subpanel report will comment briefly on some of the implications for $C^3$ of adding various defensive weapons. The dividing line between the strategic $C^3$ system and the various weapons systems it controls is far from clear. Some weapon systems, including some versions of BMD, are largely autonomous and require only alerting and release. Others, such as air defense, may be highly dependent on a continuing flow of information and instructions. In other cases, the weapon systems may be an important source of information that must be fed back into the broader $C^3$. There is no simple or bureaucratic way to handle these interfaces in a satisfactory manner. $C^3$ is not a separable system. It must be developed in consort with the weapon systems as a full partner. If we want to be able to fight, particularly if we want to be able to fight defensively as well as offensively, we must force ourselves into thinking about a unified war-fighting capability. Wars cannot be fought with weapons alone or with $C^3$ alone. It is the combination of weapons and $C^3$, integrated and exercised, that makes it possible to fight effectively.

## $C^3$ FOR BALLISTIC MISSILE DEFENSE (BMD) (U)

(U) Ballistic missile defense has traditionally been immersed in a relatively complex set of strategy options, involving penetration aids, precursor nuclear bursts, defense depletion, shoot-look-shoot tactics, and direct attacks on the BMD system itself, among many others. Since a critical element of BMD defense is the sensor which must detect and track incoming re-entry vehicles (RVs), the topic of $C^3$ is hardly separable from the design of the overall BMD system. However, the BMD subpanel has dealt with most of these issues, and we shall not concern ourselves with the "internal" $C^3$ subsystems which tie together the BMD sensors, decision centers, and weapons. Instead, we shall focus on the interaction between the BMD system and the national "external" $C^3$ system, and on some of the broader $C^3$ problems whose solutions are essential to an effective BMD system.

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(b)(5)

[redacted]

(b)(5)

(b)(5)

[redacted]

(b)(5)

(b)(5)

[redacted]

(b)(5)

[redacted]

$C^3$ FOR AIR DEFENSE (U)

(U) Our current air defense system consists of an elaborate network of fixed ground-based radars ringing the CONUS (with numerous additions and upgrades scheduled or projected), a relatively small number of airborne surveillance radars, and a few groups of fighter/interceptors. This system is not capable of actually defending the U.S. against a full-scale bomber attack, and is generally regarded as a tactical warning system with a limited air-sovereignty role.

(b)(5)

[redacted]

exchange, the complex and fragile $C^3$ system associated with peacetime operation is essentially irrelevant to the topic of trans- and post-attack air defense.

[redacted] (b)(1)

As the Soviets bring a cruisemissile capability to operational status, we must develop an effective sensor network, probably utilizing airborne UHF radar, ground-wave radar, proliferated microwave/IR sensors, or perhaps even acoustics.

(b)(5) [redacted]

(U) The remainder of our discussion will be devoted to trans- and post-attack air defense. As discussed by the Air Defense subpanel, it may be possible to reconfigure surviving resources into a new air defense system that has limited but non-negligible capability even in the harsh operational environment of trans- and post-attack nuclear war. The purpose of such a system is to deny the enemy a "free ride" within our country, to give him a significant risk of failing to complete his airborne bombing or reconnaissance missions successfully. (b)(5) [redacted]

(U) The $C^3$ portion of the air defense system must play three major roles. First, it must help in the survival of as many assets as possible. Second, it must direct those assets to geographical locations where they will be most effective. Third, it must coordinate the use of sensors, radios, and weapons so that enemy aircraft can be destroyed without inflicting unacceptable damage on our own surviving civil and military air traffic.

(b)(5) [redacted]

[redacted] (b)(5)

[redacted] With the plan in hand, the $C^3$ system can undertake the difficult task of directing and monitoring the movement of defense assets. As they reach their assigned locations, they will have to be supplied with food, medical aid, military protection, and all the other logistics support demanded by a mobile force. If more nuclear weapons are exchanged, the plan may have to be revised accordingly.

(U) The $C^3$ system has the task of coordinating the actions of the surviving operational defense assets. The ground-based radars will bear the main burden of surveillance, aided where desirable by whatever E-3A and E-2C aircraft can achieve airborne status. [redacted]

(b)(1)

(U) Defense of our missile fields against armed reconnaissance aircraft represents a special but important case in the post-attack period. The missile fields are regions that are likely to have intolerable radiation levels and are therefore not suitable for the placement of SAMs. However, the regions are small enough that radar-equipped interceptor aircraft would probably have no difficulty in acquiring bombers, once warning was given. Ground-based radars located near the edge of the missile fields could maintain surveillance, and both AWACS-type radars and interceptors could be sent aloft upon receipt of alerts anywhere in CONUS. It might even be possible to utilize surviving BMD assets to defend the field against bombers, if they were designed to handle this additional burden.

(b)(5) [redacted]

### $C^3$ FOR SPACE DEFENSE, SURVEILLANCE, AND COUNTER-$C^3$ (U)

(U) The term "space defense" is intended here to mean the defense of our spaceborne assets against attacks from an enemy ASAT system or from enemy jammers. Part of such defense is inherent in many of the architectural concepts that have been proposed and, in a few cases, implemented over the years to make our satellites more difficult to destroy or disable. (b)(5) [redacted]

(b)(5)

(b)(5)

(b)(5)

[redacted]

(U) Different programs are coming to different answers:

(b)(5)

[redacted]

(b)(5)

[redacted]

(U) In brief, though there has been some good thinking on overall satellite control architecture (MGTs, satellite cross-links, etc.) very little of it has yet been reflected in budgets for the individual programs.

(b)(5)

[redacted]

(b)(5) [redacted]

(b)(5) [redacted] Mobile ground-based sensors such as tactial radars and optical space sensors are another matter and can play an important role if available in sufficient quantities, properly based, and dispersed on warning.

(U) Aircraft are important sensor platforms, provided they can be made to survive an initial attack and can be supported in the post-attack environment. Extensive coverage is likely to be difficult but reconnaissance flights, random patrols and responses to alert from cruder sensors should be possible and useful. Enduring communications with aircraft at long distances is necessary.

(U) Ships at sea can serve as valuable sensor platforms in the post-attack period. [redacted]

(b)(5)

(U) Space-based sensors and communications are of enormous importance and their protection or reconstitution should be given the highest priority. [redacted]

(b)(5)

The DSB Summer Study on Counter-$C^3$ contains detailed discussions of these matters.

(b)(5)

(b)(5)

[redacted]

(b)(1),(b)(5)

(b)(5)

(b)(5)

[redacted]

(b)(5)

(b)(5) [redacted]

$C^3$ FOR CIVIL DEFENSE (U)

(U) Civil defense is directed toward measures which will maximize the survivability of the civil population under nuclear attack. The Civil Defense subpanel has discussed the major elements of a survival program, and we shall not treat the details here. The principal features include extensive preplanning, stockpiling, dispersing, and the dissemination of information and decisions facilitating the relocation of people, materials, and services in the post-attack phase.

(U) An essential ingredient in this process is the availability of an enduring nationwide communications system which is accesible to both military and civil agencies, yet can be managed so that it does not immediately saturate in times of stress. Many concepts for such a system have been developed, and the 1979 DSB report included an Annex on an Order-Wire System which is thought to have considerable merit. In general, the plans for establishing communications involve the patching together of whatever kinds of peacetime links may survive after a nuclear attack: parts of the telephone system, satellite links, ham radios, broadcast stations, VLF/UHF aircraft radios, etc. We shall not attempt to elaborate on individual schemes, but shall take for granted the existence of some effective systems.

(U) It is not apparent that the $C^3$ systems which support ballistic missile defense and ASAT share any common elements with civil defense, other than the need to assure warning of an impending nuclear attack. However, our previous consideration of $C^3$ for air defense included several aspects which reoccur in dealing with the issues of civil defense.

(U) Both the air defense and the civil defense $C^3$ systems must arrange for the measurement of radiation from fallout, must predict the path of future fallout, and must decide where equipment or people are to be moved in response to the threat from fallout.

(U) Both air and civil $C^3$ systems are concerned with the identification of airfields which are still in serviceable condition after a nuclear exchange.

(U) Both systems are involved with some form of Air Traffic Control in the post-attack period. The air defense problem centers around the protection of our own aircraft from accidental or inadvertent destruction by our SAM missiles; the civil defense role is simply to be helpful to the pilots who are attempting to fly from one point to another without the normal aviation aids.

(b)(5)

[redacted]

(U) A considerable overlap of desirable $C^3$ functions in support of the air defense and civil defense systems is evident, and a joint undertaking of development and implementation would be prudent and efficient.

## $C^3I$ COST ESTIMATES (U)

(U) Defensive strategic $C^3$ demands, first, as noted earlier, that the offensive strategic $C^3$ system be made capable and enduring, and then that enduring surveillance, warning, and intelligence capabilities be provided in the trans and post-attack periods. Although the $C^3$ subpanel spent most of its time and attention on defensive $C^3$ measures which might survive post-attack, it is clear that our strategic offensive $C^3$ system is badly in need of major improvements and, in fact, that the fixing of the offensive portion of the system will cost far more than the addition of defensive measures.

(U) In Section 12.1 (Current State of Strategic $C^3$) the subpanel discussed its brief and informal review of the Wade Study on Strategic Connectivity, which gave us an up-to-date summary of planned and proposed costs for upgrading and hardening our strategic $C^3$ system, mostly in the offensive area. That study detailed an investment of approximately $14 billion over the five years of FY83 through FY87. About <u>$10 billion</u> of the suggested improvements are already included in the Fy83-FY87 POM, leaving a shortfall of about <u>$4 billion</u>. The study also recommended an additional <u>$15 billion</u> to provide for programs which have not yet been defined -- referred to as an unspecified "planning wedge." Athough the $C^3$ subpanel was exposed only to the draft version of the Wade Study report, and had insufficient time and resources to thoroughly review the study recommendations, we are in general agreement with both the nature and size of the suggested program, including the estimate for the unspecified planning portion, and we shall use these figures in our cost estimates presented later.

(U) The Wade Study did not include consideration of warning sensors against bomber attacks on CONUS. Space-borne sensors may someday perform this function, but the present plans call for the implementation of two new over-the horizon backscatter (OTH-B) radars on the east and west coasts, and the upgrading of the old Distant Early Warning (DEW) line of microwave radars across northern Canada. The investment cost for these two proposed programs is estimated at <u>$2 billion</u>.

(U) We estimate the cost of the various programs to strengthen our strategic defensive $C^3$ -- regarded here as additions to the programs included in the Wade Study -- as <u>between $3 billion and $4 billion</u>. The rationale for this estimate, based on the system concepts discussed earlier with respect to $C^3$ for BMD, ASAT, space hardening, and air defense will be presented briefly at the end of this section. However, before we give this relatively detailed discussion, we shall continue with the other major proposed $C^3I$ expenditures on summarize the total cost impact if all were to be implemented.

(b)(5)

[redacted]

associated with endurance into the post-attack period.

(U) The 1979 DSB Report on Enduring Strategic $C^3$ contained strong recommendations for realistic testing and training of our strategic systems. The $C^3$ subpanel believes that such testing and training, and the iterative process in which failures and weaknesses are discovered and eventually corrected, is crucial to the development of an operationally effective capability. Our estimate of the cost for strategic testing, training, and correction is between $5 billion and $10 billion over a period of ten years.

(U) One of the many actions which have been proposed to increase the survivability of our strategic bomber fleet and or airborne command posts is the rebasing of these aircraft to fields located in the interior of the U.S. Random basing the provision of parallel runways are additional measures which might be taken in some cases. Since to our knowledge the Wade Study did not include rebasing in its collection of topics, we estimate this additional cost at approximately $2 billion.

(U) As a final item, we estimate that the operation and support (O&S) costs for all our strategic $C^3$ assets will be about $2 billion per year over the next ten years.

(U) These strategic $C^3$ estimates may be summarized as follows:

| | | |
|---|---|---|
| FY83-FY87 POM | $10B | from the Wade Study |
| Specific Shortfall Programs | 4B | |
| Unspecified Programs | 15B | |
| OTH-B Radar and DEW Radar Upgrade | 2B | |

| | |
|---|---|
| Add-Ons for Strategic Defense | 3-4B |
| Enduring Intelligence | 3-4B |
| Testing, Training, and Corrections | 5-10B |
| Rebasing of Strategic Aircraft | 2B |
| | $44 billion to $51 billion |

The total investment would be expended over a period of about 10 years, thus implying an annual expenditure rate of $4 billion to $5 billion. The O&S to keep the systems running would require $2 billion per year.

(U) We now return to a consideration of the strategic defensive add-on programs described earlier in the subpanel report, and for which the total cost was estimated at between $3 billion and $4 billion. The smaller figure ($3 billion) is the sum of three components, estimated at $1 billion each: hardening of our current strategic space assest, the implementation of a new space surveillance system to support our post-attack ASAT operations, and the provision of a thin enduring surveillance system to support post-attack CONUS air defense against enemy bombers and reconnaissance aircraft.

(b)(5)

[redacted]

(b)(1) [redacted] Our estimates for post-attack air defense do not include the procurement of new E-3As or E-2Cs. We believe that a broad class of strategic counter-$C^3$ measures should be undertaken, (b)(1) [redacted] We have not attempted to estimate the cost for counter-$C^3$ actions, except for the special important case of non-lethal countermeasures against enemy intelligence satellites whose purpose is to support an enemy shoot-look-shoot attack on our BMD systems.

(U) The remaining discussion presents a somewhat more detailed description of the costs associated with $C^3$ support to post-attack ASAT, air defense, and non-lethal countermeasures against enemy intelligence satellites.

<u>$C^3$ in Support of Post-Attack ASAT Capability</u> (U)

(b)(5) [redacted]

locations (some at overseas sites) after the danger from nuclear attack subsides. They might take days to unfold and erect and calibrate. The antenna could therefore have a fairly large operational aperture. The radars should have a detection range of about (b)(5) sufficient for handling low-altitude intelligence satellites that fly nearly overhead. We estimate they might cost (b)(5) each.

(b)(5)

command system. We estimate the additions to the sensors (computers, communications, displays, etc.) at $100M.

(U) Because the number of pre-war resident satellites is quite large, it appears essential to make the SPACETRACK satellite catalog available to the post-war facilities. This catalog will not be entirely accurate in the post-war period, because both U.S. and Soviet satellites will have maneuvered in an attempt to enhance their survivability; however, most of the remaining satellites could at least be identified and sorted on the basis of the old catalog. The proliferation of the SPACETRACK catalog can probably be best done through the (b)(5) [redacted] but undoubtedly some peripheral equipment and some software changes would be needed. We estimate the cost at $100M.

(U) The O&S for all of the above items is dictated primarily by the need for real-world practicing and readiness, since the systems themselves would have little actual utility during peacetime. We estimate the cost at $30M per year for ten years, or $300M.

(U) To summarize the $C^3$ costs for the new post-attack ASAT systems discussed above:

| | |
|---|---|
| Mobile ground-based radar (6 needed) | $300M |
| Mobile ground-based GEODSS (6 needed) | 100M |
| Modify selected range ships | 100M |
| Distributed command facilities | 100M |
| Proliferate SPACETRACK satellite catalog | 100M |
| Ten-year O&S | 300M |
| | $1B |

$C^3$ in Support of Post-Attack Air Defense (U)

(U) An air defense system with some limited ("no free ride") capability in the post-attack period seems feasible. It requires the setting up or reconstitution of a thin CONUS-wide air surveillance system, using some new radars (e.g., TPS-43s) and as many of the surviving civilian radars as possible. (b)(5) [redacted] We have estimated a "medium" system, as follows.

(U) We suggest the procurement of 50 TPS-43 radars or equivalent, plus the communications necessary to allow them to communicate with passing aircraft; we estimate the cost at \$10M per radar, for total of \$500M.

(U) We suggest upgrading 200 currently-operating radars (mostly civilian) so that they could operate in a post-attack environment if they survived attack; this implies autonomous prime power, protection for operators, and radios for communicating with aircraft. We estimate the cost at \$1M per radar, for a total of \$200M.

(b)(5) [redacted]

(U) The overall air defense system would need command centers to provide the equivalent of air traffic control, to decide whether any enemy aircraft are within CONUS, and to direct the on/off status of our post-attack weapons: SAMs and interceptors. However, the amount of air traffic is not expected to be high, and there seems to be no reason to automate the control centers; old-fashioned grease pencils should do the job.

(b)(5)

(U) Part of concept calls for the monitoring of usable airfields, and the monitoring of fallout patterns throughout the country. Since an airfield system with fallout-monitoring capability has been proposed for other reasons, the cost (estimated at $40M) will not be counted against the air defense system.

(U) As with the new post-attack ASAT system, the O&S cost is dictated primarily by the need to practice, not to provide peacetime capability. We estimate O&S at $10M per year for 10 years, or a total of $100M.

The costs are summarized below:

| | |
|---|---|
| 50 new radars @$10M | $500M |
| 200 upgraded radars @$1M | 200 |
| (b)(5) | |
| O&S for ten years @$10M per year | 100 |
| | (b)(5) |

(b)(5)

[redacted]

(b)(5)

[redacted]

(U) In summary, useful counter-$C^3$ capability against intelligence satellites might be obtained for about $200M.

GENERAL COMMENTS (U)

(U) Active defenses place additional demands on strategic $C^3$, primarily by requiring enduring waring and attack assessment. The extent and importance of this information depends on the characteristics of the specific weapon systems chosen. [redacted]

(b)(5)

$C^3$ must be dealt with as a whole and their interactions and interdependencies considered.

(U) Intelligence relevant to nuclear weapon defense embraces knowledge of the adversary required for the design, appraisal, and operation of defense systems throughout all stages of war. Since nuclear defense and offense are integrally related, intelligence includes the full scope of knowledge about the adversary component of the total interaction of our forces. Specifically, it includes warning and reconnaissance, whether by deterministic sensors or more classic intelligence means, since accurate appraisal depends on the synergism of many sources.

(U) Intelligence is not just data, whether obtained by a message stream from a satellite or a secret agent, but data acted on by thought: knowledge. Most knowledge relevant to pre-, trans- and post-attack nuclear war will be gained by human and machine-aided analysis of complex data streams against an essential background, and competent analysts will be essential. No useful command decision can be made without this sort of intelligence support.

(U) The people to do this job are in short supply. They embrace systems operators, photo-interpreters, linguists, people with many other skills, and above all analysts. They tend to come in all age groups and both sexes, not all combat-ready. Their effective and enduring survival under conditions of nuclear exchange will be extraordinarily difficult.

ORGANIZATION, OPERATION, AND FUNDING (U)

(U) It is important to note that there is no design for a strategic war-fighting capability as such. In fact, there is no organization responsible for the creation of such a capability below the level of the SECDEF himself. There is actually no operating command for strategic war fighting, the responsibilities being divided up between the nuclear-capable CINCS and NORAD. This distribution of responsibility is probably satisfactory under the current situation where almost all the emphasis is on offensive operations trans-attack, but it is not obvious that the distribution of responsibility will prove adequate post-atack, especially if a properly integrated defensive capability is to be created.

(U) The situation for strategic $C^3$ is even more difficult. The absence of focused attention on a war-fighting capabiity has led to a confusion of goals and a lack of sensible and generally accepted requirements. Worse still, there is really no strategic $C^3$ system as such, only a collection of $C^3$ components, the design, procurement, and operation of which is spread over all the services and a number of Defense Agencies. Proposals for improving strategic $C^3$ generally take the form of lists of things to be purchased, dozens or hundreds of items, each of which must be fought independently through the funding and approval process.

(U) No one would think of buying a weapon system in this fashion. The M-X, despite the bitter struggles over its characteristics and basing, is considered a system in itself to be bought or not, for 30-odd billion dollars. It is not broken up into hundreds of different items procured by dozens of different independent organizations. It is not subject to having the first stage funded but not the second, the shelters built but the doors cancelled, and the transporters delayed two years so the responsible service can put the money on something it believes is more important.

(U) Everyone understands that if you don't buy all the M-X you haven't bought anything.

(U) There may be enormous arguments about the details of the components of the M-X, but the arguments are internal and settled internally as long as the exterior envelope of capability and cost are maintained. Almost no one looks at strategic $C^3$ this way. Strategic $C^3$ is imprecise, undefined and unmeasured. It is easy to tell whether the M-X exists or not. Strategic $C^3$ always exists, almost by definition, but it is very difficult to tell whether or not it will work when needed.

(U) A first step to curing this difficulty would be to define an envelope of capability and cost for Strategic $C^3$. The envelope can and probably should be quite general. The envelope for the M-X is - a survivable ICBM for $30 billion. A suitable envelope for Strategic $C^3$ might be - a survivable and enduring strategic $C^3$ capability for $20 billion (or some other agreed-upon number).

(U) The responsibility for this $C^3$ capability should then be assigned to a suitable organization appropriately placed in the DoD structure. This organization, adequately funded, could then undertake the necesary evaluations, tests, studies, and experiments to define a detailed program, get approval and funds, and proceed. Approval should be possible. [redacted]

(b)(5)

(b)(5) [redacted]

(U) The exact nature and location of the Strategic $C^3$ organization itself is considerably less important than the definition of its responsibility and authority. Strategic $C^3$ should be defined as a unified program with a line item in the budget. The organization designated must have the authority to do all the things necessary to carry out the program including control of design tradeoffs and money tradeoffs. This definition sounds like a System Program Office or SPO, and, in fact, it is a kind of SPO. The Strategic $C^3$ program responsibility might be assigned to a particular service, assigned to the Defense Communications Agency, made part of the Office of the Under Secretary of Defense for Research and Engineering, or established as a new agency, but it should be assigned somewhere.

(U) In recent years, a number of attempts have been made to pull $C^3$ activities together, including the Deputy for Telecommunications and Command and Control and the Assistant Secretary of Defense for Communications, Command, Control, and Intelligence. These positions have failed because they did not have responsiblity for a unified program but for a collection of programs over which they had only limited authority. The many programs were like a flock of sheep harried by the wolves of the Services, competing programs, the Controller, OMB, and the Congress. The appointed shepherd, despite his lofty title, had neither the time nor the resources to protect everything and either went down fighting or gave up in frustration. At the moment, there is no appointed shepherd and it is probably useless to search for one sufficiently powerful to protect such a weak and scattered flock.

(U) Fencing the money helps by limiting the number of people who can interfere, but is not an adequate answer. If Strategic $C^3$ is worth doing, it should be put together as a program and allowed to defend itself like any other major program.

(U) A joint-service organization is not the answer either. Joint-service SPO's are essentially committees in which the various operational and political interests of the services are fought out to the detriment of the quality and efficient prosecution of the end product. Joint-service SPO's seldom work: it is inconceivable that one could succeed in such a difficult program as Strategic $C^3$.

(U) The Strategic $C^3$ organization should not, of course, undertake the design of all the many components and subsystems. These should be subcontracted to the Services as their characteristics and costs are defined. The central organization must retain real control of the design and the funds. The multitudinous service staffs must not be allowed to interfere.

(U) In summary then, Strategic $C^3$ should be defined and created as a unified program under the design and funding control of a single responsible organization suitably located in the DoD structure. Where it is located is much less important than what it is.

(U) As work proceeds, it may transpire that the $C^3$ capability is more difficult and expensive than predicted. If so, the amount of money can be increased, not an unheard-of action for weapon systems. The total cost of modernizing our strategic weapon systems over the next 10 years will be over $100 billion. Ten or even 20 billion dollars to provide the $C^3$ without which the weapons are ineffective does not seem unreasonable and should be defended as such. If a fixed fraction of the weapon cost were allocated to $C^3$, the money would probably continue to be adequate since it is unlikely that the $C^3$ would escalate in cost any faster than the weapon systems.

(U) Another problem with $C^3$ results from its large content of procedure, which is often unspecified, cannot be purchased as an item, and is therefore usually left to be developed on an ad hoc basis by the various users. $C^3$ should be recognized as the combination of its procedures and equipment and means found for developing the $C^3$ capability as a whole. Probably the most promising way for developing a capability as opposed to a thing is by means of thorough realistic tests and exercises performed at the capability level in the presence of all those responsible: users, developers, and decision-makers. The DSB $C^3$ Report made this point but it cannot be repeated and emphasized too often.

## CONCLUSIONS AND RECOMMENDATIONS (U)

(U) The recommendations of the subpanel on Defensive Strategic $C^3$ fall into three categories, those related to overall strategic $C^3$, those related to the special demands of strategic defense, and those related to organization and procedure.

Overall Strategic $C^3$ (U)

(U) Effective enduring defensive strategic operations depend first upon the existence of enduring $C^3$ for strategic offense. The subpanel therefore recommends that:

(1) The general recommendations of the DSB Task Force on Enduring Strategic Operations be confirmed and acted upon. These recommendations emphasize proliferation, dispersal, redundancy, and flexibility; the use of non-strategic assets, both military and civilian; the importance of assured warning thought of as a continuum of indications and actions; and the need for prior planning and training.

(U) Although we have not examined each item in detail, we also generally agree with and support the conclusions and recommendations of the Wade Committee on Strategic Connectivity.

(U) We further urge that comparable attention be paid to assuring the endurance of intelligence assets for strategic operations.

(U) Space-based assets form an increasingly important part of the strategic $C^3$ system. The protection of these assets is of the greatest importance. The subpanel recommends that:

(2) (b)(5) [redacted]

(b)(5) [redacted]

(U) The importance of $C^3$ assets to us is paralleled by the importance of enemy $C^3$ assets to him. The subpanel recommends that:

(3) (b)(5) [redacted]

Enduring $C^3$ for Strategic Defense (U)

(U) Most of the BMD systems under discussion are highly autonomous once activated, but do require warning to avoid giving away the locations of their radars sooner than necessary and to conserve prime power over long periods. The subpanel recommends that:

(4) special attention be given to assuring enduring warning of missile attacks as a necesary element of any ballistic missile defense system. This same warning, of course, will serve the needs of our bomber force and our civil defenses. (b)(5) [redacted]

(b)(5)
[redacted]

(U) Post-attack defense against enemy bombers and reconnaissance aircraft appears to be a necessary element of an enduring strategic capability. CONUS-wide air defense at all altitudes is difficult and expensive pre-attack and probably impossible post-attack with current technology. A thin, mobile post-attack air defense to deny the enemy a "free ride" is possible and would be very valuable. The subpanel recommends that:

(5) a thin, enduring ground-based air surveillance system be implemented, based on mobile tactical radars deployed at random in areas of importance. Surviving weapons such as SAMs, fighter aircraft, and BMD could be alerted and controlled by such a system and residual airborne radar platforms launched at critical times. The survival and reconstitution of air defense assets are important tasks for the air defense ground net.

(b)(5)
[redacted]

(b)(5) [redacted]

Organization (U)

(U) The subpanel notes that there is no design for a strategic war-fighting capability as such, and there is no single organization in DoD responsible for the creation of such a capability. The resulting confusion of goals and lack of sensible and generally accepted requirements makes the creation of an adequate strategic $C^3$ system extremely difficult. The subpanel recommends that:

(7) the Department of Defense undertake to develop strategic capability by setting appropriate goals and clarifying responsibilities for both design and operation.

(U) A $C^3$ system includes not only various items of equipment but trained people, attitudes, and procedures. A capability results from a process of building, testing, and exercising human as well as equipment parts. The subpanel recommends that:

(8) the strategic capability be tested and exercised under realistic conditions in order to reach consensus and to guide the design. These tests and exercise should be thorough, well planned and instrumented, run at frequent intervals, and continued indefinitely. The

watchwords for senior DoD officials should be - Plan, Participate, and Persevere.

(U) There is no definable strategic $C^3$ system as such, only a long list of parts and an even longer wish-list of suggested improvements. The subpanel believes that the development of strategic $C^3$ must be treated more like a weapon system in organization -- that is, developed with an agreed-upon envelope of performance and cost and not as a loose assemblage of pieces. The subpanel recommends that:

(9) strategic $C^3$ be organized and funded as an entity. A separate organization for Strategic $C^3$ should be established to control the design and the money, with clearly defined subelements subcontracted to Program Offices in the individual Services and Agencies.

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ATTACHMENT A TO ANNEX 4

# EXECUTIVE SUMMARY

# OF DSB TASK FORCE

# ON ENDURING STRATEGIC $C^3$

OCTOBER 1979 (J. MacLUCAS)

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**UNCLASSIFIED**

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE
BOARD

16 October 1979

Honorable Harold Brown
Secretary of Defense
Pentagon, Room 3E880
Washington, D. C. 20301

Dear Harold,

The attached report was prepared by John McLucas as Chairman of the DSB Task Force on Enduring Strategic $C^3$.

I suggest that you try to read pages 1-11 as a minimum. If you have time, pages 12-15 are also important. Recommendations are listed in pages 52-60.

There are concepts recommended for, and actions to be taken by, Bob Komer, Bill Perry, Gerry Dinneen, David Jones, and the NSC. The copy you will receive will be the only one marked on the margins (pages 8-10 and 52-60) by the symbols (P) (RE) ($C^3$) (CJCS) (NSC) to indicate which entity or entities are most directly involved. You may wish to use these references. Let me quote from the report:

> "Very little attention has been given to long term endurance...., an affordable strategic $C^3$ system can be constructed...(but) we doubt that (such a) system will result from the programs now underway and proposed: A fundamentally different approach is called for."
>
> "Redundancy, proliferation....are preferable to specialization."
>
> "Communications are considerably more vulnerable than the warning sensors. More resources must be devoted to communications at the expense, if necessary, of reducing the investment in improved sensors. (This is the opposite of what is planned today; note by EGF.) Assured warning is more important than attack assessment."

The report gives (pages 52-60) recommendations to translate these concepts into practice.

I recommend that you depart from the usual procedure and send the report first to David Jones, Bob Komer and Bill Perry for comments. Also I suggest that you request Gerry Dinneen to collect these comments, summarize them and attach his summary of the comments to the Task Force report. This summary and the report should then be sent to the Services and the other ASDs for additional comments.

The office of the ASD($C^3$I), in cooperation with the CJCS, should then formulate an overall plan for your approval. This plan must be coordinated with USD(P) and ASD(PA&E).

Sincerely,

Gene

Eugene G. Fubini
Chairman

Attachment

~~SECRET~~

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

Dr. Eugene G. Fubini
Chairman
Defense Science Board

Dear Dr. Fubini: Gene

(U) At your request, I organized a Defense Science Board Task Force on Enduring $C^3$. Our report is forwarded herewith. We are prepared to brief the report at your convenience.

(S) We believe that additional emphasis on survivability and endurance of strategic $C^3$ is both timely and necessary to maintain deterrence at adequate levels. There has been a significant change in force balance in recent years as the Soviets have built a larger and larger strategic capability. Increases in their forces have been paralleled by proliferation of their $C^3$ with high survivability. Rapid increases in numbers and accuracy of Soviet RVs have raised the possibility of inadequate US response to Soviet attack. Clearly, the continuation of deterrence demands that we have a credible capability to absorb a Soviet strike and still launch a devastating attack in return. Our Task Force has drawn on a number of previous studies (see Appendix II), has endorsed a number of recommendations from those studies, and offers still others of our own.

(S) As a general statement, we applaud recent increased attention in the Pentagon to this subject. Most earlier studies of $C^3$ were concerned chiefly with $C^3$ up to the beginning or during the early stages of a strategic exchange and our $C^3$ systems were based on such plans. There is now a developing awareness that the spasm attack represents but one possible scenario and that an adequate war-fighting capability must include $C^3$ which can absorb damage over a wide range of attack scenarios spanning extended time periods and still be able to control our remaining forces.

Classified by USDRE

Declassify on 31 Oct 1985

Review on



~~SECRET~~

~~(S)~~ A number of actions are underway to improve our $C^3$ posture. We are concerned that they may be inadequate and accordingly our report enumerates additional steps that we think should be taken. Before going further, there are a number of background points we would like to make.

(b)(1) [redacted]

~~(C)~~ 2. It is not necessary in wartime to have the ideal level of connectivity that exists in peacetime. [redacted] (b)(1)

~~(S)~~ 3. We need to develop the ability to determine quickly what $C^3$ capability we have available to us at that time. We envision using that

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ 5. While our study has dealt principally with $C^3$ from Sec Def downward, we recognize that what happens at the NCA level is extremely important. We suggest that DOD take the initiative to propose improvements [redacted] (b)(1) We further suggest that DOD offer to staff senior FEMA slots to improve the quality of support which DOD can expect from FEMA.

~~(S)~~ 6. We recognize that improving the endurance of our strategic $C^3$ will be expensive and that our recommendations imply substantial expenditures in addition to those already planned, especially for planning, training, and exercising and for proliferating certain facilities and devices. As stated in Section VIII of the Report, we estimate these items will total roughly $1 billion in the next 10 years not counting the potentially large costs of such matters as improving the survivability of the telephone network. We have couched our recommendations in the form of those that really should be done and those with lesser priority which could be deferred or dropped, if necessary, to provide funds for the high priority items. [redacted] (b)(1)

(U) Although our report lists dozens of recommendations, we will mention only a few here.

~~(S)~~ 1. Our principal recommendation is that proliferation and diversification are the keys to $C^3$ endurability and that we should take advantage of proliferation every chance we get. [redacted] (b)(1)

~~(S)~~ 2. Since we cannot specify what type of attack we might face, we should stress flexibility, versatility and endurability rather than design for maximum capability and sophistication. We, therefore, recommend an educational campaign which inculcates this design philosophy.

~~(C)~~ 3. We recommend that JCS be tasked to create a cadre of professional exercise planners who would over a period of years develop a capability to regularly exercise ways of establishing connectivity with all essential force elements in the face of massive outages.

[redacted] (b)(1)

~~(C)~~ Incidentally, we understand that action on the Hill to zero out funds to begin work on the five times synchronous (5X) strategic satellite system has been attributed at least in part to recommendations of our Task Force.

Our Task Force did not recommend deletion of 5X satellites. Rather, we put higher priority on the proliferated parts of SSS (the single channel transponders of AFSATCOM, for example) than we did on the dedicated 5X components. We felt -- and still feel -- that no one system can be so good that we can place almost total reliance on it. Hence, no one system should be permitted to deprive other worthy programs of essential funding. Our Task Force supports the 5X system development on an orderly basis.

Sincerely,

John L. McLucas

Enclosure
As stated

cc: Mr. Robert R. Everett, Vice Chairman
Dr. Solomon J. Buchsbaum
Gen Russell E. Dougherty
Dr. John S. Foster
Dr. Davis B. Bobrow
Admiral Isaac C. Kidd, Jr.
Dr. Robert E. LeLevier
Dr. Michael M. May
LTG Brent Scowcroft
Mr. John P. Stenbit
LTC George T. Weathers, Jr.
Dr. Darimil (NMI) Kybal

## DSB TASK FORCE ON ENDURING STRATEGIC $C^3$ (U)

### 1.0 (U) SUMMARY

~~(S)~~ As one reaction to the continuing buildup of Russian strategic forces, DOD has given increasing attention in recent months to the enduring survivability of our strategic $C^3$ beyond that required to assure the effectiveness of a retaliatory strike. There is growing awareness that there will be substantial population, facilities and military forces, both strategic and conventional, remaining after a nuclear exchange, that their continued survival, regeneration, and resistance to enemy action is possible, and that an enduring $C^3$ system is a necessary ingredient of that survival. The DSB has therefore been asked to review the vulnerabilities of our strategic $C^3$ and to make recommendations for its improvement.

~~(S)~~ A distinction is sometimes made between survivability and endurance, survivability meaning the ability to withstand a nuclear attack and endurance meaning the ability to operate for a long time in the face of a set of attacks. The Task Force was primarily concerned with endurance by this definition, recognizing that endurance includes survivability as a special case.

[redacted] (b)(1) we are convinced that an affordable strategic $C^3$ system can be constructed which will meet minimum essential needs and will survive as long as there are surviving military forces.

(U) We doubt, however, that an enduring $C^3$ system will result from the programs now underway and proposed. We believe that a fundamentally different approach is called for, an approach that depends on using large numbers of existing assets rather than on building a few new ones. In general, we conclude:

- (S) The historical emphasis on $C^3$ performance as opposed to survivability must be reversed if enduring $C^3$ is to be obtained. Survivability must come first: we must learn to use whatever performance we can make survive.

- (U) The future needs for strategic $C^3$ are predictable in general terms but not in detail. $C^3$ design must emphasize flexibility against a multitude of situations and not optimization against some "approved" threat or scenario.

- (b)(1) [redacted]

- (U) Emphasis must be placed on enduring capability to perform a function - rather than on the endurance of specific facilities. Further, we can not demand that all the functions needed in peacetime and all their timeliness criteria be satisfied in the post attack era.

- (U) Realistic system level tests and exercises are absolutely necessary. Whatever is not thoroughly practiced beforehand is almost certain not to work when needed. Realistic is meant to convey the notion that tests should be run with various key links and facilities assumed to be knocked out. The task of the experimental team is to find ways to operate even with these outages.

(U) The Task Force observes that these statements, which appear almost "self-evident" are, in fact, more often given lip service than real support at all levels of DOD. We recognize that making changes in attitudes and approaches and perhaps in organizaton is much more difficult than simply picking and choosing among program alternatives. But we believe that such changes are absolutely necessary if we are to repair our strategic $C^3$ and protect our country from the threat of war. Firm, dedicated, and enlightened leadership is necessary, leadership which must come from the very top officials of the Department of Defense.

(U) We do not mean to imply that our recommended approach will be less expensive than the programs now under consideration. We believe that substantial additional sums will be required. Our rough estimate is $1 billion over the next ten years, for planning, training, and exercising and for the proliferation of certain facilities, especially communications facilities, while most of the strategic $C^3$ programs now budgeted will still be needed. [redacted]

(b)(5)

(U) Beyond these general conclusions, the Task Force came to a number of more specific conclusions and recommendations. Although we believe that strategic $C^3$ forms a unified whole, the critical problems differ throughout the spectrum of conflict and we have chosen to deal with them in three time periods: pre-attack, trans-attack, and post-attack. Although the prime focus of the Task Force was on long-term endurance, we have considered and will discuss each period.

(b)(1)

[redacted]

~~"MATERIAL DELETED TO~~

~~REDUCE CLASSIFICATION TO SECRET"~~

~~"MATERIAL DELETED TO~~

~~REDUCE CLASSIFICATION TO SECRET"~~

~~"MATERIAL DELETED TO~~

~~REDUCE CLASSIFICATION TO SECRET"~~

(b)(1)

[redacted]

(b)(1)

(b)(1)

[redacted]

(b)(1)

[redacted] Fortunately, the United States has great quantities of communications assets both military and civilian ranging from military HF radios to the enormous telephone plant, including police, FAA, Coast Guard and many other radio networks, and the broadcasting system. Wherever there are surviving military assets there will be surviving communications.

(b)(1)

[redacted]

(b)(1) [redacted]

(b)(1) [redacted] The Task Force notes that Soviet observation of such exercises should significantly enhance deterrence by demonstration that such capabilities exist.

(U) Many of the Task Force's recommendations involve planning for reconstitution and exercising, matters which lie above the Services, although the execution of the plans will certainly involve the Services as well as the operating commands. The Task Force suggests that responsibility for the recommended planning be assigned to the JCS with technical support from the WSE (WWMCCS System Engineer) and that adequate funds for these activities be budgeted in FY80 and 81.

(U) Based on these comments and conclusions, the Task Force makes the following recommendations:

(U) <u>In General</u>

- ~~(S)~~ Emphasize endurance over performance. Make use of what survives. Encourage redundancy, diversity, proliferation, and flexibility.

- (U) Exercise personnel and facilities under realistic conditions, pre, trans and post attack. Run such exercises frequently and under a wide variety of possible circumstances.

(U) <u>Pre-attack</u>

(b)(1) [redacted]

(U) <u>Trans-attack</u>

(b)(1) [redacted]

(b)(1) [redacted]

(U) Post-attack

- ~~(S)~~ Review and extend where necessary the procedures for reorganizing the military command structure from surviving senior military officers of various commands and services and appropriately train and equip such potential commanders.

(b)(1) [redacted]

(U) The body of this report discusses these matters in greater detail and makes some more detailed suggestions, more to illustrate the Task Force approach than to imply that we have a finished design. The appendices include a set of suggested program actions consistent with the Task Force conclusions.

ATTACHMENT B

SUMMARY OF ACTIONS RESULTING FROM THE 1979 DSB TASK FORCE ON ENDURING $C^3$ (U)

(U) This attachment summarizes the recommendation made by the 1979 Defense Science Board Task Force on Enduring $C^3$, and for each recommendation discusses the actions taken during the intervening years by the Department of Defense.

(U) Many of the recommendations of the DSB Task Force study of Enduring Strategic $C^3$ have been explicitly followed, and the sense of the recommendations is reflected in a number of other programs. [redacted] (b)(1) The WWMCCS Survivability & Endurance R&D Program (now called Enhanced Post-Attack WWMCCS R&D Program) received initial funding in 1979 concurrent with the DSB study. The National Communication System (NCS) has a number of programs that have been initiated in the last 18 months to address specific upgrades of national $C^3$ systems.

(U) On the other hand, there are significant divergences from some strong DSB recommendations. Attack assessment has gotten higher priority throughout the AF and OSD than suggested. [redacted] (b)(1)

(U) This summary is organized in the same pattern as the original DSB Task Force report, i.e., it begins with "General Recommendations" and then proceeds from "Pre-attack Recommendations" through "Post-attack Recommendations". The DSB recommendations are given in italics, followed by our comments on the current status or actions resulting from each recommendation.

General Recommendations (U)

(U) **Emphasize endurance over performance. Make use of what survives. Encourage redundancy, proliferation, diversity and flexibility.**

(U) There has recently been movement toward recognizing the importance of endurance, though the tradeoff between assigning limited resources to endurance vice performance has not yet become explicit. $C^3$ endurance has gotten attention through WSEO's Post Attack Initiatives programs, and particularly from the recent WWMCCS Post Attack Symposium. A recent memo from BGen Powers, System Integration Office, describing an architectural design concept for employment of the Jam Resistant Secure Communication (JRSC) system, is consistent with several specific recommendations of the DSB study and, more importantly, reflects the study's general concept of proliferating $C^3$ links and nodes in order to achieve network survivability.

(U) **The Task Force recommends that OSD issue a directive on strategic $C^3$, stating its intentions and emphasizing endurance. The Task Force suggests an appropriate goal would be to make the $C^3$ as enduring as the forces.**

(U) We are aware of no current high-level action comparable to the study's recommendation for an OSD directive. We believe that there was an earlier, unconsummated attempt by JCS to define requirements for $C^3$ survivability. The MEECN Master Plan explicitly addresses "making use of what survives."

**(U) Exercise personnel and facilities under realistic conditions, pre, trans and post attack. Run such exercises frequently and under a wide variety of possible circumstances.**

(b)(1)

[redacted]

(b)(1) [redacted]

(b)(1) [redacted] Total support for these projects is on the order of $1 million annually.

~~(C)~~ Budget items for system-level exercise should be established in JCS for operational costs and in the WSEO for planning, instrumentation and technical support. The Task Force suggests $20 million in each account (a total of $40 million) for FY81 as a tentative amount, subject to change as planning proceeds.

(U) Budget items for additional operational costs have not been established. Planning and technical support is currently funded. There is as yet no commitment of resources at the $20-40 million scale suggested by the Task Force.

(b)(1) [redacted]

~~(S)~~ A number of programs (JRSC and DSP upgrades) are being pursued as detailed in the next three recommendations.

[redacted] (b)(1)

(~~S~~) Several DSP upgrades are programmed. [redacted] (b)(1) Hence, the completion date for a satellite may be well before the time it is deployed in orbit. [redacted] (b)(1)

[redacted] (b)(1) The Task Force supports the current program to establish a network [redacted] (b)(1)

(U) This activity is still under way in association with the JRSC programs. SIO has specified a TW/AA architecture employing a redundant communications net including satellite links, standardized command center displays, and summary attack assessment data from the sensors. We are exploring these points to anticipate the degree to which they represent an AF commitment to the redundant architecture concept. Also note the proliferated LF concept mentioned later.

[redacted] (b)(1) **The appro priate size of this budget item should be negotiated with SAC but the Task Force suggests $10 million as a tentative planning figure.**

(U) We are not aware of a direct response to this recommendation. No CINC discretionary funds are earmarked for hardening the warning communications network. The existence of the SIO at ADC may satisfy the spirit, if not the letter, of this item.

(U) Note also that Lt. Gen. Dickinson, USA, is quoted in <u>SIGNAL</u> May/June 1981, pg. 69, as follows: "On advice of a DSB Task Force, ASD ($C^3I$) has Element to provide CINCs greater flexibility in satisfying short-term, low cost $C^3$ program requirements."

(b)(1) [redacted]

(U) Apart from BGen Powers' JRSC statement, we are not aware of any formal policy to achieve this goal. According to that statement, however, "The TW/AA System...must survive all levels of conflict to the same degree as the National Command Authorities."

(b)(1) [redacted]

~~(S)~~ There have been explicit priority statements written by OSD, ESD and ADCOM. (b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ The funds necessary to toughen the warning communications, if available nowhere else, should be taken from the sensor improvement programs.

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ We are under the impression that such procedures have existed for sometime that these are actions which Unified and Specified commands take to increase the alert status of the $C^3$ system.

(b)(1) [redacted]

(b)(1) [redacted]

(U) We expect that this will be part of the SCEO master plan for strategic connectivity.

(b)(1) [redacted]

(U) There have, in fact, been false alarms from the in at least one (Pacific) airborne command post launch [reference Senators Hart, Goldwater report].

~~(S)~~ **The plan should take into account the need to maintain alert status for the necessary time periods.**

(U) No specific data are available as yet. In this same vein, however, is the issue of adding AFSATCOM capability to three additional FLTSATCOM satellites in order to extend AFSATCOM life.

~~(S)~~ DoD should be prepared to fund the facilities, equipment, personnel and O&M required to support the plan. The Task Force has no estimate of the funds needed but they may be substantial, i.e., some 10's of millions of dollars per year.

(U) There are no such appropriations to our knowledge.

<u>Trans-Attack Recommendations</u> (U)

(b)(1) [redacted]

(b)(1) [redacted]

Other recommendations are discussed below.

(U) Note that to maintain trans-attack capability, several aircraft must be alert and survivable per orbit.

(b)(1) [redacted]

(~~S~~) The Air Force Program carries the full 6 E-4Bs. Currently, however, the No. 5 and 6 aircraft fall below the cut line in the DoD budget (i.e., not funded at present). A final decision on this matter is not needed until December of 1982.

(b)(1) [redacted]

(U) We are not aware of explicit studies of these ideas though they are often mentioned. Concepts based on JACC/CP and ABCCC have been looked at.

(b)(1) [redacted]

(U) The WSE Ground Mobile Communications Capability Study responds directly to this recommendation.

[redacted] (b)(1) An additional $50 million might be required for these purposes.

(b)(1) [redacted]

(b)(1) [redacted] This year it is going to FSD with an estimated IOCV around 1988.

(b)(1) [redacted]

(U) High-power transmitters are not being procured for TACAMO.

(b)(1) [redacted]

(U) This is being done. Two aircraft will be maintained on airborne alert by FY83. A replacement to the TACAMO EC-130Q aircraft is planned for IOC in the late 1980's. Hardening of the current TACAMO aircraft is being considered.

(b)(1) [redacted] This might cost an additional several million dollars per year.

~~(S)~~ A rebasing study has led to new TACAMO patrol routes, [redacted] (b)(1)

(b)(1) [redacted]

(U) ALCS III has been tested but not yet procured. When deployed, it will provide reportback and thereby permit reprogramming when necessary. We are collecting more details on the current status of the program.

(b)(1) [redacted]

(b)(1)

[redacted]

~~(S)~~ Continue to refine the dedicated segment through concept formulation with due regard to conventional and day-to-day uses and their effects on dedicated segment specification.

(U) As above.

(b)(1) [redacted]

~~(C)~~ Vigorously pursue the development of adaptive HF.

(U) Adaptive HF is being pursued quite vigorously, as recommended, by all three Services. There is a Joint Logistics Command HFD working group to coordinate development efforts. DCA has steered a tri-service test of a prototype system, "NEW LOOK", which has not been funded to completion.

(U) The immediate ESD approach is to modify existing procurement contracts with Collins radio to produce digitally controlled radios that will allow "selective calling" between HF radios as a partial adaptive HF capability. The digitally controlled radio could then be complemented by a "SELCAL" (Collins tradename) microprocessor-based controller to enable the selective calling feature. Additional adaptive HF technology developed programs are being conducted at RADC.

(b)(1)

[redacted]

(b)(1) [redacted]

(U) We are not privy to any actions along these lines.

(b)(1) [redacted]

<u>Post-Attack Recommendations</u> (U)

(b)(1) [redacted]

(U) We believe this is covered by continuity of OPS plans for each Service. We are not aware of the existence of plans or intents to plan cross-Service operations.

(b)(1) [redacted]

~~(S)~~ A major development activity should be started jointly by the JCS and the WSEO to investigate, plan and demonstrate such a network with the support of the Using Commands and the Services as needed. The Task Force suggests that $5 million be budgeted for this purpose.

(U) WSE is studying (but not developing) several new systems including meteor burst, adaptive HF (described above), and a proliferated LF network.

(U) Several million is budgeted for these studies.

(b)(1) [redacted]

(U) The AF orderwire program is an active effort in this direction.

(b)(1) [redacted]

(U) SRI is currently under contract to NCS/DCA to study a Ubiquitous Survivable Network (USNET).

**~~(S)~~ Work with the telephone companies to find ways of improving the reconstitution of the telephone system in the event of a nuclear attack.**

(U) FEMA and NCS have been following this recommendation. A steering group, including representatives of the presidents of the 16 major telecommunications companies, has been formed to advise the NCS. Both technical and policy (deregulation) problems are being addressed.

(b)(1)

[redacted]

(U) There is a DCA program under way and a Rockwell study beginning this fall.

(b)(1)

[redacted]

(U) We are not aware of other plans along these lines or ways of getting data on aircraft survivors. Nor are we aware of schemes to assemble available information for post-attack force management.

(b)(1) [redacted]

(U) AFWWMCCS began this work in a recent document (dated June 1981) covering military systems only. WSD is expanding upon this with MITRE support, with specific emphasis on commercial systems. NCS is conducting a similar activity.

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Annex 5

SPACE DEFENSE (U)

(b)(1)

[redacted]

(b)(1)

[redacted]

(3) In peace time they have come to be regarded as sanctuaries: hence a direct attack might signal the beginning of a war.

(U) Costs to provide significant protection against present generation threats and potential "cheap shots" are of the order of 20% of the current present program investment.

(b)(1)

[redacted]

(b)(1) [redacted]

~~(S)~~ A previous DSB Summer Study[1] concluded that additional major commitment in space could give the U.S. an important and perhaps lasting military edge. This is equally true in defense aspects. Some of the obvious elements of required capabilities are discussed in subsequent sections [redacted]

(b)(1)

[1](U) "Report of the DSB Summer Study on Space Application", May 1981, (M. May); see Attachment A.

ASAT AND SPACE WARFARE POLICY RESTRICTIONS (U)

~~(S)~~ Three rounds of anti-satellite (ASAT) negotiations have been held with the Soviets: in Helsinki starting in June 1978, in Bern starting in January 1979, and in Vienna starting in April 1979. No ASAT negotiations have taken place since mid-1979. As a result of these negotiations, the two sides reached agreement in principle concerning parts of a potential ASAT treaty. The generally agreed elements included: (1) a prohibited acts understanding which would prohibit destroying, damaging, or changing the trajectories of space objects in which the other party has an interest, but does not prohibit use of EW or lasers that do not render the equipment inoperable or otherwise damage or change the trajectory of the space object; (2) an undertaking to suspend ASAT testing for 12-18 months; (3) an undertaking to notify the other party in case of accidental or unforeseen risk to the party's space objects. During the negotiations, the US made no commitments to limit its ASAT program, and no such obligations resulted from these negotiations.

(U) The United States recognizes some existing international law relating to ASAT activity. The outer space treaty (1) prohibits stationing of nuclear weapons or any other weapons of mass destruction in outer space and (2) requires consultations before a party undertakes activity which would cause potentially harmful interference in the peaceful exploration and use of outer space by another party. The United Nations charter (article 51) recognizes the right of individual and collective self-defense in the event of armed attack. The limited test ban treaty prohibits any nuclear explosion in outer space. The ABM Treaty prohibits interference with any national technical means (NTM) of verification operating in accordance with international law to insure compliance with the ABM Treaty.

~~(S)~~ In summary, different elements of ASAT activity are restricted in different ways by existing international law. ASAT development short of testing is not restricted in any way. ASAT testing is restricted only if it involves a nuclear weapon (no stationing or use in outer space) or other weapon of mass destruction (no stationing in outer space). ASAT operational system deployment is not restricted in any way, aside from the aforementioned stationing restrictions. ASAT weapon use is restricted in several ways: ASATS may be used against another party's assets only in self-defense; no nuclear weapons may be exploded in outer space; no interference with NTM is allowed; and consultations are required before interference with the peaceful use of outer space of another signatory to the outer space treaty.

REQUIREMENT FOR ASAT CAPABILITY (U)

(b)(1) [redacted]

~~(S)~~ In time, the Soviets may deploy a space-based weapon system which is unacceptably threatening to the U.S.

(b)(1) [redacted]

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ An ASAT capability is important but not sufficient in local or theater war situations. [redacted]

(b)(1)

GENERAL NUCLEAR WAR ASAT NEEDS (U)

~~(S)~~ The case of general nuclear war would be considerably different. All normal satellite tracking, control and launch facilities would presumably be targeted in early exchanges. [redacted]

(b)(1)

[redacted]

(b)(1)

It is important to minimize the ability of the Soviets to observe either the effect of their prior attacks or the military moves we make.

(b)(1),(b)(5)

[redacted]

(b)(5)

(b)(5)

[redacted]

PRESENT ASAT STATUS AND PROGRAMS (U)

~~(S)~~ The Soviets have been testing a non-nuclear ASAT since the late 1960's [redacted] (b)(1) [redacted]

(b)(1) [redacted]

(b)(1) [redacted]

(b)(1) [redacted]

(U) SPADATS, the principal U.S. satellite surveillance system, tracks all satellites, U.S. and Soviet and can, on demand provide target coordinates to the MV/F-15 in a short period. The location accuracy is a variable depending on which station does the tracking and on how many passes are tracked, but for purposes of this study it can be assumed to be about 5 miles. These coordinates are relayed to the F-15 base which passes them on to the waiting F-15's. (This data in principal can be passed directly to the F-15's in flight, but such a provision is not contemplated for the first system.)

(U) The F-15 then, using its own inertial navigation system flies a course which places the F-15 launched SRAM in a proper launch position with respect to the target satellite. It noses up, launches the SRAM and ALTAIR upper stage. Assuming good inertial guidance for these two launch vehicles, the MV heads directly for the target on collision course, with launch errors not made greater than the errors originally transmitted by SPADATS. The error, to be corrected by the MV then consists primarily of the SPADATS location uncertainty plus the errors in guidance of the F-15 and associated launch vehicle. If another launch system were used other than the F-15, the principal errors to be corrected would still be due to the uncertainty in the SPADATS target coordinates. This would also be true in a general nuclear war if (an unlikely case) some soft SPADATS radars would continue to survive.

~~(S)~~ The current Air Force Space Defense Program provides a force structure for the MV with two U.S. bases, each with a squadron of non-dedicated F-15's and sufficient missiles/MV's [redacted]

(b)(1)

(b)(1)

[redacted]

DISCUSSION OF MV (U)

(b)(1)

[redacted]

(b)(1)

[redacted]

[1] (U) "Report of the DSB Summer Study on Space Application", May 1981, (M. May); see Attachment A.

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ The MV is currently scheduled for first flight in April 1983 and IOC in late 1985. At this stage, it does not appear practical to expedite these milestones to any significant degree. However, it is possible to buy more R&D missiles now to increase confidence in the IOC and additional funding could move FOC up much closer to IOC by early purchase of the major components of the system. Early FOC is desirable because of the possibility of Soviet countermeasures to a long stretched-out program. FOC by 1985 ought to be possible by "concurrently" making the necessary procurements prior to the first flight test.

(U) Despite these problems, the MV system, because of the many difficulties in countering it, represents a good first version of an operational ASAT for use in theater conflict.

~~(S)~~ The ASAT weapons could be given endurance, even in a protracted nuclear war, by appropriate dispersal of the aircraft and their support. Working with the tradeoff between aircraft and missile performance, it is practical to consider other aircraft with better V/STOL performance if that is necessary to achieve adequate dispersal for endurance.

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ It is possible to provide more enduring surveillance but at considerable cost. Aircraft or satellites using visible, IR or radar sensors have been studied. However, a thorough examination of concepts, system configurations and acceptable degradations needs to be conducted to define the most cost-effective options.

(b)(1) [redacted]

SOVIET ASAT (U)

(U) The current version of the non-nuclear Soviet ASAT in many ways is more primitive than the U.S. system (MV) now under development. A Soviet surveillance system similar to SPADATS is used to determine target location and passed on to Tyuratam where a launch vehicle is waiting. [redacted] (b)(1)

*The information on this page is Unclassified.*

(b)(5) [redacted]

(U) Another possible Soviet ASAT is speculated to be a nuclear warhead on a Galosh SAM. Most of these SAMS seem to be deployed around Moscow for Air Defense. If the Galosh is designed also to be an ASAT as well, it would have many of the same characteristics as the F-15/MV system (high velocity approach, rapid response once the target is overhead, low altitude capability only, etc.). It would have the disadvantage (compared to the MV/F-15 system) of being more easily visible [redacted] (b)(1)

SPACE SYSTEMS SURVIVABILITY (U)

(U) There appears to have developed a general attitude that space assets are not survivable and hence cannot be counted upon to support wartime operations. While it is true that no asset (space, ground, sub-surface) can be made survivable under all possible attack scenarios, the weakest link

(b)(5) [redacted]

(U) During peacetime operations, the desire to have access to large quantities of information gathered by space systems for non-real-time intelligence analysis purposes has driven space systems in the direction of wider and wider communication bandwidths to ground collection/processing stations. [redacted] (b)(1)

(U) A first and most significant step in increasing the survivability of a space system to be used during wartime is to remove that system's dependency [redacted] (b)(1)

(U) For present day satellites, not too much effort has gone into designing survivability into the space segment of the system. This is to be expected. The lack of a Space Warfare Policy means that no requirement for survivable satellites was, nor can be, promulgated. [redacted] (b)(1) If nothing else is accomplished by this study, issuance of such a policy is mandatory.

(b)(5) [redacted]

(U) Further survivability (self-defense) measures can be incorporated for non-nuclear ASAT engagements such as

(b)(5)

(b)(5) [redacted]

~~(S)~~ It should be noted that the subject of U.S. satellite survivability was previously examined by the DSB Summer Study on Space Applications[1]. [redacted] (b)(1)

(U) With regard to management aspects, that panel indicated that improvement "requires actions cutting across Service lines, program lines, classification lines, even of major National responsibility. These actions (improvements) are not being implemented to the extent necessary for survivability. The responsibility for implementation is not uniformly well defined. A low priority is accorded survivability as compared with other mission needs at the architectural design stage of some major programs".

(U) The situation has not changed in the year since that Task Force concluded its work. This is another example of inaction due to the lack of a Space War Policy.

LASER WEAPON SYSTEMS (U)

(U) Considerable review of the availability and utility of space-based lasers has taken place in the past year.

(U) The DSB Summer Study on Space Applications[1] concluded as follows:

> [redacted] (b)(1) While the long term prospects are sufficiently interesting to justify the costly research necessary to define what can be done eventually, for the 80's, the basic question is, what can a laser ASAT do that cannot be done as well and perhaps earlier and cheaper by other means? A more detailed evaluation of ASAT alternatives than is now available is needed and is the principal recommendation of the Study Panel in regards to lasers. Commitment to a space-based laser weapon system should be made only when and if indicated by this evaluation. The same recommendation is made with respect to laser DSAT and BMD roles which are even more demanding".

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ Another study of space-based lasers under the auspices of the Office of the Secretary of Defense[2] was conducted with participation by the Air Force, Army, DARPA and OSD. The report of this group was then reviewed by a special DSB Task Force[3] at the request of the Under Secretary of Defense for Research and Engineering. The principal conclusions of this DSB Panel were as follows:

(b)(1) [redacted]

2 (U) "DoD Report to the Congress on Space Laser Weapons", 15 May, 1981.

3 (U) "DSB Task Force Report on Review of the DoD Space-Based Laser Weapons Study", May 1, 1981, (J. Foster); see Attachment B.

(U) - A systems development decision is premature but continued research is important

~~(C)~~ - Additional work is required in mission utility analyses, target vulnerability and countermeasures, laser weapon station vulnerability and surveillance/$C^3$ aspects.

(b)(1) [redacted]

A series of specific recommendations consonant with these observations was offered.

(U) We concur with the conclusions and recommendations of these prior DSB examinations.

(b)(1) [redacted]

(b)(1)

[redacted]

(b)(1)

(b)(1)

---

4 (U) Air Force Space Division memorandum of July 24, 1981.

(b)(1)

[redacted]

(U) In conclusion, then, it seems that for the near and intermediate term, we must rely on the MV and a possible nuclear warhead for an ASAT capability. High energy lasers may have their role but only in the late 1990's time period. However both ASATs lack endurance in a general nuclear war, the weakest links being surveillance, $C^3I$ and launch base survivability roughly in that order. Steps are urgently needed to remedy these weak links as well as protect where possible, our own space assets both against a Soviet ASAT as well as an indirect hit aimed at some other target.

*The information on this page is Unclassified.*

URGENT RECOMMENDATIONS (U)

(1) Issue and implement an overall DoD space warfare policy and plan. (An example of what such a policy might contain is attached.)

(2) Give immediate attention to defining and evaluating options for an enduring ASAT capability in the event of general nuclear war, including the requisite surveillance, basing, and command and control.

(3) (b)(5) [redacted]

NECESSARY BUT LESS URGENT RECOMMENDATIONS (U)

(5) Expedite development of the MV ASAT for use through theater conventional (and possibly theater nuclear war) for the protection of naval assets. FOC by 1985 ought to be possible by "concurrently" making the necessary procurements prior to the first flight test.

Also look at other, possibly better options, such as a nuclear ASAT for use in general nuclear war for protection of all U.S. strategic assets.

(b)(5)

[redacted]

Addendum

EXAMPLE OF A SPACE WAR POLICY (U)

(U) Whereas space assets are hereby regarded as an essential portion of the element of any engagement involving General Nuclear War and . . .

(U) Whereas it is essential that the General Nuclear War be terminated on a basis most favorable to the United States and . . .

(other "whereas's")

(U) A policy is hereby established which places requirements on the development and acquisition of all systems involving space components. The following are the (essential) elements of that policy:

1. Space is not to be regarded as a sanctuary for either U.S. or Soviet assets.

2. U.S. space assets that are crucial to a general engagement are (in order of priority):

(b)(5)

3. Soviet space assets that are a threat to U.S. operations and must be countered in both pre-attack and following the start of war are:

(b)(5)

Current Assets [redacted]

Future Assets

4. Space assets are defined as including the segment located in space, the ground (or airborne segment) and the end-use segment.

5. Survivability (or endurability) is defined as the ability to perform the functions defined in the system requirements under the entire range of combat conditions for which that system is needed. Survivability/endurability is not an absolute, but is a function of the level of combat and is mission specific.

(U) The Department of Defense will implement this policy as follows:

1. Within six months after the issuance of this policy statement, each space system SPO will, after suitable discussions with Service Secretaries and the Office of the Secretary of Defense, establish endurability requirements for its own· system.

2. At the same time, a space asset survivability group, chaired by DDR&E, will develop and provide an integrated space system plan into which each space system will fit.

3. Step 1.) and 2.) above are considered an iterative process and should be completed twelve months after issuance of the space warfare policy document.

4. Consistent with agreed-upon funding levels, each SPO will indicate the time frame in which its system (or at least the function to be performed by its system) can be regarded as survivable (enduring) and will proceed to upgrade its own system to meet these new requirements.

ATTACHMENT A TO ANNEX 5

# EXECUTIVE SUMMARY

# OF DSB SUMMER STUDY PANEL REPORT

# ON SPACE APPLICATION

MAY 1981 (M. MAY)

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UNCLASSIFIED

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

1 MAY 1981

MEMORANDUM FOR SECRETARY OF DEFENSE
DEPUTY SECRETARY OF DEFENSE

7 MAY 1981

THROUGH: THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: DSB Report on Review of the DoD Space-Based Laser Weapon Study - ACTION MEMORANDUM

I am transmitting to you the report of the Defense Science Board's Task Force on Review of the DoD Space-Based Laser Weapon Study, chaired by Dr. John S. Foster, Jr. The Task Force reviewed the USDR&E Committee's written report to the Congress on Space Laser Weapons and also received briefings from DARPA, the Air Force, the OSD Staff and prominent scientists.

The Task Force concluded that considerable technical progress has been made in the high energy laser area, and in general, the laser program continues to be vital and innovative. The potential utility for the Space-Based Laser (SBL) is significant and we recommend that approximately $50 million/year be added to the SBL program. We feel that these funds should be used primarily by the Air Force to address space systems integration issues, surveillance, acquisition, vulnerability, countermeasures and specific mission applications. A portion of these funds should also be used by DARPA to sponsor additional research on shorter wavelength lasers. The Army and Navy should also address potential mission applications for the SBL.

With regard to specific applications for the SBL, we feel that Ballistic Missile Defense (BMD) is probably the most difficult task for a laser weapon, and we find no immediate promise of achieving significant damage limiting capability based on current SBL chemical laser technology. Moreover, to do so would endanger longer term, higher payoff technologies and perhaps other more achievable mission applications, e.g., anti-aircraft. Furthermore, in our view, a ground based laser anti-satellite (ASAT) system appears to be within current technological capabilities and has attractive complementary characteristics when coupled with the miniature vehicle ASAT system.

The Task Force report is succinct, and I recommend that you read it in its entirety. With your approval, this report will be distributed to the high energy laser community.

Norman R. Augustine
Chairman

MAY 8 1981
DEP SEC HAS SEEN

Attachment
DSB SBL Report

Approved Frank C. Carlucci 8 MAY 1981

Other ____________



UNCLASSIFIED

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

30 April 1981

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of Space-Based Laser Task Force

Attached is the final report of the Space-Based Laser (SBL) Task Force. As is, it represents the unanimous view of the members.

In our view, it is too soon to attempt to accelerate SBL development toward integrated space demonstration for any mission, particularly for ballistic missile defense. We do find good progress, and promise that SBL will prove to be of use for some missions. All of these require further R&D, and a push toward integrated on-orbit demonstrations would seriously endanger this necessary work. Finally, we feel that the Services should be more strongly involved, and particularly that the Air Force should be in charge of space component experiments, such as TALON GOLD. A great deal of mission analysis and full systems study must be done, in concert with technical developments, before we will know the potential for accomplishing SBL missions; we strongly suggest that these be performed by competing teams, again with Service involvement.

Some people are certain to be disappointed by our findings. I should point out that this group was not one which set out to find fault. In fact, every member of this panel has been a strong supporter of the U.S. laser weapon program, most of us since its inception. We remain strong supporters, convinced that the program is healthy and promising, as evidenced by the fact that we recommend an increase of $50 million/year. Occasionally programs like this one are endangered as much by their advocates as by their enemies. We would like to say that SBLs are ready for integration to weapon systems, but they simply aren't there yet. That is no reason for psssimism, since the technological task has been so great. The DSB should be on record as convinced of the significance of SBL work and supportive of a judicious program.

Johnny

John S. Foster, Jr.
Chairman
Task Force on SBL



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## I. Charge and Introduction

(U) On 5 March 1981 the Chairman of the Defense Science Board (DSB) was requested (see Appendix A) by the Acting Under Secretary of Defense, Research and Engineering to review the draft DoD Study on Space-Based Laser Weapons, to help finalize DoD recommendations on the future of space-based laser weapons programs.

(U) A DSB Task Force was formed for this purpose. The membership comprised Dr. John S. Foster, Jr., (Chairman), Dr. Robert S. Cooper, Mr. Daniel J. Fink, Dr. Roland F.Herbst, Dr. Eberhardt Rechtin and Dr. Edward Teller. Dr. Edward T. Gerry acted as a technical advisor to the Task Force. It is worth noting that two of the members, Drs. Foster and Cooper, as well as the technical advisor, served as members of the 1979 DSB Task Force on High Energy Lasers.

~~(S)~~ After reading the draft DoD report individually, and in the interest of soliciting additional pro and con arguments on the subject, members of the Task Force met in Washington on 27 March and 6 April 1981, hearing additional testimony from DARPA, the Air Force and prominent technical critics of the proposed system. A presentation was also made of the recent x-ray laser results at Lawrence Livermore National Laboratory. This report constitutes the product of the review and analysis.

## II. Conclusions

1. (U) The Task Force is pleased to find that considerable progress has been made in several technical areas since the review two years ago. In particular, there have been important technology advances in laser power and beam quality, and in mirror optical coatings and substrates, and conceptual and experimental progress in optical cavity design and overall laser power extraction efficiency. Beam control research has impressively improved jitter control and tracking. Thus, on the whole, the laser research program continues to be vital and innovative.

2. (U) With regard to the applications which we perceive to be central to the motivation of our review, the Task Force's findings are:

a. ~~(S)~~ We find that there is no immediate promise of achieving significant damage limiting capability by developing a space-based laser (SBL) ballistic missile defense (BMD) system based on current technology. BMD is probably the most difficult task for a laser weapon system, and it remains for the present well beyond our reliably predictable capabilities. For example, in the 25/15* system described in the draft USDRE report, we find: a cost optimistically estimated in excess of two hundred billion dollars; a difficult but required system performance (brightness) improvement in excess of a million fold over that currently demonstrated, without confidence that the full improvement can be made; a variety of potential passive countermeasures which could seriously degrade the effectiveness of the system, or raise its cost significantly with an unfavorable cost-exchange ratio, which could well be 100 to 1; a variety of active countermeasures with which the SBL system may have great difficulty coping, and an enormously complex operating, surveillance and $C^3$ system, inadequately studied; and the unattractive property of degrading precipitiously rather than gradually, under credible attack situations.

b. ~~(S)~~ We find that the SBL anti-satellite (ASAT) system is not highly attractive. The required performance improvements of about one thousand fold are probably achievable. It seems likely that attacks directly on such an ASAT could be successfully made. The ASAT system



*Megawatts/meters

would degrade poorly, because of the small number of satellites in the system. Most importantly, for currently projected U.S. ASAT requirements, such a system does not appear to offer any significant advantages over the miniature homing vehicle (MHV) ASAT system currently under development: The MHV system is less complex, more easily proliferated (degrades gracefully), and is far cheaper.

3. ~~(S)~~ Having said these things, we wish to reinforce our initial conclusion that some high-power laser missions not involving unreasonable extrapolation of current technology and system performance still appear to be very attractive. The Task Force expresses interest in the SBL anti-aircraft (AA) mission, particularly with respect to third nation aircraft, for which improved lasers might indeed prove practical. System performance improvements required for this mission are about ten thousand fold over current capabilities. A successful AA system would also inherently have significant ASAT capability. Much additional attention must be paid to AA systems and their associated surveillance and acquisition functions (see below) in order that we might fully comprehend their utility.

~~(S)~~ A ground-based ASAT system, which appears to be within current technological capabilities, is feasible and, may have attractive complementary characteristics, such as large fuel supply, no weight/volume constraints, technical growth capability (adaptive optics), and different limitations and vulnerabilities than a conventional ASAT. Moreover, development of a ground-based ASAT prototype would provide a sensible, versatile and much smaller step in the development and integration of major laser systems components.

~~(S)~~ Of course, BMD, because of its strategic significance, continues to be a subject of major interest, and lasers and laser systems which might have some potential for contributing to this mission must receive vigorous research. In addition, some members expressed a strong interest in the study of conceptual approaches to the defense of synchronous satellites, and in the development of technologies in support of promising approaches. The time-of-flight advantage of lasers becomes more important at synchronous altitudes.

4. (U) The applications considered above make the research leading to them so important that it must not be endangered by unwarranted early efforts to cash in on short-term applications beyond the reach of existing technology. A systems development decision made now would certainly be

premature and would divert funds from needed basic research and technology advancement. Integrated space demonstrations at this time could only be justified by compelling evidence that they would succeed and would rapidly lead to systems which would markedly alter the strategic balance of power and control of space. Such a situation does not exist today. Therefore, the research and exploratory development programs leading toward promising applications must be fully funded and protected.

5. ~~(C)~~ All of the applications outlined in the DoD report and considered by the Task Force revealed severe shortcomings in the mission analyses performed to date. Systems questions such as target vulnerability and target surveillance, weapon command and control, and SBL system vulnerability to attack have not been adequately studied. Very large cost and schedule uncertainties continue to be associated with all SBL missions. Mission analysis and preliminary systems designs would aid in understanding the elements of cost in these systems, and could point the way to future lower-cost design approaches. As the potential customer for SBLs, the Air Force must begin to address the SBL missions, operational requirements, and system issues.

(b)(1) [redacted]

7. ~~(S)~~ On the basis of mission analyses thus far performed (particularly by the Air Force; see also USDRE report, Section V.5) it seems that the appropriate performance targets (b)(1) [redacted] (b)(1) [redacted]

8. (b)(1) [redacted]

(b)(1) [redacted]

III. Recommendations

1. ~~(S)~~ In consonance with conclusion 2, we do not recommend a program accelerated toward rapid demonstration of integrated BMD or ASAT system feasibility of any SBL now. In consonance with conclusion 3, we recommend proceeding with a modestly augmented national SBL program, that is, funded at a level roughly $50 million/year above the current level, these additional funds to be managed primarily by the Air Force. This represents a choice intermediate to Options 1 and 2 in the USDRE report. [redacted] (b)(1)

2. (U) The possibility of space conflict is real. The direct damage on earth could be negligible, yet the outcome could be decisive for subsequent strategic

operations. We, therefore, recommend that responsibility for space conflict be specifically assigned to a Service, presumably the Air Force. SBL may become an essential part of the planning for space conflict.

3. ~~(C)~~ Technology program:

(b)(1)

[redacted]

(b)(1) [redacted]

(b)(1) [redacted]

e. (U) The MIRACL chemical laser equipment should be exploited to improve our understanding of relevant beam quality, mirror loading, adaptive optics and operational reliability issues.

4. (U) Lethality/Vulnerability program:

a. (U) Laboratory studies of satellite, aircraft, booster and SBL lethalities should be expanded. Where appropriate the national laser test range should be exploited to demonstrate lethalities for SBL targets.

(b)(5) [redacted]

(U) Funding for both these programs should be separately provided and accounted for, to guarantee that it is not absorbed by overruns elsewhere in laser programs.

5. ~~(C)~~ Systems and Systems Integration program:

a. ~~(C)~~ Detailed mission analyses must be performed, preferably by competing teams (offense vs. defense), of all SBL missions, [redacted] (b)(1)

b. ~~(C)~~ For each of these proposed missions, the competing teams must develop a detailed SBL system design definition, including $C^3$ support. Funding for all these activities must also be protected, as above.

c. (U) For SBL systems to be practical, full advantage must be taken of space shuttle capabilities. Studies to exploit on-orbit assembly of several SBL segments delivered to orbit in separate sorties should be accomplished. In addition, the added capabilities of resupply of propulsion expendables and replacement of failed redundant components and subsystems must be carefully studied with the aim of reducing prospective overall system cost.

d. (U) The Air Force program should include a planning effort to determine the most appropriate space experiment integrating laser, large optics, and beam control technologies, and to lay out a rationale, cost and schedule for such a project.

## IV. (U) Comments on Draft USDRE Report

(U) The report of the USDRE committee is an excellent product. However, in properly presenting the arguments , for and against a full range of potential applications in the presence of great uncertainty, the report could potentially be used by people of good will to support nearly any conclusion about the near term desirability of a major weapon system development. Therefore, it is recommended that a caveat statement be printed on the cover of the report to advise the reader that the report contains a description of the current SBL program, and a discussion of several alternative programs but intentionally does not make specific recommendations or completely address all potential alternatives.

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# Annex 6
# AIR DEFENSE (U)
## PROLOGUE

"The Japanese will not politely declare war--and Hawaii is wide open to Japan, vulnerable from the sky. Yet, we bring the Navy to Hawaii every Saturday night so the sailors can have shore leave at Pearl Harbor. This is where the blow will be struck--on a fine, quiet Sunday morning!"

Gen. Billy Mitchell - 1935
(History of the Air Force Assn.)

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Annex 6

AIR DEFENSE (U)

WHAT'S NEW ABOUT AIR DEFENSE (U)

(U) An intelligent persons' view of continental air defense could well be: "What's new--we haven't thought it had enough priority before, so why support it now?"

(U) During the last decade there has, in fact, been a conscious lowering of the priority for allocation of assets to the revitalization of continental air defense. Those in charge have believed our limited financial resources were better placed on increasing strategic attack and conventional war fighting ability.

(b)(1) [redacted]

(U) Furthermore, recent technology implementation allows use in the continental air defense program of equipment in general use by the conventional war fighting forces. In this way the cost of much of the program proposed by us can be viewed as not specialized to continental air defense but as contributing to an overall conventional force capability, to be used where its need is greatest.

~~(C)~~ The fundamental position of this panel's report therefore, is that <u>two things are new</u>. (b)(1) [redacted] (b)(1) [redacted] The second is that much of the investment in continental air defense is not irrevocably committed to that purpose alone, but may be diverted to support of conventional war fighting if that need is more pressing.

~~(C)~~ Another feature of the DSB panel recommendation is that it is responsive to the various levels of air defense; providing, sequentially, elements for pre-attack warning, damage limiting (b)(1) [redacted] main attacks; and, when fully implemented, will provide some capability for enduring, post- attack air defense capability against reconnaissance aircraft and bombers.

AIR DEFENSE GUIDANCE (U)

~~(TS)~~ On 18 May 1981, the Secretary of Defense promulgated a succinct statement of basic "Defense Guidance" pertaining to strategic defense of the U.S. (including air defense) which required (a) the U.S. to have strategic defensive forces and $C^3I$ systems for North America that can provide timely, accurate, and unambiguous tactical warning and attack assessment through all phases of conflict; and (b) in conjunction with Canada, to limit damage to strategic retaliatory forces, (b)(1) [redacted] (b)(1) [redacted]

~~(S)~~ While this official guidance statement lacks precision concerning the desired extent of damage limitation to strategic retaliatory forces (and is silent regarding damage limitation to any other resources or facilities), it is unequivocal with regard to an enduring requirement for warning, and attack assessment, as well as the combined US/Canadian task (b)(1) [redacted] We view these statements of requirements and tasking as deliberate, calculated guidance that imposes specific requirements on the one hand, but leaves open the extent [redacted] (b)(1) We will deal with the air defense questions in light of this official guidance -- guidance which we consider adequate and which makes the tasking both reasonable and lucid, leaving the extent of the active tasks to be determined in light of the threats, priorities and offensive/defensive tradeoffs expected to result from recurring analyses.

CURRENT AIR DEFENSE CAPABILITIES (U)

~~(C)~~ The evolution of the operational capabilities of the U.S. for atmospheric warning and active air defense has not kept pace with the hostile offensive capabilities and tactics that could be brought to bear against North America; in fact, the capabilities for atmospheric warning and active defense [redacted] (b)(1)

(b)(1)

[redacted]

(U) Similarly, the progressive shift from full [operational] command to operational control only by the command and staff structure focused on atmospheric defenses has resulted in a serious mismatch in perceived responsibilities and actual budgeting and programming authorities. [redacted]

(b)(5)

working well; however, there is concern that conflicts could occur.

ASSESSMENT (U)

(b)(1) [redacted]

~~(C)~~ As a minimum criteria for the warning and active defense forces to provide basic deterrence to atmospheric attack, we find the current guidance reasonable and cogent. [redacted] (b)(5) A sound defensive balance requires that we confront hostile forces with a high degree of risk of detection; and, as a minimum, some degree of risk of attack by our atmospheric defenses during all phases of conflict. The air defense obligation we see for the U.S. is one of developing, procuring and fielding operational capabilities to meet current DoD guidance to a level of assurance that does not encourage or invite atmospheric attack and imposes some degree of risk on all forms of atmospheric attack or reconnaissance.

(b)(1) [redacted]

(b)(1)

[redacted]

RECOMMENDATIONS (U)

(U) Our recommended force structure improvements are grouped by five year increments; i.e., near-term -- now through 1985; mid-term -- 1985-1990; longer term -- beyond 1990 and by level of air defense ranging from warning to enduring defense (see Figure 6-1). In the longer term, we have identified the atmospheric defense capabilities we consider to have either a high- potential payoff or a high degree of anticipated need in the air-defense mission area.

(b)(1)

[redacted]

Near-Term (U)

(U) In the near-term to 1985 we recommend efforts by the Security Defense and the Joint Chiefs of Staff to vest the air defense command structure with geater programming, budgeting and operational authority over air defense assets and dispositions; greater authorities that are made commensurate with the ultimate command responsibility for complying with defense guidance. We recommend this to ensure sufficient visibility to this potential problem area, to ensure increased programming authority be vested in the specific mission-area commander, and to bring advocacy and continuity to the fulfillment of these recommended programs.

~~(S)~~ Also, we consider that the gaps in detection, warning, and active defense capabilities emphasize the urgent need for the Security Defense to insist on more, better and faster, all-source intelligence integration. [redacted]

(b)(1)

Mid-Term (U)

~~(S)~~ In the 1985-90 mid-term we should deploy OTH-B radars looking east, west, and south -- three of the potential avenues of attack. [redacted] (b)(1) About 100 additional F-15s are required to complete active fighter force modernization and to improve capabilities for access control and better damage limitation. Twelve additional AWACs should be built to make 19 designated AWACS available for air defense. [redacted] (b)(1)

[redacted] (b)(1)

(b)(1) [redacted] The remaining Patriot units would be used to support the individual training base.

~~(C)~~ (Note: The AWACS and F-15 increases appear as a logical, modest strategic air defense improvement; furthermore, they couple persuasively with the well-known general purpose force needs, while maintaining the continuity and efficiency of ongoing AWACS and F-15 production lines. These increases will provide additional needed, flexible, dual-purpose assets for the overall U.S. weapons inventory).

(U) No attempt was made to perform a quantitative analysis of the value of the various levels of air defense discussed. However, a qualitative, judgemental assessment was made that the levels of air defense improvements recommended would deter or deflect far greater Soviet offensive effort than the U.S. defensive investments required.

~~(C)~~ The provision of systems for tactical warning and attack assessment [redacted] (b)(1) will give greater protection against the surprise of nth country intrusions.

(b)(1) [redacted]

(b)(1) [redacted] provides an active defense that cannot be ignored or challened with impunity.

~~(C)~~ In the later portion of the mid-term, say 1988, we recommend the deployment of a minimum force [redacted] (b)(1) we forsee such a weapons system as a centerpiece for creating an enduring air defense environment. While not "leak-proof", this survivable system is capable of posing a risk that an attacker cannot ignore. We should get on with this - and evolve it as we learn; the technological risk is extremely low.

Longer-Term (U)

(b)(1) [redacted]

[redacted] (b)(1) While we recognize the potential payoff from such systems, we were not prepared to select and recommend from among them. We do urge that long range air-to-air weapons be developed and deployed in this period; the need is not unique to air defense, but the resultant weapon will have great application to the enduring air defenses and to our ability to limit damage to facilities in the U.S. Finally, we foresee Hawk phase- out and improved Patriot disposition [redacted] (b)(1) to discourage and deter atmospheric attacks or provide some opportunity to limit damage to such facilities.

Costs (U)

~~(C)~~ Lastly - costs of our recommended improvements: [redacted] (b)(1) This means that the intelligence integration investment costs plus out-year O&S are the only air defense-unique funds not currently programmed.

PANEL SUMMARY (U)

Summary Findings ~~(S)~~

(b)(1) [redacted]

2. - (b)(1) [redacted]

3. - Near term technology and weapon systems are available to fix these deficiencies.

4. - A realizable, graduated program can be developed by mission area and by time,

5. - providing enduring air defense is difficult, but probably can be accomplished to some degree, primarily by mobile, rugged systems.

~~(S)~~ Nobody wants to fight a war at home - but technology has put the possibility of having to do so squarely "on our plate"... and it is getting worse. The ballistic missile imposes a unique defense problem, the atmospheric threats pose another. (b)(1) [redacted] We can do something about our atrophied air defenses; the technological risk is manageable; the relative investments are low; the payoff in enhanced security is high.

<u>Summary Recommendations</u> ~~(S)~~

~~(S)~~ (Recapped and presented with costs by air defense functional areas and by time.)

1. <u>For Warning and Attack Assessment</u> - to plug the holes in our warning structure (investment costs - $100 million; $900 million 10 year O&S).

a. <u>Near Term - Now to 1985</u>:

(1) <u>Increased Programming and Budgeting Authority for CINCNORAD/CINCAD</u> will help ensure the continuity and cohesion of our recommendations and all other ongoing programs. Insurance against any dibilitating conflict among contributing commands and agencies.

(2) <u>Improved Integration of All-Source Intelligence</u> [redacted]

(3) [redacted] (b)(1)

[redacted] (b)(1)

b. <u>Mid-Term 1985 to 1990</u>:

(1) <u>OTH-B East/West/South</u> will provide wide-area surveillance, and some degree of attack assessment of any atmospheric attack [redacted] (b)(1)

(2) Improved DEW-Line Radars, similar to the SEEK IGLOO improvements now underway in Alaska, along the northern avenues of attack to North America, will provide warning of any form of airbreathing attack [redacted] (b)(1)

c. Longer Term - Beyond 1990:

(No programs selected; costs not calculable)

(b)(1)

(1) [redacted]

(2)

(3)

(4)

2. (b)(1) [redacted]

(All of the above recommendations apply - plus:)

a. Mid-Term - 1985-1990: (Investment cost $2B; with $1.5B 10 year O&S)

(1) Modernizing Active and AirNG Fighter Forces to provide look-down, shoot-down fire control systems, better intercept capabilities and proper interface with AWACs and wide-area surveillance and detection systems, (b)(1) [redacted] additional F-15s are required to do this, with applicability to both defense and general purpose uses.

3. For Damage Limitation- for active protection of strategic assets.

a. Near Term - Now to 1985 ($200M investment costs in facilities; $1.8B for 10 year O&S)

(1) (b)(1) [redacted]

b. Mid-Term 1985-1990 (Investment $1.4B; with $1.1B 10 year O&S)

(1) Add about 12 Additonal AWACS with Northern Basing to provide 19 designated air defense AWACS to enhance all the foregoing options, to exploit modern fighter interceptors, [redacted]

(b)(1)

(2) Long Range Air-to-Air Weapon development is foreseen as having a high payoff (e.g., ASALM, ballistic weapons, etc.) incorporated into a long-range surveillance system.

4. For Enduring Air Defense - to continue to plan attackers and Reconnaissance at risk through all phases of conflict.

a. Term Now to 1985 (no consequential investment)

(1) Internetting Tactical Radars to achieve increased operational capabilities from existing tactical radars when not deployed; expanding the potential for endurance.

(2) Develop Mission Area Architecture for Enduring Air Defense to maintain some capabilities in all phases of conflict. We recommend such architecture build on rugged, reliable,

mobile and redundant capabilities to handle the unpredictable situations in which systems must remain viable.

b. <u>Mid-Term - 1985-1990</u> ($100M investment in facilities - $200M 10 year O&S)

(b)(1)

[redacted]

EPILOGUE

(U) This is not enough - and it's not perfect -- but it is a good beginning on "the road back" to protecting our nation and our people from surprise attacks and "cheap shots". It seems to us that this is an <u>obligation</u> of the Defense Department as well as in keeping with the Department's guidance.

ATTACHMENT A ANNEX 6

# EXECUTIVE SUMMARY

# OF JOINT US/CANADIAN

# AIR DEFENSE STUDY

OCTOBER 1979 (E. C. ALDRIDGE)

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# I. EXECUTIVE SUMMARY

## A. BACKGROUND AND PURPOSE

(U) The existing North American air defense system was designed and built in the 1950s and early 1960s as a cooperative venture between the United States and Canada. It was designed to reduce the level of damage that could occur from a Soviet bomber attack on North America.

(U) The dramatic growth in the Soviet ballistic missile threat in the last 20 years, compared to the relatively stable Soviet bomber forces, and a decision not to deploy active defenses against ballistic missiles has resulted in policy decisions to decrease the emphasis on the damage limiting mission of the air defense system. This deemphasis has had the effect of reducing the size and capability of the North American air defense system and delaying its modernization.

(U) Most components of the North American air defense system are or will soon be obsolete. Programs to replace certain of the components are already in progress, but two factors suggest that further study should be undertaken before proceeding with additional component replacements:

- First, new air defense components can be expected to have useful lives of about 20 years. It is essential that the new components be effective and properly deployed against the Soviet capabilities likely to be encountered during this 20-year period.
- Second, changes in the capabilities, deployment, and the operating concepts of the interrelated system elements could necessitate a major reconfiguration of the overall air defense system. This reconfiguration could affect the requirements for and capabilities of most, if not all, the air defense components.

(U) In recognition of these problems and to ensure that joint planning is both coordinated and sufficiently farsighted, the Joint United States/Canada Air Defense Study (JUSCADS) was initiated at the direction of the

Minister of National Defence of Canada and the Secretary of Defense of the United States. The purposes of the study are to define system options, in terms of cost-effectiveness and programmatic plans, to meet North American air defense needs from now through about the year 2000, and to identify opportunities for joint U.S./Canada research and development.

(U) The significant items of guidance reflected in the terms of reference are summarized as follows:

- Examine American and Canadian air defenses on a continental basis (i.e., as if no border existed for air defense planning).
- Recognize ballistic missiles as the principal threat to North America while considering non-ballistic attack options.
- Consider options that integrate systems and programs into architectures for a North American air defense system from the near term (until about 1985) to the long term (1985 to 2000).
- Give emphasis to the warning function, but consider all forms of active air defense systems.
- Use the following North American Air Defense (NORAD) objectives, jointly ascribed to by the U.S. and Canada, as a basis for assessing capabilities:
  - -- To assist each country in safeguarding the *sovereignty* of its airspace.
  - -- To contribute to deterrence of attack on North America by providing capabilities for *warning* of attack and for *defense* against an attack.
  - -- Should deterrence fail, to ensure an appropriate response against attack by providing for the *effective use of the forces available* for air defense of the two countries.
- Evaluate an option based on the existing air defense system against the existing threat.
- Take into consideration American and Canadian planned and programmed systems modernization through the mid-1980s. Assume the air defense programs of both nations which are approved and under way will proceed generally as planned (specifically JSS/ROCC and E-3A).
- Adjust the size and basing posture of the fighter force and the configuration of surveillance systems in examining tradeoffs to determine the most cost-effective options.

(U) The study was directed not to address issues dealing with responsibility or cost sharing between the U.S. and Canada of any of the air defense initiatives identified.

B. APPROACH

(U) To meet the objectives set forth in the terms of reference, the study followed the steps identified below:

1. (U) *Policy Alternatives.* Four policy alternatives were developed to highlight the range of mission priorities, design requirements, and capabilities that are possible to derive from the NORAD objectives of sovereignty, warning, and defense:

   -- (U) Alternative I: Provide warning and characterization of a bomber attack against strategic retaliatory forces and command, control, and communications ($C^3$) sites. This alternative would deny the Soviets a no-warning attack option. Control over sovereign airspace, and active defense against bombers, would be provided using the surveillance, interceptor, and $C^3$ assets necessary for the warning function.

   -- (U) Alternative II: Provide warning and characterization of a bomber attack against strategic and major industrial target complexes in North America. This alternative would deny the Soviets a no-warning attack option. Control over sovereign airspace, and active defense against bombers, would be provided using the surveillance, interceptor, and $C^3$ assets necessary for the warning function.

   -- (U) Alternative III: In addition to Alternative II, provide a highly effective defense of strategic and major industrial targets against a small bomber attack without a prior missile attack (air defense systems do not have to survive an ICBM/SLBM attack). This alternative would deny the Soviets the option of holding North American military facilities or cities hostage with a small number of bombers and would contribute to deterrence of a large bomber attack.

   -- (U) Alternative IV: Defend strategic and major industrial targets against a large-scale bomber attack following an ICBM/SLBM attack (requiring air defense component survivability).

   System design requirements and supporting rationale were developed for each of the policy alternatives; emphasis was placed on Alternatives I and II (per the study terms of reference). A prior international crisis and force generation was assumed in the achievement of the air defense requirements of Alternatives III and IV.

2. (~~S~~) *Threat Analysis*. Since threat projections do not typically range beyond a 10-year period, the study developed a method for extending the threat projections to the year 2000. This methodology projected a continuation of the historical 10-year bomber development cycles, 5-year Soviet decision points, and technological improvements (lagging U.S. developments by 5 to 8 years) to

postulate threat force levels, types of forces, and capabilities. In addition, some attack options were identified which illustrated how the Soviets might use their forces to the detriment of North America

3. (U) *Evaluation of Current Systems*. The current system consists of 331 U.S. and Canadian manned interceptors located at 32 alert sites (26 in the U.S., 3 in Alaska, and 3 in Canada), 31 Distant Early Warning (DEW) radars located across the Arctic coastline, 24 Pinetree radars across southern Canada, 46 Joint Surveillance System (JSS) radars along the U.S./Canada border and the U.S. coastline, and 13 long-range radars in Alaska. North America is divided into eight regions for the command and control of the air defense system assets. In time of crisis, additional "augmentation" forces would be called on to increase the air defense capability. The study evaluated the capabilities, cost, and limitations of the current air defense system against the current and future threat. The results of this evaluation provided the development and deployment needs and priorities for the future air defense equipment to resolve deficiencies.

4. (U) *Requirements*. Utilizing projected threat capabilities and system design requirements, the study developed sensor, interceptor, and $C^3$ performance requirements.

5. (U) *Technical Options for Analysis*. A range of approaches for satisfying the system design and performance requirements for each policy alternative was developed. For each approach, a programmatic plan was established and a total cost[1] determined.

6. (U) *Evaluation*. In this step, a comparative evaluation was made of each system concept developed. Evaluation criteria were cost, capability, risk, and sensitivity to uncertainties (especially in uncontrollable factors such as threat and environment). Future sensors, weapon systems, and $C^3$ concepts which did not meet requirements or were not cost-effective were discarded; those that could not be discarded for these reasons became candidates for decision.

7. (U) *Options for Decision*. Based on insights and evaluations identified from the previous steps, air defense system options were formulated. These options ranged from those which could be implemented now to those which provided for a transition from near-term capabilities to the future air defense system. The decision options (which included a programmatic plan) were evaluated for cost (annual and total) and capabilities.

---

[1](U) All air defense costs for this study are shown in constant CY 1979 U.S. dollars. The rate of exchange assumed was \$U.S. = 0.85 x \$Canadian.

8. (U) *Recommendations for Joint R&D*. Risk areas and technological advances relating to the various systems necessary for each option were reviewed to determine what R&D was necessary. Opportunities for joint U.S./Canadian participation were identified.

(U) In addition to these analytical steps, the study established a set of air defense definitions for use in the study and developed background material on the history of air defense development and cost trends.

## C. DEFINITIONS

(U) For the purpose of this study, the term *air defense* is taken to comprise the totality of the roles and missions included in the concepts of sovereignty, warning, and defense. Definitions of the terms used in this report are given below:

- *Sovereignty* is the inherent right of a nation to control aircraft approaching or operating within its airspace.
- *Airspace integrity*, for this study, refers to the air sovereignty of the U.S. and Canada collectively. The mission of airspace integrity involves detection (sensors), identification, and enforcement (armed interceptors) to deny unchallenged access to any aircraft attempting to penetrate specified areas of airspace over North America.
- *Warning* is the detection and designation as unknown of aircraft (including cruise missiles) entering the surveillance area of North America.
- *Threat characterization* is the determination, subsequent to warning, that an aircraft is potentially hostile and has the capability and possible intent to destroy a target in North America. It can be accomplished by: (1) visual observation and identification of enemy aircraft or cruise missiles, (2) the detection of several unidentified aircraft attempting to penetrate the surveillance area simultaneously, or (3) observation or detection of aircraft weapons launch/release.
- *Defense* is the complete process of warning and characterization plus the actual destruction of enemy aircraft (denoted as *active* defense).

D. FINDINGS

1. <u>Air Defense Policy</u>

(U) *Mission priorities and design requirements to meet the jointly approved North American air defense objectives are ambiguous and should be clarified.* Four policy alternatives were developed to remove the ambiguities and clarify the mission priorities and design requirements. Protection of the U.S. strategic forces is the fundamental military objective for deterring a nuclear attack against North America. A North American air defense system should provide, (1) as a minimum, warning of a potential bomber attack on U.S. strategic forces, and (2) no less warning time than that provided by the strategic missile attack warning system (Alternative I). Expanding on this minimum capability to provide additional warning and characterization capability for bomber attacks on major industrial targets of North America (Alternative II) resulted in negligible increased cost and, therefore, forms the basis for the *options for decision* (Section E). Once the warning and characterization system is implemented, the objectives of Alternative III could be met with properly trained and equipped augmentation (non-dedicated, but available) forces in time of crisis. A decision to procure additional dedicated air defense capability for damage limiting (Alternative IV) would be very expensive and should be deferred pending resolution of the desired bomber warning and characterization system and other strategic force decisions which could reduce the dominant Soviet ballistic missile threat.

(b)(1)

[redacted]

(b)(1)

[redacted]

2. Current Capability and Limitations

(b)(1)

[redacted]

(U) *The current locations of surveillance radars, aircraft identification zones, and interceptor operating areas do not cover some potential bomber penetration routes and do not reflect the evolution of civil air traffic routes* [Fig. I-1]. Introduction of new equipment and demands for fuel economies are changing the civil domestic and international air traffic patterns. Many trans-Atlantic great circle routes (shortest distance for bombers or civil traffic) make landfall on the Labrador coast. The

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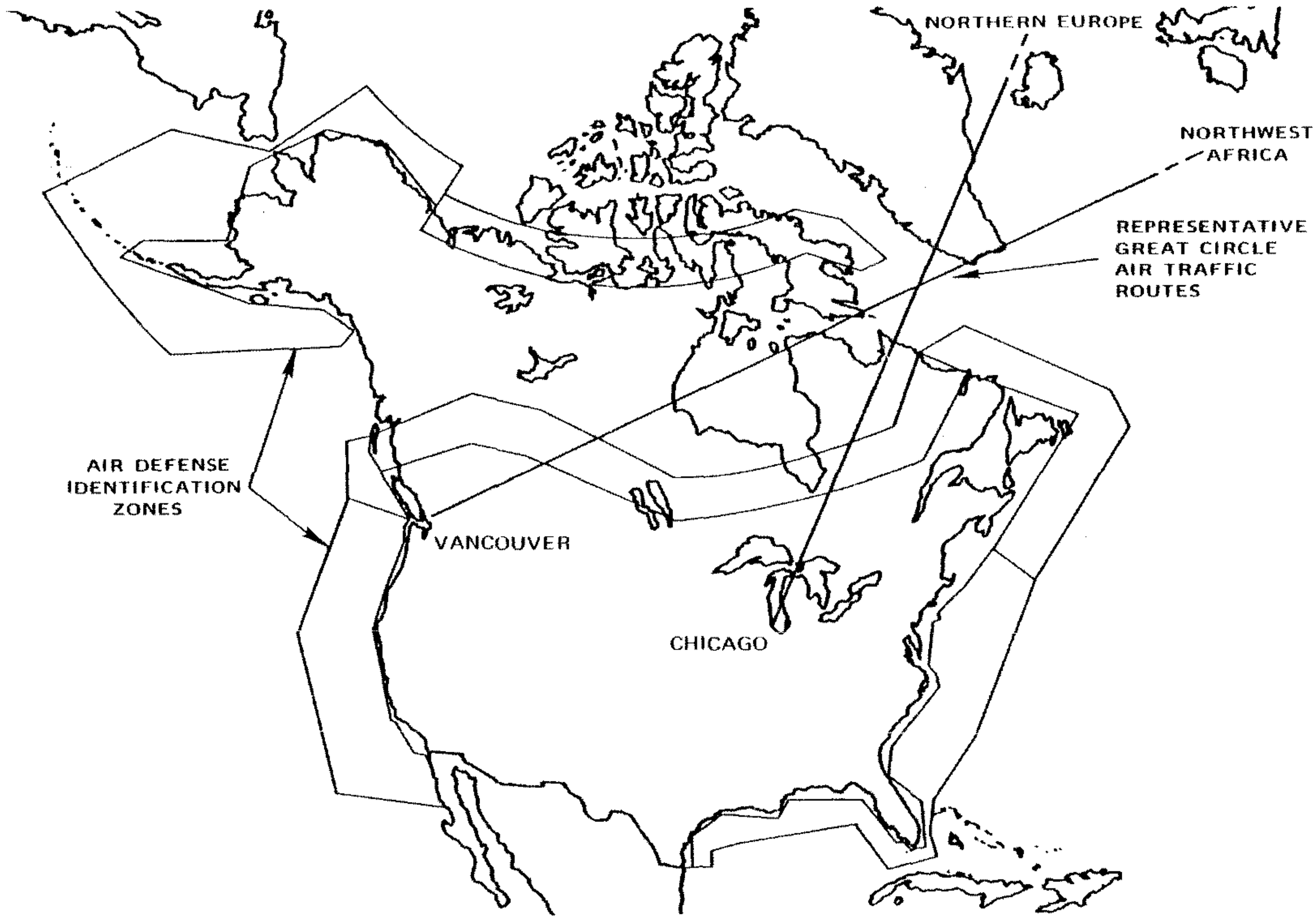


FIGURE I-1 (U). AIR DEFENSE IDENTIFICATION ZONES (U)



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external configuration of the air defense system, however, has remained much the same as it was in the late 1950s, leaving significant gaps in coverage for bomber warning and apparently ignoring airspace integrity enforcement problems.

(b)(1)

[redacted]

(U) *The efficiency of the current system can be improved by increasing the interdependence of the two nations.* Changes in the interceptor basing and radar sitings without regard to national boundaries and eliminating some redundant and low utility coverage at the U.S./Canadian border could improve the effectiveness and reduce the cost attributable to the current air defense system.

~~(S)~~ *Attempting to maintain the current air defense system radars, interceptors, and $C^3$ would cost about $23 billion over the 1980-2000 period, assuming equipment could continue to be operated during that period.*

(U) *The operating and support cost is the major factor in the annual and life-cycle (1980-2000) cost for air defense, accounting for about 80 percent of the total.* A major thrust of the study was developing system alternatives which could satisfy air defense requirements while minimizing future operating and support costs.

(b)(1)

[redacted]

3. Threat Analysis

~~(S)~~ *The emerging Soviet capability with major air defense impact is the extended range air-to-surface missile (ASM).* The key elements of the threat are (1) the extension of ASM range from the current 320 nmi to 800 nmi in the 1982-1984 period, and to 1,000 nmi by the 1990s [Fig. I-2], and (2) sustained low-altitude flight capability (1,500 feet now to a few hundred feet in the 1990s) for bombers and ASMs. A new long-range bomber is projected to enter the Soviet inventory, but long-range bomber force levels are not expected to increase. All Soviet bombers, including Backfire, would be capable of launching the long-range ASM.

(b)(1) [redacted]

4. Future Modernization

(b)(1) [redacted]

(b)(1)

(b)(1)

(b)(1)

(b)(1)

[redacted]

E. OPTIONS FOR DECISION

(b)(1)

[redacted]

~~(S)~~ Option 1 offers three approaches to improve the efficiency of operations, remove coverage gaps, and provide high-altitude airspace integrity enforcement at one-fourth less total cost than the current system, but with some near-term annual procurement cost increase. Options 2 and 3 build on Option 1 and offer two ways to use these cost savings to achieve the required lower altitude and longer range surveillance capabilities to meet the requirements against the projected threat to the year 2000. Options 2 and 3 differ primarily in the timeliness of the achievement of these capabilities and the near-term funding requirements. The options for decision are summarized as follows:

- ~~(S)~~ *Option 1: Modernization and redeployment of the existing system*. The philosophy of this option is to develop a contiguous North American warning, characterization, and airspace integrity system capable of providing an intercept capability [redacted] (b)(1) Three different sub-options are provided. Each of these sub-options will reduce current operating and support costs, replace obsolescent equipment, close landfall radar coverage gaps [redacted] (b)(1) The option selected becomes the base on which an all-altitude, long-range coverage system would be deployed after the mid-1980s.

(b)(1)

(b)(1)

(U) Table I-1 summarizes the equipment and cost of the various sub-options.

TABLE I-1 (S). SUMMARY OF OPTION 1 (U)

(b)(1)

[redacted]

~~(S)~~ Options 2 and 3 offer two ways to add a meaningful warning and characterization capability to the system. [redacted]

(b)(1)

(b)(1)

[redacted]

(U) Table I-2 summarizes the key features of Options 2 and 3.

(b)(1)

(b)(1)

TABLE I-2 (S). SUMMARY OF OPTIONS 2 AND 3 (U)

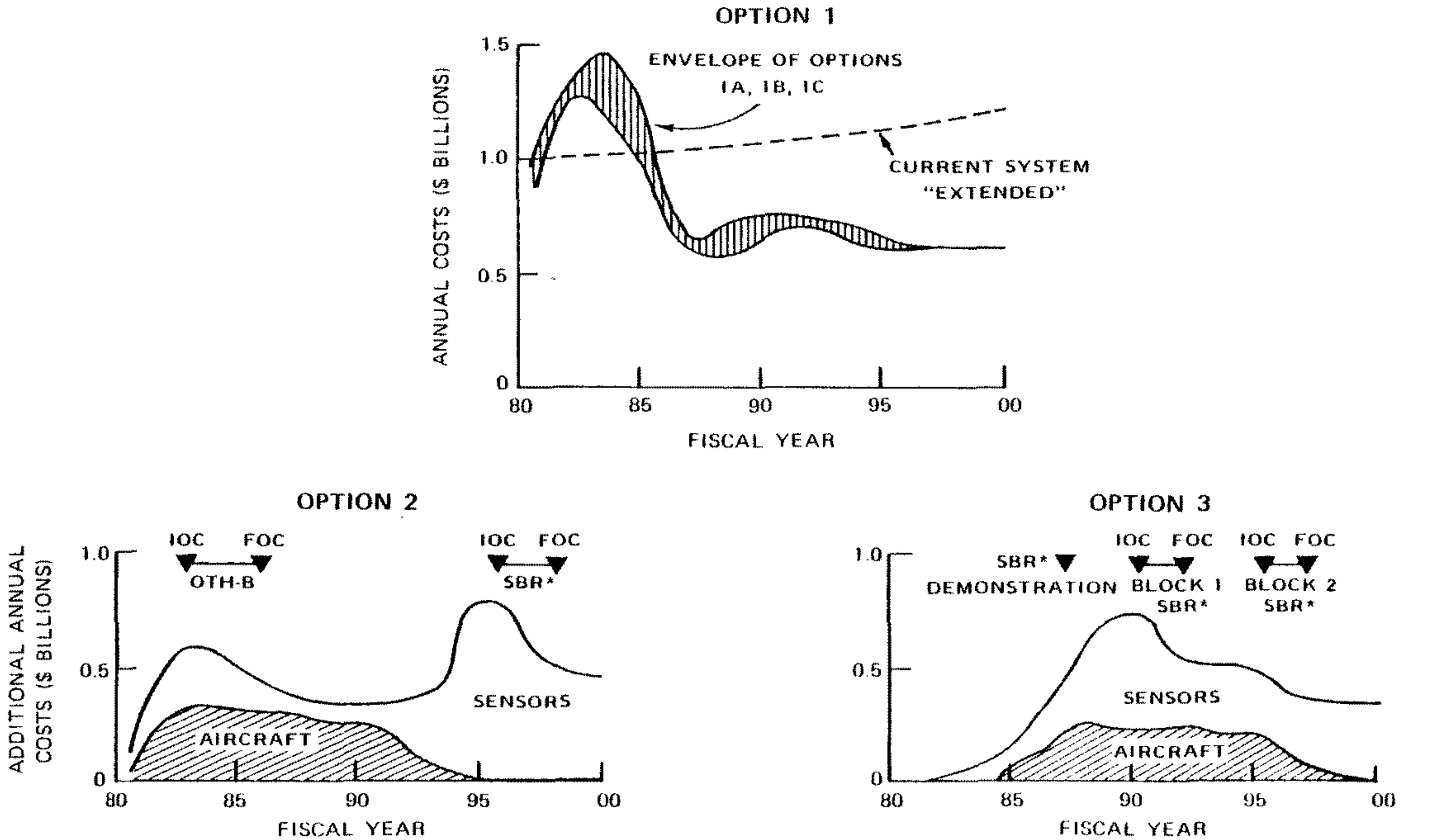
(b)(1) [redacted]

(U) The annual funding profiles for the various options for decision are shown in Figure I-6.

## F. SUMMARY OF DECISION ISSUES

~~(S)~~ Decisions will have to be made on modernizing air defense components. Failure to make a decision will result in a higher cost of air defense system operations, an uncertain ability to continue to operate many of the existing components, and an inability to deal with the current and projected threat capabilities. On the other hand, a decision on the following issues will provide the necessary guidance to (1) remove the existing ambiguities in the North American air defense objectives and (2) develop the plan for the future modernization of the North American air defense system.

- ~~(S)~~ *What should be the extent of coverage of airspace integrity enforcement over North America?* [redacted] (b)(1)




* SBR — Space-Based Radar Option Shown

FIGURE I-6 (S). ANNUAL FUNDING PROFILES FOR DEPLOYMENT OPTIONS (U)

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(b)(1) [redacted]

-- Modernization of the current radars [redacted] (b)(1)

(b)(1) [redacted]

-- The removal (or the turnover to the FAA) of the northern tier JSS radars in the U.S.

-- Reductions of dedicated interceptors to those levels necessary to support the airspace integrity and warning and characterization capabilities; an expanded active defense capability would be obtained with properly trained and equipped augmentation forces.

(b)(1) [redacted]

- ~~(S)~~ *Should the U.S. and Canada deploy a long-range, all-altitude surveillance system to deal with the altitude and range capabilities of the current and projected threats to North America? On what schedule?* [redacted] (b)(1)

(b)(1) [redacted]

- ~~(S)~~ *Should additional dedicated air defense components be procured to provide an active defense and damage limiting system against bomber/cruise missile attacks?* [redacted] (b)(1)

(b)(1) [redacted]

(U) Figure I-7 summarizes the building block approach to air defense modernization of these decision issues.

G. OTHER ISSUES

(U) There were several issues which arose in the study that fell outside the terms of reference:

- (U) In some options, a reduction in air defense presence at the U.S./Canadian border would require a revision in the current procedures for civil/military cooperation.
- (b)(1) [redacted]
- (~~S~~) The projected deployment of space surveillance systems within the next 20 years could have a significant impact on U.S. strategic posture, could influence arms limitations, and might change international space and radio frequency usage. The question of whether the proposed systems are possible and desirable in the broader international and strategic context needs to be examined
- (b)(1) [redacted]

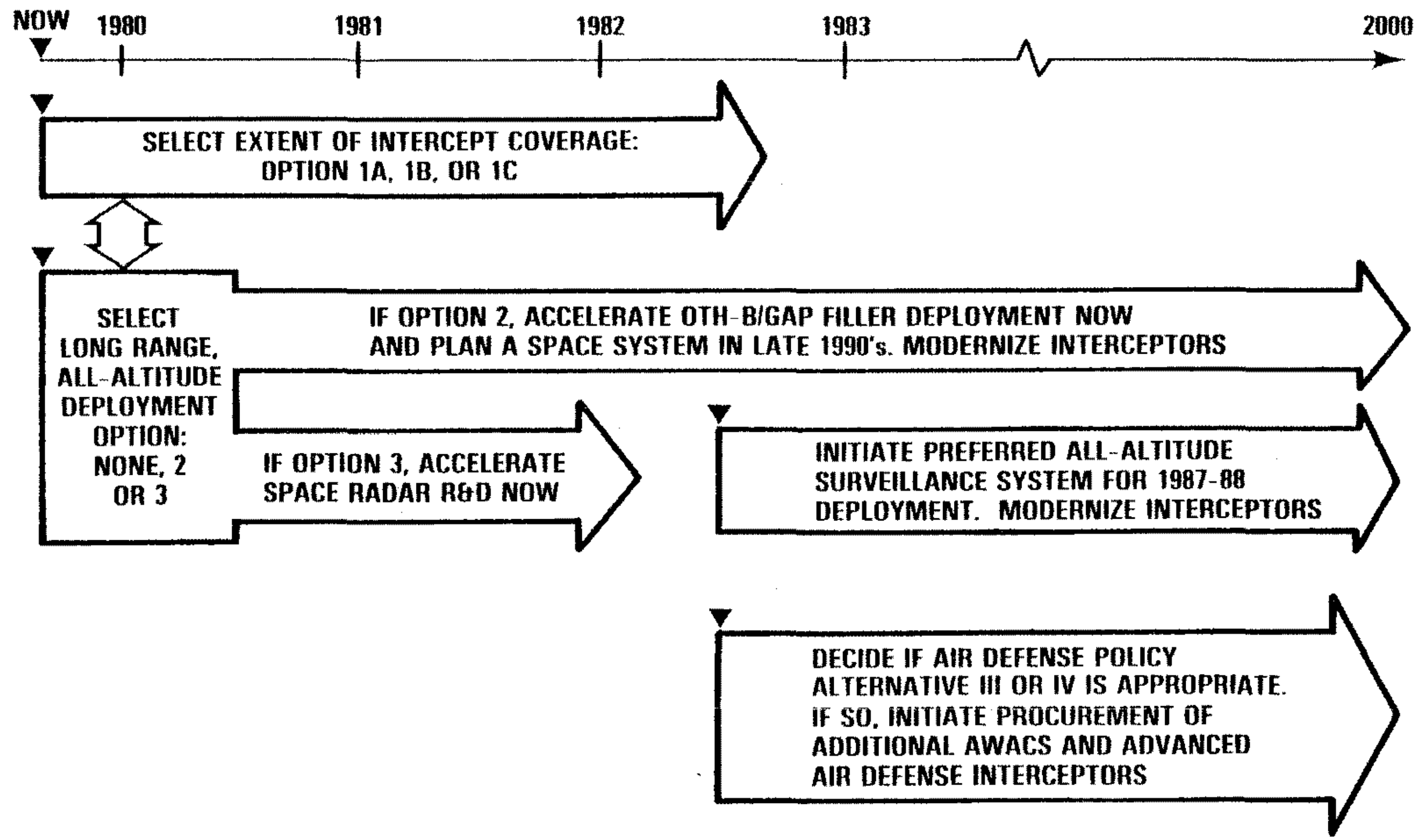


FIGURE I-7 (U). AIR DEFENSE SYSTEM BUILDING BLOCKS (U)

ATTACHMENT B TO ANNEX 6

EXECUTIVE SUMMARY

OF U.S. AIR FORCE

AIR DEFENSE MASTER PLAN

JANUARY 1981

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Jan 27 1981

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE/COMMAND CONTROL, COMMUNICATIONS AND INTELLIGENCE

SUBJECT: Air Defense Master Plan (U) - INFORMATION MEMORANDUM

(U) In response to the March 1980 Consolidated Guidance, the Air Force has developed a plan to improve the air defense of North America. This plan includes program recommendations which would improve warning, surveillance and active defense capability.

~~(S)~~ In developing the plan, strict adherence was paid to both the spirit and the letter of the 1980 U.S.-Canadian Policy Statement. The major emphasis of the plan is to provide deterrence. This deterrence has both a broad and more specific dimension. In the broadest sense, the plan would provide an air defense posture which is flexible and credible enough to deter the Soviets from embarking on a dedicated intercontinental bomber and standoff missile program. In the more specific sense of deterrence, the plan provides a credible capability to limit damage (b)(1) [redacted] (b)(1) [redacted]

~~(S)~~ The recommendations outlined in Section VIII of the plan represent a reasonable and fiscally achievable program for gradually upgrading our capability through the mid-to-late 1980s. [redacted] (b)(1)

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ With regard to AWACS, we recommend better exploitation of the unique capabilities of this force to improve significantly warning, surveillance and active defense. (b)(1) [redacted]

(b)(1) [redacted]

(b)(1) [redacted]

(U) The plan includes funding profiles for each recommendation. Reluctantly, we have aligned the Air Defense Master Plan with last minute changes to the FY 82 President's Budget. Thus, there are no unfunded FY 82 requirements which could short-circuit the plan early on. However, when viewed in the overall context of air defense requirements, three of the recommendations should be reconsidered for FY 82 funding: continuation of the 31-site DEW through FY 82 ($19M), expeditious construction of the Tinker Alert Facility ($23M), and continued production of AWACS in FY 82 ($250M). Without restoration of these programs, the logic of the plan is undermined to the extent of their absence.

(U) We will include appropriate funding for the outyears in our FY 83-87 POM. At this time only partial outyear funding for these initiatives is included in the FY 82 President's Budget.

(U) We look forward to working with you as you build the OSD Master Plan and continue deliberations with the Canadian Government. We offer our full support -- including active participation on the working group developing the OSD Air Defense Master Plan -- in helping to justify, fund, and deploy the capabilities outlined in the attached plan.

Lew Allen

LEW ALLEN JR, General, USAF
Chief of Staff

Hans Mark

HANS MARK
Secretary of the Air Force

Atch
USAF Master Plan for
North American Air Defense (S)

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A. (U) Background

~~(S)~~ The U.S./Soviet strategic balance has changed since the 1950/1960 era. Our strategic dominance has been lost and major efforts are now being made to assure that strategic force elements and viable response options are available to the NCA for effective wartime use.

(b)(1)

[redacted]

(U) Numerous Air Defense and tactical warning studies, as well as the 1979 Joint U.S./Canadian Air Defense Study (JUSCADS), conducted at the request of the Secretary of Defense and Canadian Minister of Defence, have been completed. These studies form the basis for this architectural plan as well as for modernization programs which were submitted to Congress requesting funds to develop new radars.

(U) The House Armed Services Committee, in reviewing the FY 80 budget request for the Enhanced Dew Line (SEEK FROST) made the following statement:

> "...The committee recommends the program (Enhanced DEW Line) be deferred until the Department of Defense presents and supports an integrated air Defense modernization plan, including a commitment to modernize our interceptor forces...."

(U) The Senate Armed Services Committee stated that testimony indicated the primary function of the Enhanced DEW Line would be to provide tactical warning of a strategic attack in order to launch the Airborne Warning and Control (AWACS) aircraft. In the light of the several other strategic warning systems, the need for a system to provide tactical warning for launching AWACS seems highly questionable.

(U) The House Appropriations Committee believes the preparation of a Master Plan is urgent and should be accelerated to the extent feasible, hopefully in time to affect the 1981 budget. Absent such a Master Plan, it will be difficult to justify support for upgrades, replacements or new starts.

(U) This architectural study examines several technological alternatives to improve the atmospheric tactical warning capability, including:

- Improved surveillance coverage and reliability of ground radars
- OTH-B full-scale experiments for aircraft detection at long range and at all altitudes
- Space-based radar and IR systems for aircraft and cruise missile detection and tracking, now in a system concept phase.

(U) Within the OSD an effort is now underway to develop a master plan for $C^3$ integration including tactical warning of ballistic missile attack as well as air-breathing attack. The complementary nature of the systems required is recognized as necessary to provide timely attack warning to the NCA. The current effort of the USAF and DOD will produce a coherent program for the FY 1981 budget and the FY 1982-1986 POM. Among the essential attributes of these systems are:

- o Improved quality of warning information
- o Timeliness of warning information
- o Rapid dissemination of information
- o Survivability of warning systems
- o Reduced operations and support costs.

(U) Accordingly, the terms of reference for this Architectural effort are: Provide atmospheric tactical warning for NCA, SIOP forces, Strategic $C^3$, and defense forces as a complement to ICBM/SLBM warning.

B. (U) Analysis of the Current and Projected Threat

~~(C)~~ The Ad Hoc Architecture effort focused on small bomber attack scenarios rather than large-scale bomber attacks [redacted] (b)(1) Scenarios considered were: precursor bomber attack as an element of first-strikes, other potential threats, a show of force, or a limited war objective. The latter leads to the need for a reconstitutable air defense against a possible second strike.

(b)(1)

[redacted]

~~(S)~~ There is also evidence of Soviet developments in new bombers and plans for range improvement to the bomber fleet by refueling operations. Use of both gravity bombs and air-to-surface missiles adds flexibility and capabilities to this bomber force.

TABLE 1
LIKELY ATTACK FORCE (U)

(Table ~~SECRET~~)

(b)(1) [redacted]

C. (U) <u>Projected Warning System Needs</u>

1. (U) <u>JCS Air Defense Policy (tentative)</u>

~~(S)~~ A revised JCS Air Defense policy statement which impacts Atmospheric Tactical Warning needs has recently been developed and recommended to the Secretary of Defense. The recommended policy is provided in Appendix B. (b)(1) [redacted]

(b)(1) [redacted]

(S-Continued)

(b)(1) [redacted]

2. (U) Warning System Needs

~~(S)~~ This policy implies a complete surveillance process that detects, identifies and transmits this information to the NCA and $C^3$ elements. [redacted] (b)(1)

~~(C)~~ The corresponding warning time needed for the mid-late 1980's threat is shown in Figure 1B, and the response times allowed are the same as were used in the early 1980's threat.

~~(S)~~ Figure 2 shows the warning needs for both threats in terms of detection distances from the defended area. [redacted] (b)(1)

(b)(1)

(b)(1)

(b)(1) [redacted]

~~(S)~~ In the case of the mid-to late-1980's threat intelligence sources indicate a M 1 New Long Range Bomber (NLRB). [redacted] (b)(1)

(b)(1) [redacted]

~~(S)~~ Warning system needs for command, control and communications ($C^3$), assuming wide area sensor coverage, would not be as complex as is normally required for active air defense. [redacted] (b)(1)

(b)(1) [redacted]

(U) Wide area dissemination of detection and track information to the NCMC and Canadian ROCCs must be assured. A fusion center may be needed which will receive track data from many different types of sensors which will have to be verified and correlated such that military operations centers can formulate accurate descriptive summaries of the threat size, direction, and intended targets.

D. (U) <u>Current Programmed Atmospheric Tactical Warning Facilities</u>

(b)(1) [redacted]

(b)(1)

(b)(1)

(b)(1)

[redacted]

(U) At present, the DEW Line is the only NORAD Atmospheric Tactical Warning system. The northern location of the DEW Line and the Alaskan Coastal radars are capable of providing sufficient warning time for National Command Authority decision making, decision dissemination, and force execution/survival.

(b)(1)

[redacted]

(U) Modern, minimally attended, ground-based radars having performance suitable for near-term improvement programs are in full-scale engineering development for operational use beginning in 1982. These systems together with the OTH-B deployment could provide a meaningful improvement to fulfill the needs advanced by the JCS policy statements. In addition, the opportunity exists to greatly reduce radar site manning and other operational and support costs.

~~(C)~~ The E-3A Sentry (Airborne Warning and Control System) is intended to provide NORAD with a wartime surveillance and control capability. [redacted]

(b)(1)

E. (U) <u>Architectural Approach</u>

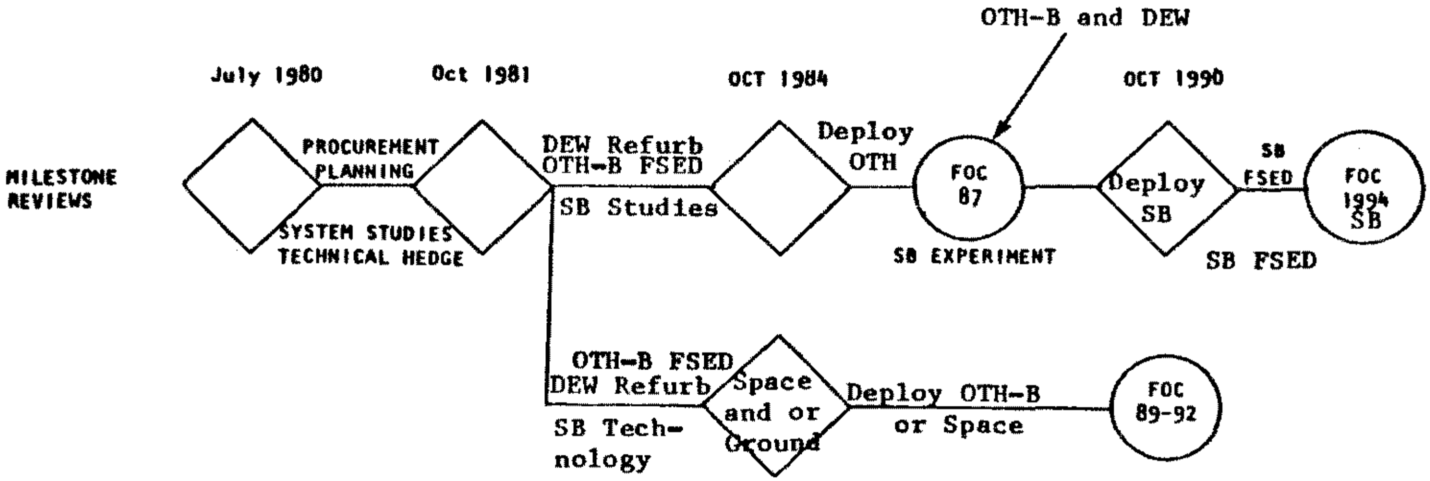
(U) A structured approach is required to assure quick response to urgently needed surveillance improvements and application of developing technology to the atmospheric tactical warning system of the future. The approach must provide for modernization, increased coverage, retirement of unnecessary systems, and low risk capability improvement for the near future.

(U) The highest priority item is an interim improvement to the atmospheric tactical warning system between now and 1984. Accordingly, our architectural approach emphasizes a plan of action that will allow the early completion of urgently needed improvements while providing a basis for the most effective future surveillance capability that can be achieved.

~~(S)~~ The architecture approach to providing a future atmospheric tactical warning capability is depicted in Figure 4. At each major milestone review, the decision-maker has been provided with multiple program options. Milestone review dates have been planned at logical and realistic

SECRET

# FIGURE 4
## BASIC APPROACH (U)
## (FIGURE SECRET)




MAJOR REVIEWS INCLUDE

- MAJCOM Comments
- THREAT
- TECHNICAL PROGRESS
- UTILITY



SECRET

(~~S~~-Continued) programmatic and fiscal milestones, for example, the OTH-B DSARC III is scheduled for October 81, after completion of ERS testing. The decision framework will allow us to keep options open so that we are able to take maximum advantage of advances in these technology areas in the future. It will provide for the appropriate level of OTH-B technology after October 1981 and determination of the appropriate level of space-based capability. It will also provide for an orderly replacement of ground radars between June 1980 and October 1984. It must be emphasized that we have not selected a preferred path but plan to collect essential data to allow the decision-maker to select one of several alternative paths at each major milestone review consistant with urgent requirements, cost, and performance assessments.

(~~S~~) The first major milestone--July 1980--has been planned to obtain a commitment by the AF and OSD to follow the framework approach. The commitment is to initiate the architecture by supporting program wedges in the FY 82 POM and by funding limited planning, study, and technology efforts in FY 81 to support the decision-maker in early FY 82 (October 1981). Early emphasis is on modernization of the DEW Line to affect cost reductions and increased capability in the mid-term period and to identify decision dates regarding the assessment of space technology. The final objective is to provide an atmospheric tactical warning capability consistent with the threat and the needs of the country.

(U) By July 1980 an Air Force corporate position is needed to provide initial commitment to improve the ground based early warning systems including funding for continued OTH-B testing and validation of space based sensor options

(U-Continued) and authorize preparation of procurement packages to support the Architecture. A corporate Air Force position on an Air Defense force structure option is also needed by July 1980 regarding F-106 replacement and U.S. coordination of these actions with Canada should begin.

(U) The architecture provides windows as shown in Figure 4 at which time DOD can review progress made in sensor developments supported by IR&D in the United States/Canada and other friendly countries to assess the least costly and lowest risk candidate sensors available. Options and the actions to be taken in this time-phased approach are given in Table 2.

F. (U) Architecture Options

1. (U) Technology Base

(U) Four alternative technologies are being considered as a basis for future capability. These technologies will provide support for much needed surveillance system improvement and reduction of current high operating costs. The potential of each of these alternatives is shown in Table 3.

2. (U) Systems Options

(U) A preliminary assessment of systems in various stages of development is listed in Table 4. Many other systems and building blocks for different systems were studied by the Ad Hoc group and will be given further consideration as the Architecture work continues. However, the systems listed are representative of the breadth of coverage considered.

(U) Current programmed system capability was previously addressed and was found to be grossly inadequate. Note that

(b)(1)

[redacted]

The 20-year costs of operation maintenance and minor refurbishment of the current programmed warning systems is 86 billion in FY 80 dollars. The costs for the United States and Canadian fighter forces are not included.

(b)(1)

[redacted]

*Minimally attended radar

(b)(1)

[redacted]

(b)(1)

[redacted]

(b)(1)

(b)(1) [redacted]

(U) The cost of operation and maintenance of the full ground-based system exclusive of the costs for the current programmed fighters is $7.2 billion.

(b)(1) [redacted]

~~(S)~~ For the purpose of this Architecture, the space-based radar was assumed to provide bomber or ASM Carrier detection and tracking from the point of origin to the intercept point and would provide information such that command and control of the fighters can be exercised without excessive delays.

(U) Current estimates for this warning system, based upon bomber warning being provided by the current system

(U—Continued) through 1993 and development of the satellite systems and supplementary technology is 7.7 billion in FY80 dollars.

(b)(1)

[redacted]

(U) This program includes full JSS, 10 Alaskan MAR radars, CADIN PINETREE current programs as well as technology for development or beyond line-of-sight communications, $C^3$ planning, non-cooperative identification, and cruise missile surveillance.

~~(S)~~ These warning systems were also compared with an airborne option which would utilize E-3A sentry aircraft on a continuous basis. [redacted] (b)(1) This would cost over 50 billion in FY 80 dollars.

(U) The Ad Hoc architecture group made a cursory examination of the fighter options needed to complete the warning function. Forward basing in the far North was considered but a more detailed look at Arctic Circle operations is required before recommendations can be made. The available fighters are discussed in Appendix D.

G. (U) Findings

(U) The fundamental findings of this study are as follows:

1) The changing strategic balance requires a review of our air defense policy.

2) Atmospheric Tactical Warning and air defense contribute directly to our strategic retaliatory posture.

3) On a 20-year life cycle basis, modernization will cost no more than retaining our current ineffective and obsolescent ground systems.

4) A roadmap for improving our ATW system results from an evaluation of current milestone and the projected technology advances.

H. (U) Summary/Conclusions

~~(S)~~ Although requirements for atmospheric tactical warning were the main considerations, the Architectural Plan centers on the capabilities projected for near and far term system developments. Ground-based radars and associated siting provide the framework for maximizing tactical warning capability, particularly in the 1980s. Minimally attended radars are to be available in two years. They provide the basis for an upgrade of the DEW Line with a resultant saving in O&S costs. The OTH-B radar, which should provide a significant extension of seaward coverage for CONUS, is currently undergoing testing. These radar types will support the near-term warning system requirements. [redacted]

(b)(1)

I. (U) Required Actions

(U) Implementation of the plan will require certain actions prior to August 1980 by Headquarters USAF, Air Force Systems Command, and User Commands. Headquarters USAF will brief MAJCOMS and initiate appropriate discussions with the Government of Canada. Accordingly, Hq USAF will issue program management directives for the affected programs to support policy changes. These directives will request analysis and data to support early DEW Line upgrade and future warning

(U—Continued) system recommendations including cost saving recommendations and a detailed threat analysis in terms of FY 82 projections. Required documentation activities will include: an architectural decision document; expansion of the architecture to encompass command, control and communications, and augmentation forces; consolidation of POM packages into architectural decisions and draft mission element needs statements for Atmospheric Tactical Warning (ATW).

(U) Specifically AFSC will prepare prior to FY 82 a program plan to include the following options:

(1) (U) Phased procurement plan for an OTH-B radar system starting with the existing Experimental Radar System (ERS) upgraded to operational standards and extended to 180° azimuth coverage and with a 180° azimuth coverage site located in the state of Washington, and 120° south-looking coverage site to be located in the state of Kansas. The refurbished Dew Line, tactical warning command centers and communications required shall also be included.

(2) (U) Phased procurement plan for an OTH-B system based upon new radar siting and new radar hardware to provide the same azimuth coverage as Option 1 except that siting is optimized to provide early warning to accommodate the mid-late 1980s threat. Dew Line refurbishment and $C^3$ needs will also be included in the plan.

(3) (U) Phased development plan for space-based ATW systems to include details on a space system validation phase (i.e., ground tests space segment demonstrations) for both space-based IR systems and radar systems to provide detection and tracking of bomber or missile carrier aircraft. This plan would also include the necessary $C^3$ elements.

(4) (U) An interim warning system plan based on the use of the E-3A for peacetime warning to augment ground-based radar systems. This plan would also include the refurbished Dew Line Command Centers and the necessary communication and identification systems needed.

(U) In addition AFSC will submit a plan for integrated management structure capable of carrying out the above options or combination of options.

(U) AFSC with ADCOM support will provide detailed cost estimates by 1 Oct 81 in time for the milestone review tentatively scheduled for 1st quarter FY82.

(U) Air Defense Center/TAC will:

(1) (U) Provide operations concepts for each of the plans to be submitted by AFSC. The plan will incorporate all warning sensors necessary to the options addressed including the Cadin Pinetree line JSS SEEK IGLOO and SEEK SKY HOOK. Details on fusion center needs and concept of operations various fighter basing concepts consistent with ATW systems options will also be included.

(2) (U) Perform utility analysis on the options including the interim E-3A system.

(U) SAC/TAC will provide:

(1) (U) Details on multi-mission usage of space-based options incorporating SACs needs for monitoring and control of cruise missile bomber carriers, refueling operation during peacetime, contingency warfare or general war operations as well as the needs for tactical air units during similar operations. The functional capability of space-based ATW to augment intelligence community systems should be stated.

(2) (U) An examination of means of acceleration of space-based alternatives by allowing reduced reliance of tactical warning systems during the interim in order to release money for development of a space-based system.

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## Annex 7
## BALLISTIC MISSILE DEFENSE (U)

### 7.1 INTRODUCTION (U)

(U) From its inception, ballistic missile defense (BMD) has faced an uphill battle. The apparently insurmountable problem of intercepting a fast-moving ICBM, followed by the (b)(1) [redacted] challenges posed by operating in the natural environment--and even more so in a nuclear-disturbed one--were always accompanied by high costs and political unacceptability. The latter resulted from strongly- and widely-held views that a capability to defend made war more probable, by undermining the mutual assured destruction (MAD) philosophy (never subscribed to by the Soviet Union). These views culminated in the ABM Treaty of 1972, regarded by both the arms-control community and the public in general as one of the greatest steps for peace since World War II.

(U) In spite of the technical difficulties, the high cost of resolving them, and the political climate of the last decade, significant progess has been made in BMD. (b)(1) [redacted] Prototype operational radars embodying the performance of the instrumentation radars have been built, and costs have been dramatically reduced. New concepts have appeared involving non-nuclear interceptors operating in the exosphere.

(U) Meanwhile, the potential attacking force which must be contained has grown to a degree not foreseen; however, it can be countered in the case of attacks on defended U.S. ICBMs by the combination of deceptive basing of ICBMs and BMD employing preferential defense strategies. These two factors combine to offer considerable leverage to defense. In the case of MPS deployment with, for example, 10 shelters per M-X, the number of RVs required to defeat the system is 10 times the number of M-Xs. If a defense can be defined that cannot be singled out for attack and can preferentially defend against only those RVs targeted at occupied shelters (say, holding off three RVs before the fourth kills), then to exhaust the defense and defeat M-X, the number of RVs required is 40 times the number of M-X. Such is the leverage provided by deception and preferential defense.

(U) At the same time, a more sophisticated view of the role and limitations of BMD has developed. The simple-minded paradox that any defense can be penetrated though any attack can be stopped has yielded to more meaningful analysis of offense-defense interactions in terms of the price (in re-entry-vehicles, or other resource measures) charged the offense to achieve its objectives. Although realistic (and fairly low) limits on the allowable densities of intercept engagements have been recognized, it is also clear that almost any price can be charged to kill ICBMs, if one utilizes the leverage of attack dilution through deceptive basing and preferential defense, as well as multiple intercepts per aim point. The vulnerability of the defense system itself to a suppression attack can be eliminated by deception (by hiding or moving radars) as well as by proliferation of relatively inexpensive radars.

(U) It has also been recognized that BMD should not be examined in isolation. Just as the combination of deceptive ICBM basing and BMD lead to high effectiveness, other applications of BMD profit from synergism with other appropriate actions. Even minimal protection of personnel at military bases enhances greatly the effectiveness of BMD applied to these bases, and the same applies to rudimentary hardening of factory machinery. Protection of National Command Authorities is probably best achieved through a combination of active and passive protective measures, plus deception, but BMD can still plug loopholes in this system and may raise the threshold for deliberate attacks to a high value. Coupling of offensive forces with defense, even apart from extreme cases such as launch under attack, can dramatically enhance survivability. For example, destruction of enemy reconnaissance assets can deny him the ability to assess attack effectiveness and hence the ability to efficiently re-attack surviving targets, thereby maintaining a high price.

(U) The most difficult problem is still the defense of urban population, in as much as the target is intrinsically soft and defense must be almost leakproof to deny damage. Nonetheless, civil defense measures can be employed in conjunction with BMD to make both problems more tractable.

(U) This report treats these issues, attempts to quantify some of them, and makes recommendations for both implementation programs and augmented technology base activities.

7.2 ONGOING PROGRAMS (U)

(U) A primary objective of the U.S. BMD program has been and continues to be the development of component and system technology in order to provide options for the defense of the land-based ICBM force. At the direction of Congress, these efforts have been limited, since the mid-1970's, to advanced development and technology base activities. While technology demonstrations have been and are being conducted to demonstrate the feasibility of defensive options capable of absorbing the growing U.S.S.R. threat, actual system development has not occurred, and thus is a continuing unaccomplished step in the path to a deployment option. The evolution of the BMD program during the past decade is a consequence of budget limitations, Congressional prohibition of prototype development, treaty constraints, and the challenges of rapid growth in U.S.S.R. threat size and technology.

(U) In the BMD program a balance is sought between two major objectives; (1) the ability to achieve a rapid deployment option which has low development risk and which can meet near-term objectives; and, (2) the maturing of advanced technology concepts which can counter projected future threat growth and incorporate features which further improve the attractiveness of defense. A third element is to maintain a technological lead so we will not be surprised by Soviet BMD developments. To meet these objectives, there are two major elements of the BMD program: the Systems Technology Program, which supports work on near-term BMD systems (such as LoAD) using technology reasonably at hand; and the Advanced Technology Program, which examines and matures technology to support improved system options for countering more stressing future threats.

7.2.1 SYSTEMS TECHNOLOGY PROGRAM (U)

(U) During the mid-70's the mission for BMD was directed toward defense of Minuteman; the near-term system solution for this mission was designated Site Defense. In 1979 the M-X/MPS concept was included in the U.S. ICBM force planning for the early 1990's. This option has had a major impact on the BMD program, and has resulted in the definition of a system and program that could be deployed effectively with the M-X/MPS concept. This program is known as Low Altitude Defense (LoAD).

~~(C)~~ More recently, concerns about the window of vulnerability, the status of M-X/MPS, the realism of the current mission requirement, and the evolving strategic policy, have resulted in a re-examination of rapidly deployable, mobile, terminal defenses, including variations of the above concepts. [redacted] (b)(1) It is discussed later under "Proposed Systems (7.3.1.1).

7.2.1.1 <u>Site Defense</u> (U)

~~(C)~~ Current endoatmospheric defense options have evolved from the Site Defense system designed in the early 1970's as a more cost-effective and resilient defense of Minuteman than could have been provided by SAFEGUARD. Extensive field tests at the Kwajalein Missile Range (KMR) were completed in September 1980, demonstrating the resolution of several key technical issues associated with the Site Defense radar and data processing. This program demonstrated detection, tracking, discrimination and designation at the required operating altitudes; demonstrated real-time data processing with commercial computers; and included the development of a prototype radar and a major fraction of the engagement software. [redacted] (b)(1) site defense system represents a demonstrated technology and therefore a low-risk BMD system option.

7.2.1.2 <u>LoAD</u> (U)

~~(C)~~ An alternative terminal defense is offered by the Low Altitude Defense (LoAD) system, which is a generic system being designed to be compatible with M-X/MPS as well as silo defense. [redacted] (b)(1) However, the recently-initiated pre-prototype demonstration program (PPD) includes such a demonstration, compatible with the available funding.

(b)(1)

[redacted]

Comparison of Site Defense with LoAD (U)

~~(C)~~ While several LoAD program options have been proposed, the current LoAD program is constructed around a two phase PPD program followed by engineering development and a production/deployment phase. It results in an IOC in FY90 (see Figure 7.1). A characteristic of this program is to delay engineering development on a specific system as long as possible, [redacted]

(b)(1)

(b)(1) [redacted] These key issues are addressed in Phase I of the PPD, which includes

(b)(1) [redacted]

~~(C)~~ Funding for PPD Phase I and II, which range from $250 to $350 million per year (FY82 to FY86), is included in the POM. In addition, the first year of engineering development funding of $561 million has been included in POM year 87. At these funding levels, LoAD PPD is the dominant item through the mid-1980's in the Systems Technology Program budget, which has a total proposed allocation of about $350 to $400 million per year. Lesser funds (about $30 to $50 million per year) are allocated to systems technology work for exoatmospheric intercept.

### 7.2.2 Advanced Technology Program (U)

(U) With a proposed funding level of about $150 million in FY83, the Advanced Technology Program is directed toward both terminal and overlay technology development and supports the technology base program. The two major classes of systems, terminal defense and exoatmospheric defense, involve fundamentally different technologies to resolve common system issues such as sensor performance/survivability, data processing, interceptor capability, and target discrimination. While subsystems have been under development for both concepts, there are differences in the level of maturity and the level of funding which clearly impact availability.

#### 7.2.2.1 Terminal Defense (U)

(b)(1)

[redacted]

(b)(1) [redacted]

(U) <u>Radar</u>. The agile beam radar (phase-phase or phase-frequency) represents an available technology having been developed by BMDO and many other organizations to the point that earlier problems such as signal processing capability, phase shifter producibility, antenna performance, etc., are no longer at issue, and costs have become reasonable. While the production base is not massive, one does exist. BMD-unique issues such as [redacted] (b)(5)

(U) Terminal Interception. Technical feasibility of terminal interceptors was demonstrated with Sprint (circa 1970) (b)(5) [redacted] Since 1975, no high performance interceptor has been built, and the production base is virtually non-existent. [redacted]

(b)(5)

(U) Non-Nuclear Kill (NNK). Terminal NNK interceptors that hit to kill have high technical risk, particularly in the ability to home and achieve the small miss distance required. Research programs to resolve the critical issues of end-game homing accuracy and target lethality are ongoing at a low funding level. If accelerated, these efforts could culminate in proof-of-principle testing around 1986. Therefore, the production availability of a non-nuclear interceptor is constrained to the early 1990's unless increased effort is applied and extraordinary success is achieved.

(U) Data Processing. While high throughput data processing and large real-time software programs are required for terminal BMD systems, it is in this area where technology has moved forward the fastest over the last ten years. Distributed processing which makes use of the revolution in the availability of highly capable digital hardware, coupled with vastly improved techniques for developing software systems (structured programming, etc.), make it possible to accommodate requirements for tens of millions of instructions per second in modest implementations with reasonable development times. This could become a high risk area if not addressed early and intensively in the system development; but recent experience with complex BMD type programs (most recently with Cobra Judy) indicates that no more than reasonable risk need be incurred if addressed in a timely manner.

(b)(1)

[redacted]

(b)(5) [redacted]

(U) The total funding for terminal defense work in the Advanced Technology Program is about $89 million in FY83.

7.2.2.2 <u>Exoatmospheric Defense</u> (U)

(U) An exoatmospheric defense (Figure 7.2) would intercept RV's above the atmosphere, [redacted] (b)(5) In the baseline configuration the functions analogous to the terminal defense radar are performed by the sensor probes that communicate state vectors for credible targets to a battle manager (computer). The battle manager embodies the engagement strategy and allocates the multiple kill vehicle interceptor accordingly. A second tier discrimination is performed by the interceptor prior to its assignment of the kill vehicles against the threat.

[redacted] (b)(5) Believing that the potential advantages of exoatmospheric systems could never be exploited without technology validation through flight experiments, the Army augmented its exoatmospheric validation program beginning in 1978. In the June 1982 to June 1983 time-frame the feasibility of exoatmospheric non-nuclear kill is planned to be demonstrated in a series of four flights conducted under the Homing Overlay Experiment (HOE) program. [redacted] (b)(1) These flights have begun to develop an exoatmospheric signature data base. Contracts to develop prototype sensors and data processors for exoatmospheric systems have also been intiated.

(U) Technology work is being directed toward identifying and addressing issues in several initial areas: [redacted] (b)(1) the capability to accomplish this function in a high traffic environment will be quantified under the Forward Acquisition Sensor (FAS) Ground Test Program currently to be completed in FY85. [redacted] (b)(5)

*The information on this page is ~~confidential.~~*

(b)(1) [redacted]

(U) Data Processing. In exoatmospheric defense major data processing subsystems are required in the probe, the battle manager and the interceptor. Since in practice it is desirable to minimize the down link communications capacity needed between the probe and the battle manager, the majority of discriminiation and tracking computations are to be done on the probe. [redacted] (b)(1) A full scale probe processor and its attendent software will be developed as part of the FAS ground test program and exercised in the comprehensive simulation to be completed in FY84. The data processor needs for the battle manager are not well quantified but appear to be less than that needed for a terminal system. The interceptor data processing is a subset of that needed in the probe because it deals with far fewer targets.

~~(C)~~ Interceptor. Tactical exoatmospheric defense interceptors have been designed only conceptually to date but have their best analog in SLBM/ICBM technology. [redacted] (b)(1)

[redacted] (b)(1)

(U) In the four-flight test program, the interceptor will be launched from Kwajalein Missile Range to intercept an enemy-like re-entry vehicle launched from Vandenberg Air Force Base. The target state vectors will be provided by radar and handed over to the interceptor. Included in the flight tests are a flight to demonstrate discrimination in real time between (b)(5) [redacted] and a flight to increase the background noise seen by the sensor in a depressed SLBM mission.

(U) Currently, follow-on programs to the four-flight HOE Program in the Army's five year plan for the overlay defense are inadequately funded to maintain continuity in the critical technology demonstrations necessary to make the overlay a viable deployment option before the mid-1990's. No additional flights are scheduled after FY83.

(b)(1) [redacted]

(b)(1) [redacted]

(U) Discrimination. Optical discrimination is based upon physical observables which are less persuasive than those employed in re-entry discrimination. [redacted] (b)(5) (b)(1)

(U) System Issues. System issues include architecture, nuclear effects, and coping with responsive threats.

(U) Architecture refers to the arrangements of acquisition sensors and multiple-kill-vehicle interceptors. Although a rocket-borne sensor would provide the greatest acquisition range, it must be alerted (told to launch) by some early warning system, and moreover has a severly limited lifetime. In addition, the small number of launch sites make it vulnerable to a direct attack on the sensors. An alternative platform is a high-flying aircraft or RPV, which could eliminate the first problem, though at a price in acquisition range, and which could change the nature of the second problem. This is just beginning to be investigated.

(U) The multiple-hit-vehicle interceptor is very large, and not well-suited to mobile deployment. Also, assignment of kill vehicles might not be done efficiently. On the other hand, a large interceptor can carry a supplementory discrimination sensor, and can distribute the cost of the guidance and control system over many kill vehicles. The trade-offs here must be considered.

(U) The effect of exoatmospheric nuclear detonations in creating background signals which mask targets ("redout") is not completely understood, although analysis to date indicates that it is not intractable.

(b)(1) [redacted]

(U) Planned funding for advanced technology development for exoatmospheric defense is about $30 to 40 million per year through the mid-1980's, a level which is insufficient to develop and validate the requisite technology for assuring a system development in a close-in time frame.

(b)(1) [redacted]

(b)(1) [redacted] This important interplay between our nation's advanced offensive technology programs (ABRES) and advanced defensive technology program (BMDATP) has resulted in the U.S. maintaining a significant qualitative lead in strategic offense and defense capability over the Soviet Union.

(b)(1) [redacted]

(b)(1) [redacted]

(U) - Provide technology to improve the efficiency and effectiveness of current and programmed ICBM and SLBM reentry systems.

(U) - Provide reentry system options through demonstration of prototype concepts for potential future weapon systems.

(U) - Conduct independent threat and system effectiveness analyses to support the BMD, intelligence, and SALT efforts.

(b)(5) [redacted]

(b)(5) [redacted]

## 7.3 PROPOSED SYSTEMS (U)

(U) Defense systems which take advantage of the BMD advanced technology and systems technology programs were assessed as part of the Army's summer study. The work of the Army Study Group was closely examined by the DSB panel.

~~(C)~~ Three ground rules distinguished that study and the defense concepts proposed from previous studies of BMD. First, emphasis was to be placed on analysis from an offense reasonable point of view, rather than on a defense enforceable one, of systems which can absorb large numbers of reentry vehicles (RV's). Second, there was a requirement for "enduring" defense which is capable of riding out an initial attack and still retaining defense capability for a significant time (of the order of a month). Finally, only defense systems capable of rapid development and deployment (of the order of four years to initial operating capability and six years to full operating capability) were considered.

### 7.3.1 Terminal Defense (U)

(U) For defense of ICBMs, the details of the configuration of the radar and the interceptors depends upon the choice of ICBM basing mode, which has not been decided for M-X. Two possibilities include deployment in MM silos or deployment in multiple protective shelters (MPS), and the Army study considered two representative options. In the first, 200 M-X are deployed in silos, replacing MM-IIs, and in the second, 200 M-X are deployed in a 2300 shelter MPS system with the Minuteman force remaining as is. These

These options entail silo defense or M-X/MPS defense or combinations of both.

[redacted] (b)(1) Several different existing or developmental radars, interceptors, data processors and transporters were examined to see if they could be used in the system concepts.

(U) It is crucial that the defense system not be an obvious or easy target to attack; the preferred approach for achieving this is to deny information on the location of the defense radars on a time scale needed for detection, retargeting, and attack.

(U) The choice of the means for denying location information on defense radars for the silo and MPS deployments differs. In either case, scramble on warning is a possibility. Creating uncertainty in defense location by means of scramble on warning requires accurate and timely early warning information. It also requires the use of large transporters to move the defense units at relatively high speeds, which will pose serious problems in developing them on a timely schedule. The needed warning time is also a drawback. For these reasons, it was decided to use deployments not dependent on scrambling. [redacted] (b)(1)

(b)(1) [redacted]

~~(S)~~ Three interceptor types have been considered, SPRINT I, SPRINT II, and the LoAD interceptor. [redacted] (b)(1) [redacted] In addition, it is unlikely that SPRINT II could be available before LoAD.

(b)(1) [redacted]

7.3.1.1 <u>Defense of Minuteman Silos</u> (U)

(b)(1) [redacted]

(b)(1)

7.3.1.2 <u>Defense of M-X/MPS</u> (U)

(b)(1) [redacted]

~~(S)~~ If M-X is deployed in the MPS mode, it is of course possible to defend a combination of the M-X's and the MM silos. [redacted] (b)(1)

(b)(1) [redacted]

~~(S)~~ Acquisition schedules for both systems described above have been developed. Both systems can be acquired with an IOC of four years and an FOC of six years after Authorization to Proceed provided the following conditions apply (it is assumed that Authorization to Proceed will not occur before late FY 82):

A) There will be extraordinary management and acquisition processes.

B) Production facilities and tooling can be acquired on an expedited basis.

(b)(1) [redacted]

D) The ABM Treaty will be modified at an appropriate time.

(b)(1) [redacted]

(U) Several final points about the concepts for defense of M-X/MPS and silos are important. [redacted] (b)(5)

(b)(1)

[redacted]

~~(S)~~ Finally, it is worth noting that the specific requirement for endurance set in the Army Study does not significantly impact the design of these defense concepts, though it does affect tactics. [redacted]

(b)(1)

[redacted] (b)(1) In general, interest in endurance of BMD systems is new, and questions of how much is needed and how to get it require much more attention.

7.3.1.3 <u>Other Terminal Defense Concepts</u> (U)

(U) Other so-called "low-cost" concepts for terminal defense have been examined in search of ways to credibly extract 1 RV per aimpoint at low cost with a rapidly deployable system. The idea is to provide early defense of Minuteman silos, an alternative for defense of M-X/MPS, or a backup in case of a schedule slippage of the defense systems described above.

(U) In general, the "quick fix" simple systems at best offer only one shot so that there is not much leverage unless deployed as part of an MPS system. In such a deployment the defenses either have to be proliferated, which drives up costs, or based deceptively, which is problematic for many of the concepts.

~~(S)~~ The Army study reviewed most of the proposals made for cheap systems. [redacted] (b)(1) [redacted] (b)(1) [redacted] Thus, none of the concepts were regarded as promising.

(b)(1) [redacted]

7.3.2 Exoatmosphere Defense (U)

[redacted] (b)(1) [redacted] If the threat grows in numbers, aimpoints can be added or more radars and interceptors can be deployed. Adding interceptors without adding aimpoints is not very effective because of saturation of the limited battle space. More significant resilience to growth is possible by opening up the battlespace through, for example, longer range endoatmospheric interceptors or the deployment of an exoatmospheric system to provide a layered defense. An exoatmospheric system might have an IOC in the early to mid-1990's depending on the level of funding and technological developments. Since such systems are less mature, they involve higher technical risk; however, they offer some unique capabilities if successfully developed.

(b)(1)

[redacted]

(b)(1)

(b)(1) [redacted]

~~(S)~~ To support an early 1990s IOC, key technology and system issues would have to be successfully resolved by the mid-1980s to permit a full-scale development decision at that time. [redacted] (b)(1)

## 7.4 ASSESSMENT (U)

### 7.4.1 Offense and Defense Tactics (U)

(U) A direct attack by a train of reentry vehicles (RVs) on a defended target eventually exhausts the interceptors, since each RV much be engaged by an interceptor; then one more RV destroys the target. If an attempt is made to stop a large number of attackers by deploying many interceptors, the fact that interceptors are not perfect means that each RV has a probability of "leaking through the defense, and for large enough numbers of attackers, one RV is almost certain to get through. The number of (reliable) attackers required to kill an isolated target is never greater than the number of available interceptors (plus one), and because of leakage may even be less. If the offense is willing to pay this price, he gets the target.

(U) When there are many targets, all of which are important (such as cities), an attempt is made to balance the defense, so the price of each target is made proportional to its value.

(b)(5)

(U) When defending cities, the value of the target is intangible, and judgment is the only basis for deciding the price. This is not the case with our ICBMs, however. The value of ICBMs can be expressed in dollars (or rubles), or in payload, numbers of warheads, or other currency (not all equivalent). The cost of defense can be expressed in similar currency. By expressing the ratio of the price to destroy an ICBM to the cost of that ICBM (and its defense) in the same currency, an "exchange ratio" is derived which indicates whether the attacker or the attacked is using up resources more rapidly.

(U) The advent of accurate Multiple Independently Targeted RVs (MIRVs) turned the exchange ratio (for ICBMs) in favor of the attacker; a single accurate RV could kill a booster carrying several RVs. Defending silos help this situation somewhat: each interceptor stops about one attacking RV (though the final RV which penetrates when the interceptor arsenal is exhausted kills several RVs). Thus, straightforward defense could improve the warhead exchange ratio, though not to unity.

(U) The defense can have greater leverage if it is recognized that not all ICBMs need survive. Then not all ICBMs need be defended--only some of them need be. If the defense unit has the range to cover many ICBMs, the attacker does not know which are being defended, and if he wishes to destroy most of the ICBMs, he must attack each ICBM as though it were defended. This gives leverage to the value of interceptors, greatly improves the warhead exchange ratio, and even improves the cost exchange ratio. It does, though, involve sacrificing the undefended ICBMs, and this is one of the weaknesses of the approach. If the attacker knows what fraction of ICBMs are defended, he may be willing to allow these to survive, because a light attack (one RV per ICBM) will kill all the undefended ICBMs, and the attacker will have retained most of his own forces. (The non-nuclear interceptor described later reduces the attractiveness of this attack).

(U) A more effective application of preferential defense which does not have to share the weakness just mentioned can occur when the ICBMs are based deceptively. Then the undefended points are not holes (shelters) containing ICBMs, but simply empty holes. The offense must attack each hole as though it contained an ICBM; the defense must only defend the real ICBMs. Thus, the number of reentry vehicles required to exhaust the interceptors is equal to the number of interceptors times the deception ratio (the number of holes per ICBM). This greatly improves the exchange ratio for the defense and does not have to involve sacrificing ICBMs.

(U) A further variation on these defenses is to taper the defenses, defending some ICBMs extra heavily at the expense of others which are defended less heavily. Then, if the offense wishes to kill nearly all ICBMs he must attack all as if heavily defended. The net effect is to make the drawdown more robust.

(U) One note of caution should be sounded. Highly leveraged preferential defenses are designed essentially to defend a few ICBMs heavily, while giving up others (whose real role then is simply to be decoys, keeping secret which ICBMs are really defended). Such a defense must be designed to a particular level of attack. That means that up to this level of attack the design level of survivors will be achieved. But a much smaller attack, one RV per ICBM, will also reduce the number of survivors to not much more than the same level. That is, the penalty paid for optimizing interceptor allocations against a very large attack is a vulnerability to small attacks. This vulnerability can be lessened by tapered defense. It can be overcome by a good attack assessment system which can count the number of RVs in the attack and reallocate the interceptors optimally for the actual attack; the offense's countermeasure is a two-wave attack in which the first exhausts the defense (leaving some surviving ICBMs) and the second kills all the surviving ICBMs. Further cycles of measures and countermeasures can also take place.

(U) These vulnerabilities, which result from using too few interceptors, can be cured by buying additional interceptors to reduce or eliminate the need for the leverage of preferential defense. However because the vulnerability to light attacks results from the offense killing undefended ICBMs, and not empty shelters, the leverage of MPS deception still obtains, and fewer interceptors are needed to defend an MPS basing to an equivalent level.

(U) The foregoing discussion has been predicated on the argument that the attack mode is exhaustion of the interceptor stockpile by directly attacking ICBM sites. When very large prices are generated by preferential defense, it is prudent to ask: could not these RVs be used more effectively in a different attack pattern.

(b)(5)

[redacted]

(b)(1)

[redacted]

(b)(1)

[redacted]

### 7.4.2 The Value of BMD (U)

#### 7.4.2.1 <u>Terminal Defense</u> (U)

~~(C)~~ For protecting ground-launched ICBMs, ballistic missile defense is very attractive. Figures 7.3 and 7.4 show the price charged by several basing modes calculated on the basis of individual prices previously given, as well as the cost of the basing (investment cost: R&D plus acquisition). Sunk costs are not included. Annual operating costs of defense run in the range of $200M to 300M per year, depending on the extent of the configuration chosen. Although an

(b)(1)

[redacted]

[redacted]

(b)(1)

[redacted]

attempt has been made to pick effective combinations, the configurations are not necessarily optimum. [redacted]

(b)(1)

~~(S)~~ To indicate some of the effects of changing constraints, many combinations of numbers of MPS shelters, numbers of interceptors, and growth paths are shown. These figures are calculated on an offense-reasonable[1] basis, for

---

[1] Defenders and attackers calculate the effectiveness of defense systems differently; there are two sets of reasons why this is so:

A. (U) Technical/Operational Reasons

1. Ignorance of the statistics of physical phenomena, e.g., what is the strength of concrete structures?

2. Defense "knows" its own component performance, estimates performance of offense components, and vice versa.

3. Each side credits the other with using high-risk high-payoff tactics, though it probably eschews them itself.

B. (U) The objectives of each side are different. The defense may, for example evaluate effectiveness in saving large numbers of missiles, while the offense may only be interested in lamost total destruction.

(U) The foregoing describes how the offense and the defense might make their calculations. In fact, when assessing the deterrent value of defense systems, the defense makes both sets of calculations! Defenders try to place themselves in the shoes of the attacker to estimate how <u>he</u> would evaluate the outcome of the attack. In doing so, the value of the estimates varies from sound analysis, in the case of basic physical laws, to what is often simply guess work, in the case of willingness to use risky tactics.

(U) In this environment, what is described as an "offensive conservative" view is often the defense's emulation of a paranoid defense. A judgment of what a realistic defense might think is then termed "offense reasonable." Nonetheless, there is not a great deal of difference between draw down curves calculated on an offense reasonable and defense conservative basis. The principal differences occur because of different estimates of offense objectives, and the estimate of offense objectives is essentially theological.

[redacted]

(b)(1)

(U) Growth of the terminal (endoatmospheric) defense to non-nuclear kill is of considerable value. Apart from eliminating the problems of obtaining instructions to release nuclear weapons, the principal arguments for non-nuclear interceptors are the potential elimination of the need for special nuclear materials (and consequent lower cost) and possible improved public acceptance, [redacted]

(b)(5)

7.4.2.2 Exoatmospheric Defense (U)

(U) The principal value of an exoatmospheric defense is in a layered defense concept. Its effect is to allow more interceptors to act on the threat complex, thereby overcoming the saturation limits of the systems previously described. It may be a fairly leaky system, but in conjunction with terminal systems could significantly increase the price to the offense in an attack on ICBMs. Possible leverage provided by the overlay depends upon the system's ability to defend preferentially, which, in turn, depends upon the density of aim points in the target area, their separation, and the tracking and aim point prediction capability of the probes. [redacted]

(b)(1)

A more limited leverage possibility that requires less of the sensors is to defend preferentially only selected target areas (perhaps just two of the ICBM wings, for example).

(b)(1)

[redacted]

### 7.4.3 Synergism (U)

(U) The defense of ICBMs is made simpler because they are hard, and simpler still if based in a deceptive mode.

*The information on this page is ~~confidential.~~*

This is one example of synergistic interaction whereby passive steps enhance effectiveness of active defense. Such steps also can be applied to other classes of defended targets. Sheltering of personnel greatly improves the effectiveness of defending military installations; improved reaction time reduces or eliminates the need for defending alert bombers against ballistic missiles; and internetting of communication systems lowers the value of any particular mode.

7.4.4 The ABM Treaty (U)

~~(C)~~ The ABM Treaty will have to be modified or withdrawn from to permit deployment of the ICBM defenses described. The date by which this must be done depend on an interpretation of what actions are not permitted by the Treaty. Possible actions--and dates corresponding to an immediate program start--are as follows.

| | |
|---|---|
| - Publication of Decision to Develop/ Deploy | Oct 81 |
| - Initiation of Development Program | Jun 82 |
| - Ground Breaking Outside Protocol Limits | Jun 84 |
| - Testing of Mobility | Feb 85 |
| - Initiation of Deployment of Proscribed System | Jan 86 |
| - Deployment of Components in Excess of Allowed Numbers | Oct 86 |

(U) Should the U.S. deploy BMD beyond the limits of the present treaty, the USSR will surely do so also. One consequence of this is that the USSR might not require its first strike to drawn down U.S. ICBMs so completely as with no defense, expecting to stop survivors with its own defense. This, in turn, demands better performance from U.S. BMD. The end result appears to favor BMD deployment, but this has not been examined carefully.

(U) There are additional, more political, consequences of abrogation or modification of the Treaty, and they are discussed in Annex 11.

## 7.5 CONCLUSIONS AND RECOMMENDATIONS (U)

### 7.5.1 Conclusions (U)

(U) o The value of active defense as part of the future U.S. strategic posture warranted a new look at this time because of:

(U) - new technology in the last ten years which has decreased the cost of phased array radar and has increased traffic handling and discrimination capability through advances in computer technology.

(U) - The recognized utility of LoADS for defense of M-X/MPS, provided that the questions of PLU can be resolved.

(b)(1) [redacted]

(U) - New emphasis on the offense reasonable rather than the defense conservative viewpoint.

(b)(1)

[redacted]

~~(C)~~ o The ICBM defense systems described can be deployed with an IOC of 4 years and an FOC of 6 years after authority to proceed and availability of adequate funding. This would match M-X schedules, but requires that:

~~(C)~~ - there be extraordinary management and acquisition processes;

~~(C)~~ - production facilities and tooling be acquired on an expedited basis;

(b)(1)

[redacted]

- The ABM treaty be modified at an appropriate time.

(U) o The BMD systems described above can grow to remain effective against responsive <u>qualitatively</u> improved threats and tactics.

(b)(1) [redacted]

(U) o Growth to deal with <u>quantitatively</u> more severe threats requires proliferation of aim points and/or ICBMs, or that more interceptors can be brought to bear in defending each defended missile.

(b)(1) [redacted]

(b)(1)

[redacted]

(U) o In the analysis of system effectiveness there are several constraints:

(b)(1)

[redacted]

(b)(1) [redacted]

(U) o Defense of any assets, not simply of ICBMs, dramatically raises the level of attack necessary for the offense to have high confidence of their destruction, particularly because of the uncertainites introduced. It virtually eliminates cheap shots.

(U) o Defense of isolated soft targets (e.g., SAC bases, flyout corridors) can be accomplished to charge a very high price (thousands of RVs) for the offense to have confidence of destroying most of the target set, and also buys the U.S. time. However, systems to do this require longer-reach interceptors (and perhaps more capable radars) than those proposed here for defending ICBMs. Such components have been built and are well within the state-of-the-art.

(b)(1) [redacted]

(U) o Attacks by ballistic missiles are not most effectively countered by active BMD alone. Passive measures of hardening and proliferation are also used to protect ICBMs; shorter reaction time should be built into bombers; internetting of communications systems, protection of personnel in hard shelters, and civil defense are examples of steps which should be taken in parallel with or even before active defense.

7.5.2 Recommendations (U)

~~(S)~~ o Ballistic missile defense offers attractive options to help ensure the survivability of our force:

(U) A. Defense of non-deceptive silo-based M-X and Minuteman; and

(U) B. Defense of MPS-based M-X--particularly if the MPS configuration is changed to be more defendable.

(U) - These should be given serious consideration as part of the ICBM basing decision.

(U) - If one or both of these options is to be part of an overall U.S. strategic posture we recommend that:

~~(S)~~ -- It should be funded fast and generously to tie it to the need.

~~(S)~~ -- A strategy for modifying the ABM Treaty and developing a supporting constituency must be expeditiously formulated.

(b)(1) [redacted]

~~(S)~~ o If the route of BMD is taken and the ABM Treaty modified, critical military installations should also be defended.

(b)(1) [redacted]

(U) o In order to maintain the technological base for future BMD decisions and responses, we recommend that regardless of whether or not a BMD implementation decision is made at this time

(U) - the program be augmented, to resolve the critical issues associated with exoatmospheric non-nuclear kill, and leading to pre-prototypes of key subsystems. This program should be funded initially at the level of $200M per year, increasing gradually as confidence is gained in the viability of the concept. (A total cost of $1.5 billion is foreseen if this concept is successfully pursued.)

(b)(1) [redacted]

(b)(5) [redacted]

(U) o Because of the value of non-nuclear interceptors in reducing the cost of BMD, we support the recommendations in this area of the Technology Subpanel, to be pursued as rapidly as possible.

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ATTACHMENT A TO ANNEX 7

EXECUTIVE SUMMARY

OF DSB TASK FORCE REPORT

ON U.S. BMD

SEPTEMBER 1979 (D. FINK)

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DEFENSE SCIENCE BOARD

31 January 1980

MEMORANDUM FOR THE SECRETARY OF DEFENSE

THROUGH: UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: Review of the Army BMD Program (U)

(U) As you remember, we asked Dan Fink to chair a Task Force to review the Army BMD program. His final report is attached and so is his memorandum to me that serves as a supercondensed executive summary. We also asked Al Flax to chair a Task Force on Soviet Ballistic Missile Defense. The two efforts are related and I shall report on both with this memorandum.

(~~Top Secret~~ paragraphs have been deleted from this memorandum to allow reproduction in this ~~Secret~~ report.)

~~(S)~~ The U.S. BMD Task Force recommends that we should develop the option for a Low-Altitude defense (LoAD) to take the place of Site Defense and Improved Site Defense. This new system would, hopefully, use non-nuclear kill and have, therefore, much greater public acceptance. The Task Force believes that this LoAD should be designed for use with MX as it would offer significant advantages as insurance against increases in the threat. I am afraid that the DSB is not properly informed about our high level strategies to give a competent opinion. In any case, I would be uncomfortable if we planned an ABM defense for MX before the basing is approved.

~~(S)~~ The BMD Task Force also finds that no credible rapidly deployable BMD systems exist in the U.S., and the present overlay defense program is both too risky and ambitious. They find the U.S. is now further from being able to field available BMD technology than we have been in over a decade. They recommend changing the major emphasis from the overlay system to a light area defense or a threshold defense; the latter is a limited defense of a wide array of military targets intended to introduce doubts (deterrence) in the minds of the Soviet planners about our true defensive capabilities.

(~~Top Secret~~ paragraphs have been deleted from this memorandum to allow reproduction in this ~~Secret~~ report.)

~~(S)~~ The U.S. BMD Task Force believes that resources available for BMD should be devoted to component and systems demonstration rather than maintaining a continual readiness to deploy. This is a correct view (and the most affordable view to take) if one believes in the shield of the ABM treaty and without the insights provided by Al Flax's report. In my opinion, technology not deployed wins very few victories: The issue is always to determine when to make the shift from advanced development to engineering development of a system intended for deployment. Has the time come to begin an increased emphasis on deployment options? I believe that it has, and that the threat of a deployment option will be reflected soon in the Soviet programs.

~~(S)~~ I am persuaded by the U.S. BMD Task Force report that what they call threshold defense and low-altitude defense are good ideas and may be useful in creating a rapidly deployable system. I also endorse the areas the Task Force identifies for emphasis in continuing an advanced technology base.

(U) I have attached, for your signature, memorandums to the Secretary of the Army, the Chairman of the Joint Chiefs of Staff, and the Director of Central Intelligence requesting appropriate action if you agree with the above views.

Gene

Eugene G. Fubini
Chairman

Without Attachments

DEFENSE SCIENCE BOARD

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

21 September 1979

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Report of the Task Force on U.S. Ballistic Missile Defense (U)

~~(S)~~ The final report of the DSB Task Force on U.S. Ballistic Missile Defense (BMD) is transmitted herewith. The Task Force paid particular attention to the relative priorities of potential BMD missions, as well as recent technological advances, as a means for focusing the direction of the current and future BMD program. We conclude that the current technology programs provide a sound technological base for most BMD missions, but recommend some refocusing and changes in priority. We further conclude that no rapidly deployable BMD system currently exists, and achieving and maintaining a readiness to deploy would require a substantial increase in funding.

(U) Based on these general conclusions, we make the following recommendations for the U.S. BMD program:

- ~~(S)~~ Develop and demonstrate the components required for a low altitude defense [redacted] (b)(1)
- (U) Pursue endoatmospheric non-nuclear kill aggressively,
- ~~(S)~~ Continue to evaluate and seek interim defenses for MINUTEMAN defense with emphasis on non-nuclear kill,
- ~~(S)~~ Define systems for the defense of strategic aircraft and critical strategic command, control and communications nodes,
- ~~(S)~~ Redirect the overlay defense development to less stressing light area and threshold defense missions,

- o (U) Continue the development of technology related to BMD components and techniques, and
- o (U) Continue to emphasize the interaction between BMD and the Advanced Ballistic Reentry System (ABRES) program.

~~(C)~~ BMD technology has been advanced significantly since the program was directed toward technology enhancement; however, the U.S. is now further from being able to field our available BMD technology than we have been in over a decade. To maintain a satisfactory level of technology advancement and to increase emphasis on component and system demonstration to keep pace with the Soviet breakout capability will require an increase in BMD funding. To conduct the recommended demonstration, continue to collect and analyze field data and to continue aggressive technology development will require some restructuring of the BMD program and will cost about $1.8 to $2.0 billion over the FY1981-1985 period, based on Army cost estimates. This represents an increase of from $300 to $500 million over the current Five Year Defense Plan. The Task Force feels that with the changing strategic environment and the advances in BMD technology, this additional commitment will provide a high leverage investment.

(U) The Task Force could not properly address the organizational arrangement of the BMD program as requested in the Terms of Reference; however, it was our observation that the current arrangement appears to function well and to enjoy the full support of the Army Staff.

(U) I urge that you take steps to implement the above recommendations.

Daniel J. Fink
Chairman - DSB Task Force
U.S. Ballistic Missile Defense

SECRET

(The information on this page is UNCLASSIFIED.)

SUMMARY

## S.1 INTRODUCTION

(U) Since 1956, the United States has spent $11.8 billion on Ballistic Missile Defense, or an average of $512 million per year. This peaked at $1.4 billion in 1971 and is now running at a level of $227 million. This vast expenditure of resources has resulted in some of the most advanced military technology ever contemplated. The old question of "can a bullet hit a bullet" has been demonstrably answered in the affirmative; most people would agree that if we desired we could deploy a ballistic missile defense system which would be effective to some threat level for some specific purpose. In actual fact, of course, there are no plans to deploy any BMD system, for a wide variety of reasons, not the least of which are the ABM treaty and SALT constraints. Therefore, the U. S. BMD advanced development program is not driving towards readiness to enter engineering development for some specific system, but rather is a "hedge" in the most expansive sense of the term. Hence, our BMD program must have multiple objectives. It is necessary to delineate these objectives as clearly as possible, and to assemble them in some order of priority, since the components and system elements being worked on may differ greatly, depending on the mission to be addressed.

(U) This document represents the report of the Defense Science Board Task Force on U. S. Ballistic Missile Defense, a committee organized to study our BMD program in order to review its objectives and directions in the light of current technological and political realities. We have arrived at a set of conclusions and recommendations which may provide guidance to the current BMD program plans.

(U) Our report is organized as follows: This summary continues with an outline of the missions and priorities of U. S. BMD as we perceive them. Next, the conclusions and recommendations based on these priorities are stated. The body of our report is given in four major sections. Section 1 provides a historical perspective. We discuss the assessment of mission priorities in Section 2 and present the association of defense system concepts which best address the missions in Section 3. We conclude with a detailed discussion regarding defense components in Section 4.

## S. 2 MISSIONS AND PRIORITIES

~~(S)~~ We have identified the possible mission objectives for a variety of U. S. BMD systems and have placed them in an order of priority which reflects both the military need and the feasibility of technology to provide a system. We believe these priorites should be used to guide our research and development program. These missions and their rank ordering are shown in the following table:

~~(S)~~ PRIORITY MISSIONS FOR BALLISTIC MISSILE DEFENSE IN THE U.S. (U)

(b)(1) [redacted]

Missions 6 and 7 are not system-oriented. For each of the remaining missions, a particular type or class of BMD system most suitable for the task may be identified. We have done this sorting in order to organize our conclusions and recommendations in a parallel manner.

## S. 3 TYPES OF BMD SYSTEMS

~~(S)~~ The defense missions established above differ in the hardness of the defended region or point, the level of attack likely, and the time available for the defense to function. (b)(1) [redacted]

(b)(1)

(b)(1)

(b)(1)

[redacted]

S.4 CONCLUSIONS

(U) By comparing the BMD system families with the BMD missions and priorities, and considering the build up of Soviet ICBM forces, we have arrived at the following general conclusions:

(b)(1)

[redacted]

(b)(1)

[redacted]

(U) Conclusions With Respect to BMD Technology Effort. A strong BMD technology program has three important benefits in addition to those relating to specific system deployments.

a) It provides for development of defense components for possible future deployments

b) It guards against possible Soviet BMD technical surprise and

c) It stresses and assists in the development of the U.S. strategic offense technology

## S.5 RECOMMENDATIONS

Based on the conclusions stated above, we make the following recommendations for the U.S. BMD program.

(b)(1)

[redacted]

(b)(1) [redacted]

~~(C)~~ b) Pursue Endo NNK Aggressively. While interceptors with nuclear warheads may provide the only solution for a near term, high confidence defense system, they are undesirable in terms of nuclear materials requirements, safety, security, release and public acceptance.

(b)(1) [redacted]

(b)(1)

[redacted]

4. BMD Technology

(U) a) Continue Development of BMD Components and Techniques. Many of the components being considered for various BMD deployments are the products of past technology developments. It is expected that future BMD systems will exploit components and techniques currently under development. Therefore we recommend this work be continued at about the current level.

(b)(1)

[redacted]

ATTACHMENT B TO ANNEX 7

# EXECUTIVE SUMMARY

# ON ARMS CONTROL AND DISARMAMENT

# AGREEMENTS

1980 EDITION

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# Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems

*Signed at Moscow May 26, 1972*
*Ratification advised by U.S. Senate August 3, 1972*
*Ratified by U.S. President September 30, 1972*
*Proclaimed by U.S. President October 3, 1972*
*Instruments of ratification exchanged October 3, 1972*
*Entered into force October 3, 1972*

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties,

Proceeding from the premise that nuclear war would have devastating consequences for all mankind,

Considering that effective measures to limit anti-ballistic missile systems would be a substantial factor in curbing the race in strategic offensive arms and would lead to a decrease in the risk of outbreak of war involving nuclear weapons,

Proceeding from the premise that the limitation of anti-ballistic missile systems, as well as certain agreed measures with respect to the limitation of strategic offensive arms, would contribute to the creation of more favorable conditions for further negotiations on limiting strategic arms,

Mindful of their obligations under Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons,

Declaring their intention to achieve at the earliest possible date the cessation of the nuclear arms race and to take effective measures toward reductions in strategic arms, nuclear disarmament, and general and complete disarmament,

Desiring to contribute to the relaxation of international tension and the strengthening of trust between States,

Have agreed as follows:

## Article I

1. Each party undertakes to limit anti-ballistic missile (ABM) systems and to adopt other measures in accordance with the provisions of this Treaty.

2. Each Party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this Treaty.

## Article II

1. For the purpose of this Treaty an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of:

(a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role, or of a type tested in an ABM mode;

(b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and

(c) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.

2. The ABM system components listed in paragraph 1 of this Article include those which are:

(a) operational;
(b) under construction;
(c) undergoing testing;
(d) undergoing overhaul, repair or conversion; or
(e) mothballed.

Article III

Each Party undertakes not to deploy ABM systems or their components except that:

(a) within one ABM system deployment area having a radius of one hundred and fifty kilometers and centered on the Party's national capital, a Party may deploy: (1) no more than one hundred ABM launchers and no more than one hundred ABM interceptor missiles at launch sites, and (2) ABM radars within no more than six ABM radar complexes, the area of each complex being circular and having a diameter of no more than three kilometers; and

(b) within one ABM system deployment area having a radius of one hundred and fifty kilometers and containing ICBM silo launchers, a Party may deploy: (1) no more than one hundred ABM launchers and no more than one hundred ABM interceptor missiles at launch sites, (2) two large phased-array ABM radars comparable in potential to corresponding ABM radars operational or under construction on the date of signature of the Treaty in an ABM system deployment area containing ICBM silo launchers, and (3) no more than eighteen ABM radars each having a potential less than the potential of the smaller of the above-mentioned two large phased-array ABM radars.

Article IV

The limitations provided for in Article III shall not apply to ABM systems or their components used for development or testing, and located within current or additionally agreed test ranges. Each Party may have no more than a total of fifteen ABM launchers at test ranges.

Article V

1. Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.

2. Each Party undertakes not to develop, test, or deploy ABM launchers for launching more than one ABM interceptor missile at a time from each launcher, not to modify deployed launchers to provide them with such a capability, not to develop, test, or deploy automatic or semi-automatic or other similar systems for rapid reload of ABM launchers.

Article VI

To enhance assurance of the effectiveness of the limitations on ABM systems and their components provided by the Treaty, each Party undertakes:

(a) not to give missiles, launchers, or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and not to test them in an ABM mode; and

(b) not to deploy in the future radars for early warning of strategic ballistic missile attack except at locations along the periphery of its national territory and oriented outward.

Article VII

Subject to the provisions of this Treaty, modernization and replacement of ABM systems or their components may be carried out.

Article VIII

ABM systems or their components in excess of the numbers or outside the areas specified in this Treaty, as well as ABM systems or their components prohibited by this Treaty, shall be destroyed or dismantled under agreed procedures within the shortest possible agreed period of time.

Article IX

To assure the viability and effectiveness of this Treaty, each Party undertakes not to transfer to other States, and not to deploy outside its national territory, ABM systems or their components limited by this Treaty.

Article X

Each Party undertakes not to assume any international obligations which would conflict with this Treaty.

Article XI

The Parties undertake to continue active negotiations for limitations on strategic offensive arms.

Article XII

1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.

2. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.

3. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this Treaty. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices.

Article XIII

1. To promote the objectives and implementation of the provisions of this Treaty, the Parties shall establish promptly a Standing Consultative Commission, within the framework of which they will:

(a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;

(b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

(c) consider questions involving unintended interference with national technical means of verification;

(d) consider possible changes in the strategic situation which have a bearing on the provisions of this Treaty;

(e) agree upon procedures and dates for destruction or dismantling of ABM systems or their components in cases provided for by the provisions of this Treaty;

(f) consider, as appropriate, possible proposals for further increasing the viability of this Treaty; including proposals for amendments in accordance with the provisions of this Treaty;

(g) consider, as appropriate, proposals for further measures aimed at limiting strategic arms.

2. The Parties through consultation shall establish, and may amend as appropriate, Regulations for the Standing Consultative Commission governing procedures, composition and other relevant matters.

Article XIV

1. Each Party may propose amendments to this Treaty. Agreed amendments shall enter into force in accordance with the procedures governing the entry into force of this Treaty.

2. Five years after entry into force of this Treaty, and at five-year intervals thereafter, the Parties shall together conduct a review of this Treaty.

Article XV

1. This Treaty shall be of unlimited duration.

2. Each Party shall, in exercising its national sovereignty, have the right to withdraw from this Treaty if it decides that extraordinary events related to the subject matter of this Treaty have jeopardized its supreme interests. It shall give notice of its decision to the other Party six months prior to withdrawal from the Treaty. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests.

Article XVI

1. This Treaty shall be subject to ratification in accordance with the constitutional procedures of each Party. The Treaty shall enter into force on the day of the exchange of instruments of ratification.

2. This Treaty shall be registered pursuant to Article 102 of the Charter of the United Nations.

**DONE** at Moscow on May 26, 1972, in two copies, each in the English and Russian languages, both texts being equally authentic.

| | |
|---|---|
| **FOR THE UNITED STATES OF AMERICA** | **FOR THE UNION OF SOVIET SOCIALIST REPUBLICS** |
| *President of the United States of America* | *General Secretary of the Central Committee of the CPSU* |

# Agreed Statements, Common Understandings, and Unilateral Statements Regarding the Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missiles

### 1. Agreed Statements

The document set forth below was agreed upon and initialed by the Heads of the Delegations on May 26, 1972 (letter designations added):

**AGREED STATEMENTS REGARDING THE TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON THE LIMITATION OF ANTI-BALLISTIC MISSILE SYTEMS**

[A]

The Parties understand that, in addition to the ABM radars which may be deployed in accordance with subparagraph (a) of Article III of the Treaty, those non-phased-array ABM radars operational on the date of signature of the Treaty within the ABM system deployment area for defense of the national capital may be retained.

[B]

The Parties understand that the potential (the product of mean emitted power in watts and antenna area in square meters) of the smaller of the two large phased-array ABM radars referred to in subparagraph (b) of Article III of the Treaty is considered for purposes of the Treaty to be three million.

[C]

The Parties understand that the center of the ABM system deployment area centered on the national capital and the center of the ABM system deployment area containing ICBM silo launchers for each Party shall be separated by no less than thirteen hundred kilometers.

[D]

In order to insure fulfillment of the obligation not to deploy ABM systems and their components except as provided in Article III of the Treaty, the Parties agree that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV of the Treaty.

[E]

The Parties understand that Article V of the Treaty includes obligations not to develop, test or deploy ABM interceptor missiles for the delivery by each ABM interceptor missile of more than one independently guided warhead.

[F]

The Parties agree not to deploy phased-array radars having a potential (the product of mean emitted power in watts and antenna area in square meters) exceeding three million, except as provided for in Articles III, IV and VI of the Treaty, or except for the purposes of tracking objects in outer space or for use as national technical means of verification.

[G]

The Parties understand that Article IX of the Treaty includes the obligation of the US and the USSR not to provide to other States technical descriptions or blue prints specially worked out for the construction of ABM systems and their components limited by the Treaty.

**2. Common Understandings**

Common understanding of the Parties on the following matters was reached during the negotiations:

A. Location of ICBM Defenses

The U.S. Delegation made the following statement on May 26, 1972:

Article III of the ABM Treaty provides for each side one ABM system deployment area centered on its national capital and one ABM system deployment area containing ICBM silo launchers. The two sides have registered agreement on the following statement: "The Parties understand that the center of the ABM system deployment area centered on the national capital and the center of the ABM system deployment area containing ICBM silo launchers for each Party shall be separated by no less than thirteen hundred kilometers." In this connection, the U.S. side notes that its ABM system deployment area for defense of ICBM silo launchers, located west of the Mississippi River, will be centered in the Grand Forks ICBM silo launcher deployment area. (See Agreed Statement [C].)

B. ABM Test Ranges

The U.S. Delegation made the following statement on April 26, 1972:

Article IV of the ABM Treaty provides that "the limitations provided for in Article III shall not apply to ABM systems or their components used for development or testing, and located within current or additionally agreed test ranges." We believe it would be useful to assure that there is no misunderstanding as to current ABM test ranges. It is our understanding that ABM test ranges encompass the area within which ABM components are located for test purposes. The current U.S. ABM test ranges are at White Sands, New Mexico, and at Kwajalein Atoll, and the current Soviet ABM test range is near Sary Shagan in Kazakhstan. We consider that non-phased array radars of types used for range safety or instrumentation purposes may be located outside of ABM test ranges. We interpret the reference in Article IV to "additionally agreed test ranges" to mean that ABM components will not be located at any other test ranges without prior agreement between our Governments that there will be such additional ABM test ranges.

On May 5, 1972, the Soviet Delegation stated that there was a common understanding on what ABM test ranges were, that the use of the types of non-ABM radars for range safety or instrumentation was not limited under the Treaty, that the reference in Article IV to "additionally agreed" test ranges was sufficiently clear, and that national means permitted identifying current test ranges.

C. Mobile ABM Systems

On January 29, 1972, the U.S. Delegation made the following statement:

> Article V(1) of the Joint Draft Text of the ABM Treaty includes an undertaking not to develop, test, or deploy mobile land-based ABM systems and their components. On May 5, 1971, the U.S. side indicated that, in its view, a prohibition on deployment of mobile ABM systems and components would rule out the deployment of ABM launchers and radars which were not permanent fixed types. At that time, we asked for the Soviet view of this interpretation. Does the Soviet side agree with the U.S. side's interpretation put forward on May 5, 1971?

On April 13, 1972, the Soviet Delegation said there is a general common understanding on this matter.

D. Standing Consultative Commission

Ambassador Smith made the following statement on May 22, 1972:

> The United States proposes that the sides agree that, with regard to initial implementation of the ABM Treaty's Article XIII on the Standing Consultative Commission (SCC) and of the consultation Articles to the Interim Agreement on offensive arms and the Accidents Agreement,[1] agreement establishing the SCC will be worked out early in the follow-on SALT negotiations; until that is completed, the following arrangements will prevail: when SALT is in session, any consultation desired by either side under these Articles can be carried out by the two SALT Delegations; when SALT is not in session, *ad hoc* arrangements for any desired consultations under these Articles may be made through diplomatic channels.

Minister Semenov replied that, on an *ad referendum* basis, he could agree that the U.S. statement corresponded to the Soviet understanding.

E. Standstill

On May 6, 1972, Minister Semenov made the following statement:

> In an effort to accommodate the wishes of the U.S. side, the Soviet Delegation is prepared to proceed on the basis that the two sides will in fact observe the obligations of both the Interim Agreement and the ABM Treaty beginning from the date of signature of these two documents.

In reply, the U.S. Delegation made the following statement on May 20, 1972:

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[1]See Article 7 of Agreement to Reduce the Risk of Outbreak of Nuclear War Between the United States of America and the Union of Soviet Socialist Republics, signed Sept. 30, 1971.

The U.S. agrees in principle with the Soviet statement made on May 6 concerning observance of obligations beginning from date of signature but we would like to make clear our understanding that this means that, pending ratification and acceptance, neither side would take any action prohibited by the agreements after they had entered into force. This understanding would continue to apply in the absence of notification by either signatory of its intention not to proceed with ratification or approval.

The Soviet Delegation indicated agreement with the U.S. statement.

**3. Unilateral Statements**

The following noteworthy unilateral statements were made during the negotiations by the United States Delegation:

A. Withdrawal from the ABM Treaty

On May 9, 1972, Ambassador Smith made the following statement:

The U.S. Delegation has stressed the importance the U.S. Government attaches to achieving agreement on more complete limitations on strategic offensive arms, following agreement on an ABM Treaty and on an Interim Agreement on certain measures with respect to the limitation of strategic offensive arms. The U.S. Delegation believes that an objective of the follow-on negotiations should be to constrain and reduce on a long-term basis threats to the survivability of our respective strategic retaliatory forces. The USSR Delegation has also indicated that the objectives of SALT would remain unfulfilled without the achievement of an agreement providing for more complete limitations on strategic offensive arms. Both sides recognize that the initial agreements would be steps toward the achievement of more complete limitations on strategic arms. If an agreement providing for more complete strategic offensive arms limitations were not achieved within five years, U.S. supreme interests could be jeopardized. Should that occur, it would constitute a basis for withdrawal from the ABM Treaty. The U.S. does not wish to see such a situation occur, nor do we believe that the USSR does. It is because we wish to prevent such a situation that we emphasize the importance the U.S. Government attaches to achievement of more complete limitations on strategic offensive arms. The U.S. Executive will inform the Congress, in connection with Congressional consideration of the ABM Treaty and the Interim Agreement, of this statement of the U.S. position.

B. Tested in ABM Mode

On April 7, 1972, the U.S. Delegation made the following statement:

Article II of the Joint Text Draft uses the term "tested in an ABM mode," in defining ABM components, and Article VI includes certain obligations concerning such testing. We believe that the sides should have a common understanding of this phrase. First, we would note that the testing provisions of the ABM Treaty are intended to apply to testing which occurs after the date of signature of the Treaty, and not to any testing which may have occurred in the past. Next, we would amplify the remarks we have made on this subject during the previous Helsinki phase by setting forth the objectives which govern the U.S. view on the subject, namely, while prohibiting testing of non-ABM components for ABM purposes: not to prevent testing of ABM components, and not to prevent testing of non-ABM components for non-ABM purposes. To clarify our interpretation of "tested in an ABM mode," we note that we would consider a launcher, missile or radar to be "tested in an ABM mode" if, for example, any of the following events occur: (1) a launcher is used to launch an ABM interceptor missile, (2) an interceptor missile is flight tested against a target vehicle which has a flight trajectory with characteristics of a strategic ballistic missile flight trajectory, or is flight tested in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range, or is flight tested to an altitude inconsistent with interception of targets against which air defenses are deployed, (3) a radar makes measurements on a cooperative target vehicle of the kind referred to in item (2) above during the reentry portion of its trajectory or makes measurements in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range. Radars used for purposes such as range safety or instrumentation would be exempt from application of these criteria.

C. No-Transfer Article of ABM Treaty

On April 18, 1972, the U.S. Delegation made the following statement:

In regard to this Article [IX], I have a brief and I believe self-explanatory statement to make. The U.S. side wishes to make clear that the provisions of this Article do not set a precedent for whatever provision may be considered for a Treaty on Limiting Strategic Offensive Arms. The question of transfer of strategic offensive arms is a far more complex issue, which may require a different solution.

D. No Increase in Defense of Early Warning Radars

On July 28, 1970, the U.S. Delegation made the following statement:

Since Hen House radars [Soviet ballistic missile early warning radars] can detect and track ballistic missile warheads at great distances, they have a significant ABM potential. Accordingly, the U.S. would regard any increase in the defenses of such radars by surface-to-air missiles as inconsistent with an agreement.

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Annex 8

ROLE OF CIVIL DEFENSE (U)

(U) The primary and contributory objectives of Strategic Defense are to: enhance deterrence; provide stability in a crisis, and achieve damage limitations: Effective strategic defense consists of two essential inter-linking capabilities: passive and active defense.

GENERAL COMMENTS (U)

(U) Factors of passive defense which significantly contribute to strategic defense include the following: evacuation and shelter protection of population and of leadership and industrial defense.

(U) Industrial defense can protect critical industries and/or equipment, essential resources, and key skilled labor force. The resultant capabilities of such a passive defense should be perceived by the enemy(ies) as to enhance deterrence in a crisis, and should perform effectively if deterrence fails and the nation is subjected to nuclear attack - of short or long duration.

(U) Civil defense has a reputation for being unacceptable by a vocal minority of our society and by the major news media. The aspects of civil defense are complex and thus readily susceptible to misintepretation and benign neglect. However, from extensive public surveys, and based upon past experiences, it is posited that with steadfast leadership programs can be expected to generate public and Congressional acceptance. A necessary component of this leadership must be evidence that the Defense Department and the military services recognize passive defense as an essential component of national defense, war deterrence, and warfighting.

CIVIL DEFENSE AND OTHER NATIONAL PROTECTION PROGRAMS (U)

(U) A U.S. ability to protect population by evacuation and sheltering should be available to counter Soviet evacuation moves or threats and thus provide the President with appropriate options for crisis management. For the case of short warning the use of in-place shelters in risk areas is an alternative to population evacuation.

(U) For longer duration, in-place sheltering should be viewed as a back-up to evacuation. Additional supporting elements are communications, radiological monitoring, shelter management training, emergency operating centers for all levels of government and resources for life and economic support. The described overall population program, which has been named program D plus, is estimated to cost about $3.4 billion in 1982 dollars if deployed within the next five years (this does not include O&S costs). Such a program should include an RDT&E program to provide options to add-on measures for a higher degree of in-place shelter protection of population. Such a civil defense program is deemed to be an important element of strategic defense.

(U) Population protection via crisis relocation, see Figure 8.1, could reduce potential U.S. fatalities from about 130 to 150 million to about 50-65 million. While this reduction is significant it still leaves a large relative asymmetry between the U.S. and U.S.S.R. This differential, results, in part from the extensive Soviet program which has been ongoing for over three decades and its much higher per

| | UNITED STATES (ALL GROUND BURST WEAPONS) | | USSR (MIX-GROUND & AIR BURST) | |
|---|---|---|---|---|
| | NO ORDERED EVACUATION | CITY POPULATION EVACUATED | NO EVACUATION | CITY POPULATION ÉVACUATED |
| Day to Day - RED FIRST | 130[1] - 150[2] | | 50[7] - 100[8] | |
| Generated - RED FIRST | 90[3] - 140[4] | 50 - 65[5] | 35[9] - 50[10] | 5[11] - 25[12] |
| Generated - BLUE[6] FIRST | 90 - 140 | 50 - 65 | 35 - 50 | 5 - 25 |

[1] No evacuation, Program D or enhanced (2.4-3.4B, 82$)* plus 2.8B 10 year O & S

[2] No evacuation C.D. at current levels (.7B, 82$)* plus 1.3B, 10 year O & S

*5 year program costs

[3] 30% spontaneous, educated evacuation - Program D

[4] 10% spontaneous, random evacuation - current program

[5] Lower value 80% evacuation; upper value 60% evacuation could be 35 m. w. increased $s more costly fallout protection

[6] Assumes that, independent of who strikes first, Soviets impact from a generated posture 4600 EMT, all ground bursts, of which 1800 EMT on U/I Targets

[7] No evacuation, 50% urban in shelters

[8] No evacuation, shelters no used.

[9] 20% spontaneous evacuation; 50% urban in shelters

[10] 10% spontaneous evacuation, 50% urban in shelters

[11] 88% evacuation, remaining city population in shelters; evacuate population in expedient shelters

[12] 70% evacuation, remaining city population in shelters, evacuated population in expedient shelters

FIGURE 8.1: (U) U.S.-USSR NUCLEAR EXCHANGE - FATALITIES (in millions) ATTACKS AGAINST MILITARY AND INDUSTRIAL TARGETS



UNCLASSIFIED

capita annual expenditure (about $8.00) than the steadily decreasing funding of the U.S. program with current expenditures at levels of about &.50, $2 to $3 with program D or D plus.

(U) Protection of industry could be implemented by various means. The best known and tested method is in-place protection of plant machinery. The nationwide costs for training and preparation of such a program (not implementation) are estimated by FEMS at about $3.5 billion.

(U) There are other options which could be combined with this in-place protection such as relocation and dispersal of critical equipment and plant protection. To date there is inadequate information on the cost and effectiveness of these alternatives.

(U) An adequate military shelter program is an important step. The protection of military and essential federal personnel cannot lag behind a nationwide civil defense without undermining federal leadership and the needed retention of law and order and public safety.

ASPECTS OF INDUSTRIAL PROTECTION (U)

(U) Broadly speaking, the elements of an "essential" industrial base which must be protected are the corresponding labor force, the machinery, capital and raw materials necessary for production.

(U) It should be recognized, that in a national emergency, the U.S. may have to adopt a degree of centralization for economic planning and for resource allocation. In fact, the related emergency mobilization planning and preparedness would have to be undertaken well in advance of any national emergency. This centralization would be required to an even higher degree in the trans-attack and post-attack periods. There is a need to preserve such a function so that it survives and endures.

(U) Assuming the need for centralized planning in a situation of grave national emergency, this function could be performed by Presidential directive initially through FEMA, by expanding FEMA's capabilities or by instituting the Office of Defense Resources (ODR). The functions of FEMA/ODR would be based upon the emergency preparedness plans to adjudicate demands between military and "essential" civilian requirements and to allocate resources accordingly. The above FEMA/ODR activities should be performed effectively during the various phases of a national emergency, i.e., in crisis, in war, and in the post war phases of survival, reorganization and eventual recovery.

(U) The current U.S. labor force is estimated at about 100 million, but this work force does not bear any close relationship to the "essential" activities and related work force that would be needed in a national emergency. To date inadequate attention has been given in defining the demands for: (1) military supply industries; (2) essential civilian industries; and, (3) lifeline services and related industries supporting both civilian and military elements. Obviously the resulting value added of these functions will, under most conditions, be lower than in peacetime, although its magnitude will vary greatly within the level and type of national emergency, its foreseen consequences, and the time required to implement these activities. First-guess estimates of the related "key-work" force indicate that it may vary between 20 and 30 million of which 14 to 20 million be in the risk areas.

(U) Assuming that the above "key-work" force could operate on a two or three shift basis, this would generate, at minimum, a need for about 5 to 10 million blast/fallout shelters at or near the place of work. The related peacetime costs of such shelters are estimated to range between 1 to 2 billion dollars.

(U) However, protection of the labor force, by itself, is not sufficient. Motivation of the work force is a crucial item. Experience in natural disasters and World War II bombing has shown that people will follow orders provided the orders make sense and their families are safeguarded. A common experience in World War II was adults crossing target zones during heavy bombing to try to find their families when there had been inadequate civil defense planning. With planning and assurance that families were safeguarded, workers followed orders, stayed near their jobs and repaired damaged equipment over and over again. For a work force to stay during a threatened nuclear crisis, there would have to be an excellent civil defense program so each worker knows his family is safer than they would be if he spent (optimistically) three to four days digging an expedient shelter for them. Such a program could be implemented through the factory by family relocation or by in-place suburban shelters. Each worker would also have to be assured there is an adequate blast shelter within a few minutes running distance. With assurance that families are safe, that there are good blast shelters at the installation, and with work that makes sense; experience indicates that workers will stay and follow directions.

In-Place Protection of Machinery (U)

(U) Tests have shown that industrial plant machinery of many types can be protected against the principal disabling effects of nuclear weapons -- fire, debris and shock. These encouraging test results naturally lead to the large question -- could the simple, easily accomplished, protective technology be adapted to and implemented by industry on a national scale?

(U) Before discussing implementation feasibility of protective schemes, a brief discussion of the fundamental concept is appropriate. A large proportion of metal cutting, shaping and similar machinery can be protected by the protective method illustrated schematically in Figure 8.2 below:

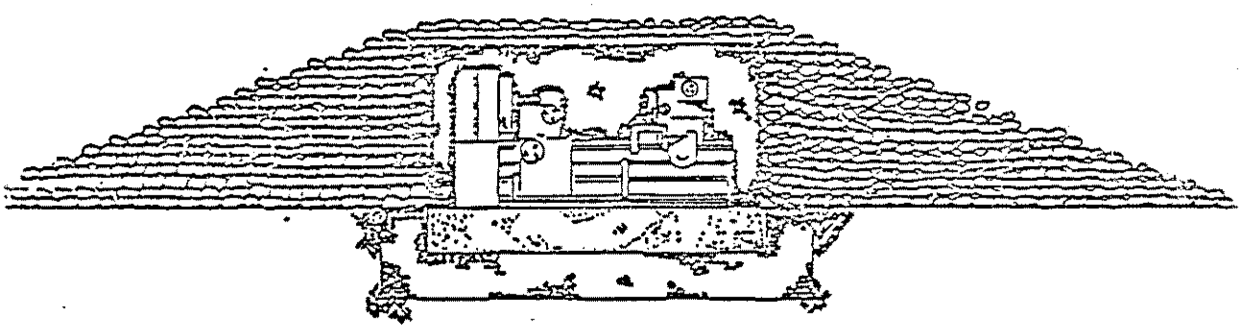

FIGURE 8.2: (U)

(U) Protection is achieved by supporting the machine or the machine foundation on a crushable material, surrounding it with crushable material, and then covering it with dirt. The purpose of the crushable material is to insulate the machine from the nuclear-blast-induced ground shock in much the same manner that fragile items are protected from the shocks encountered in parcel post.

(U) Fundamentally, the concept is this: In the event of an extremely grave crisis involving confrontation with the U.S.S.R., we could take these steps necessary to protect selected amounts -- say about one-third -- of the essential machinery in our plants. By rescheduling the workshifts, we could maintain full production on the machinery left unprotected. We estimate that the present labor force could make these preparations in about three days, which may be less time than it would take for the Soviets to complete their evacuation and sheltering process.

(U) The fraction of equipment that requires protection should be considered as a variable, since industries in peacetime vary in shifts-some one per day others three-per-day. Thus, in general the multiplicative factor for round-the-clock operation may vary, in crisis, roughly between 1.4 to 3 times peacetime operation.

(U) It should be recognized that a proper balance would have to be achieved between the discussed protected machinery and the unprotected one. The "cocooned" machinery cannot obviously be utilized until the crisis or war is over. However, in crisis as well as in war (depending upon its character and duration) the essential economy of the U.S. would have to be functioning to the best of its ability. Additional consideration needs to be given to protection of power generation, as well as to the required material resources. There is another degree of protection that should be considered, primarily for small plants, which would support the evacuated population. Some of these could be relocated to non-risk areas to adequately prepared facilities.

Protection of Special Purpose Plants, Refineries, etc. (U)

(b)(5) [redacted]

(b)(5)

[redacted]

CONCLUSION/RECOMMENDATIONS (U)

(U) The impressive Soviet progress in developing a civil defense, based on evacuation and protection of essential government leadership (civil and military) and of industry (resources and key workers), has reached a point at which it is affecting perceptions of the strategic balance between the U.S. and U.S.S.R. civil defense programs.

(U) Civil defense measures carry a visible signal that there are plans for national survival and recovery should deterrence fail. The Soviet signal has had this effect, by stressing not only their military capabilities, but also complementing these with a large and expensive civil defense program. Combined passive and active defense methods can result in a synergism which exceeds in effectiveness the sum of each individual defensive measure.

(U) Apart from the deterrence and damage-limiting potential of civil defense, the President has a clear requirement, in a nuclear crisis, to be able to bring the civilian population and industry into various stages of alert.** National security would depend on his ability

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* These transportable facilities represent a 2.7 to 4.2 fold increase in current low capacity refineries.

** It should be noted that industrial mobilization is a more lengthy process than expedient population protection.

to maintain public confidence and to minimize spontaneous and panicky behavior. This requires preparedness plans for the guidance of U.S. population and proper programs and responses should the Soviets evacuate and/or protect their popualtion. Without a U.S. civil defense, the resulting asymmetry may lead, in a crisis, to effective Soviet coercion, certainly of our primary allies and likely of our people.

(U) A summary of specific conclusions and recommendations can be found in Figures 8-3, 8-4, and 8-5.

## CONCLUSION - GENERAL

- THERE ARE A COLLECTION OF LOW-COST, WELL-CONCEIVED, EFFECTIVE CIVIL DEFENSE MEASURES FOR PROTECTION OF THE CIVIL POPULATION FROM FALLOUT AND INCIDENTAL PROMPT EFFECTS.
- THEY HAVE FAIR EFFECTIVENESS EVEN FOR UNWARNED ATTACK AND CAN BE FULLY EXPLOITED IN ABOUT THREE-SEVEN DAYS.
- CONTRARY TO COMMON BELIEF, HISTORICAL AND PUBLIC OPINION DATA INDICATE GOOD SUPPORT IN CONGRESS, PUBLIC.
- PROBLEM IS SUPPORT FROM EXECUTIVE IN BUDGET AND PUBLIC COMMITMENT.
- IMPLEMENTATION OF SUCH MEASURES WOULD ENHANCE DETERRENCE AND PROVIDE NCA WITH USEFUL CRISIS MANAGEMENT TOOL.
- BEYOND THESE, THERE ARE ADDITIONAL MEASURES FOR PROTECTION OF INDUSTRIAL FACILITIES AND ECONOMIC CONTINUITY. SOME ARE WELL UNDERSTOOD AND LOW-COST, OTHERS NEED R&D. AN OVERALL INTEGRATED ANALYSIS IS NEEDED WHEN THESE ELEMENTS ARE BETTER UNDERSTOOD.

FIGURE 8.3: (U)

RECOMMENDATION - GENERAL

- DOD SHOULD ACTIVELY SUPPORT IMPLEMENTATION OF A SENSIBLE CIVIL DEFENSE PROGRAM BY FEMA CONSISTENT WITH CONCLUSIONS ABOVE, BY

--SECDEF PERSONAL AND PUBLIC SUPPORT

--DOD IMPLEMENTATION OF ITS OWN PASSIVE PROTECTION PLAN AS SET FORTH IN RECOMMENDATION _____.

--USDRE OFFERING ITS GOOD OFFICES TO ASSIST FEMA IN THE CONDUCT OF RESEARCH ON INDUSTRIAL PROTECTION AND CONTINUITY OF ECONOMY.

--USDRE ESTABLISH A FUNDED ACTIVITY TO

-REVIEW TECHNICAL ASPECTS OF SERVICE/AGENCY CIVIL DEFENSE DESIGN, IMPLEMENTATION

-CONDUCT R&D OF DOD WIDE INTEREST

-BE THE TECHNICAL INTERFACE WITH FEAM

FIGURE 8.4: (U)

CONCLUSION - DOD

- ENDURING CAPABILITIES REQUIRE LARGER NUMBERS OF

  --SURVIVING & FUNCTIONING MILITARY OPERATIONAL PERSONNEL

  --SUPPORTING MILITARY LOGISTICS, AND CERTAIN CIVILIAN INFRASTRUCTURE (UTILITIES, FOOD, SPECIALIZED LOGISTICS, ETC.)

  NOTE: A LITTLE WILL HELP A LOT

RECOMMENDATION - DOD

- START CD PROGRAM IN DIRECT SUPPORT OF ENDURING MILITARY POSTURE

  --DOD FUNDED (I.E. NOT FEMA)
  --JCS SPONSORSHIP, INTEGRATION, PRIORITIES
  --SERVICE & DOD AGENCY DESIGN, IMPLEMENTATION AND BUDGETING
  --COMPATIBLE WITH FEMA PLANS & OBJECTIVES
  --FIRST YEAR TASKS; PUT IN FY 84-88 DEFENSE GUIDANCE (USDP) JAN '82; INITIAL PRIORITIES AND PROGRAM PACE (JCS) JAN '82; INITIAL DESIGN AND POM SUBMIT (SVCS, AGENCIES) MAY 1982; REVIEW FOR BUDGET APPROVAL (DRB) AUGUST 1982

FIGURE 8.5: (U)

Annex 9

# SUPPORTING TECHNOLOGY

## INTRODUCTION (U)

(U) This chapter addresses the question "Are the basic technologies needed for future strategic defense systems being pursued with appropriate priority and resources? If not, what changes should be made?" This annex concentrates on the problems of Air Defense and Ballistic Missile Defense (BMD). Technology for the anti-satellite (ASAT) problem is covered elsewhere. Technology for both conventional systems (those using guns and missiles as weapons) and systems using directed energy weapons is covered.

## TECHNOLOGY FOR AIR DEFENSE WITH CONVENTIONAL WEAPONS (U)

(U) We will deal separately with those air defense systems designed to be effective only against large radar cross section targets - bombers - and with those especially tailored for defense against low flying, low cross section targets as represented by cruise missiles like TOMAHAWK and ALCM.

### BOMBER DEFENSE (U)

(U) The technical problems of air defense can be subdivided into the categories of surveillance, identification, $C^3$, and attack mechanisms. Of these, the surveillance problem is the most demanding of technology. The $C^3$ problem is dealt with elsewhere. We generally have the technology to convert detections into kills, (although new concepts such as the DARPA ballistic intercept missile may improve our capability). The principle technical problems addressed here are, therefore, surveillance and identification.

IDENTIFICATION (U)

(b)(1)

[redacted]

(b)(1)

[redacted]

SURVEILLANCE (U)

(b)(1)

[redacted]

OTH-B (U)

(b)(1)

[redacted]

(b)(1)

[redacted]

(U) The difference in performance between the ERS and the FPS-95 is also viewed as a possible warning signal in extending OTH coverage to over land (vs. over water) regions (the ERS looks almost completely over water, the FPS-95 looked almost completely over land). In the small regions where the converse is true, there is some evidence of similar unexplained poor performance with ERS. Caution should be exercised in extending any operational OTH coverage over land masses, as with a sensor looking south from North America.

(b)(1) [redacted]

MICROWAVE RADARS FOR THE DEW LINE (U)

(b)(1) [redacted]

SPACE BASED INFRARED (SBIR) (U)

(b)(1) [redacted]

(b)(1)

[redacted]

SPACE BASED RADAR (SBR) (U)

(b)(1)

[redacted]

(b)(1)

[redacted]

(b)(1)

[redacted]

(b)(1)

[redacted]

~~(S)~~ Several possible configurations of SBR are being studied by contractors under the Navy/Air Force ITSS program. In view of the above considerations and the high cost of developing an SBR, their designs should be subject to an expert critical analysis before development decisions are made.

~~(S)~~ Some component work is underway, most notably at DARPA, but tailored to a specific class of configurations that may or may not be required to meet ITSS goals.

CRUISE MISSILE DEFENSE (U)

(b)(1)

[redacted]

(b)(1) [redacted]

(~~S~~) DARPA and RADC are formulating progams to explore non-conventional technical approaches to this problem.

(b)(1) [redacted]

TECHNOLOGY FOR BMD SYSTEMS USING CONVENTIONAL WEAPONS (U)

(U) In this section, we will observe the common breakdown of BMD systems into endoatmospheric and exoatmospheric systems, depending upon the altitude regime at which intercept is conducted.

ENDOATMOSPHERIC SYSTEMS (U)

(b)(1) [redacted]

largely in hand as a result of years of development. [redacted]

(b)(1)

~~(S)~~ The capabilty to use non-nuclear defensive weapons in BMD appears to offer substantial advantages in the conservation of nuclear materials, relaxation of security and mobility constraints and facilitation of system testing. This area has recently been the subject of an overall review stimulated by both OUSDRE and BMDATC. [redacted]

(b)(1)

(b)(1)

[redacted]

EXOATMOSPHERIC SYSTEMS (U)

(b)(1)

[redacted]

(b)(1)

(b)(1) [redacted]

## DIRECTED ENERGY WEAPONS FOR STRATEGIC DEFENSE (U)

(U) The conceptual attractiveness of directed energy weapons - lasers and particle beams - lies in their rapid fire promise. The efficacy of charged particle beams is still a question in the realm of physics: will they propagate stably? The question with respect to neutral particle beams is one of adequate accelerator design to get small beam spreading. Both problems are being worked, but successful application seems too far off to deal with here. Consequently, we will confine this discussion to laser weapons and their associated surveillance assets. Attention will be focused on lasers for strategic air defense and BMD applications.

## LASER TECHNOLOGY FORECASTS VS NEEDS (U)

(U) The important parameters of a laser are its power output (all lasers currently under serious consideration are continuous wave, although there is some speculation that pulsed lasers may be worthy of consideration), wavelength of operation, aperture size, beam pointing accuracy (beam jitter) and power conversion efficiency. The wavelength enters the effectiveness in two important ways: (1) if any propagation is through the atmosphere, the loss is wavelength dependent, and (2) the maximum power on target is dependent on the aperture size divided by the square of the wavelength (the "gain" of the mirror). For propagation purely in outer space, chemical lasers currently look most attractive [redacted] (b)(1)

(U) System studies have generally led to the following requirements (the range allows for target hardness, from current hardness to deliberate hardening such as coating targets with ablating material), stated in order: power/aperture diameter/beam jitter ($2\sigma$):

(b)(1) [redacted]

(b)(1) [redacted]

(b)(1)

[redacted]

~~(S)~~ The success of the ground demonstrations scheduled could lead to a space demonstration. An estimate of seven years from ground demonstration to space demonstration is projected by some, so that space lasers with performance levels suitable for air interdiction against unhardened aircraft might first be flown in the mid-90s and against soft ICBMs in the late 90s. Additional funding and risk taking would accelerate the technology, with one estimate of a 2 year compression of the time to ground demonstration of the technology and an even greater compression of the transition to space. This estimate should be considered with the caution that should attend all estimates of technical advances into uncharted regions. The Airborne Laser Lab required about 9 years from start to first flight tests (about twice the original schedule at twice the cost). Space qualification is probably even riskier and more prone to schedule and cost growth.

~~(S)~~ Based upon experience with on-orbit demonstration programs like Teal Ruby and Talon Gold, it is clear that the decision to undertake such a demonstration is not to be taken lightly. It is vital to expend the (comparatively small) amounts of money prior to such decision making to provide the best possible assessments of the probable utility of such systems. [redacted] (b)(1)

~~(S)~~ While pursing chemical lasers as the best near-term solution, shorter wave lengths should be pursued for future applications. There are also technology problems at the component level for any type of high energy laser that represent potential bottlenecks, [redacted] (b)(1) (b)(1)

SURVEILLANCE AND IDENTIFICATION FOR SPACE-BASED LASER (SBL) WEAPONS (U)

~~(S)~~ To capitalize on the space-based laser weapons, adequate surveillance and target identification are required. The previous comments on identification are generally applicable to the SBL, with the additional observation that the [redacted] (b)(1)

~~(S)~~ For space-based BMD, the identification problem solves itself from knowledge of launch point. [redacted] (b)(1)

(b)(1)

[redacted]

SUMMARY OF TECHNICAL PROBLEMS & COMMENTS ON "FIXES" (U)

General Comments and Recommendations (U)

~~(S)~~ It has often been difficult in this study to uncover the type of technical analysis of proposed systems that should underlie expensive decisions. It is certainly hoped that such analyses have been done.

~~(S)~~ It is obviously vital that the DoD and its components maintain the capability to execute and review such analyses. It is desirable that reviews that will figure in important decisions be done by people expert in their field with no allegiance to sponsors of concepts being analyzed. A serious consequence of the retrenchment of the "Strategic Defense Community" over the last decade is that in some areas, there is only one funding agency for many types of systems and virtually all competent personnel either work directly for that agency or under contract. While there is no shortage of people of unquestioned technical integrity, the appearance of conflict always lurks in such situations. For this reason as well as in the interests of the simple and recognized virtures of competition <u>it is recommended that competing or at least complementary programs and sponsorships be maintained in major areas of strategic defense</u>. An example of what is meant by "complementary sponsorships" is illustrated by the BMD-ABRES relationship where people develop similar skills for complementary programs and one useful to each other and to system planners as friendly adversaries.

<u>Specific Conclusions and Recommendations</u> (U)

~~(S)~~ For conventional air defense, we concur with the technical utility of OTH-B for surveillance against bomber-sized aircraft, [redacted] (b)(1)

~~(S)~~ An experimental program is needed to provide benchmarks for assessing SBIR utility and Teal Ruby should meet that need. On the other hand, the level of performance in target detection and false alarm generation to be expected from an SBR is capable of analytic determination. [redacted] (b)(1)

(b)(1) [redacted]

(b)(1) [redacted]

~~(S)~~ For coventional BMD, the technology for endo-atmospheric nuclear kill systems appears reasonably well in hand [redacted] (b)(1)

~~(S)~~ The exoatmospheric NNK class of systems, being based on a large amount of relatively new and innovative technology, has several component level problems that require solution. They are being worked, and solutions to most can be seen. A more aggressive component program may be in order, but first a large question needs to be resolved. [redacted] (b)(1) A "red team" re-assessment of the exo-NNK concept is urgently recommended before any substantial increase in funding.

~~(S)~~ The use of endoatmospheric NNK or hit-to-kill systems may be feasible for defense of a silo-based ICBM force, but a confident assessment and operational system design is not possible without improvement of the ability to model such interceptors. A short term effort to develop and verify a high fidelity simulation of the very agile interceptor involved is recommended. This can be accomplished by some needed component development to the "bench test" level.

~~(S)~~ The DARPA programs to demonstrate high energy laser performance parameters will hopefully provide us with a set of benchmarks on SBL by the mid-eighties. At this time, if we have done our homework on target vulnerabilities and defense of such expensive and visable assets, an intelligent decision regarding a space demonstration can be made, for a possible flight in the mid to late 90's. Some compression is possible with risk. An integrated program must be maintained to make sure all the homework that is needed gets done.

~~(S)~~ Shorter wave length lasers may ease some of the technical problems of SBLs if they can be made to work at the levels of interest, and we endorse the recent OSD funding actions to enlarge such efforts as previously recommended by the DSB Foster Panel.

~~(S)~~ Particle beam weapons are still of uncertain payoff with numerous problems in the realms of physics and weaponization that are being addressed.

~~(S)~~ Finally, it is recognized that all space-based assets may be very vulnerable to physical attack of their spacecraft ("the billion-dollar spacecraft taken out by the million-dollar MV"). However, those considered for strategic defense (SBIR, SBR and SBL) all incorporate an indigenous capability for either surveillance or defense. Can this make a difference? We recommend a study of this issue to see if the situation might be more hopeful than commonly believed.

~~(S)~~ Finally, there are broad component technology and physical phenomenology areas that permeate strategic defense. Support for this "technology base" must be maintained and much of it is sufficiently peculiar to the strategic world that is not championed elsewhere. <u>Consequently, we urge support of such activities as:</u>

(1) A continuing constructive interaction between the offense technology planners and the defense technology planners (ABRES and BMDATC in BMD; there are no obvious counterparts in air defense or space defense but should be).

(b)(1)

(2) [redacted]

(3) [redacted]

(4) [redacted]

(5) Very accurate, very agile homing missiles for NNK.

(U) The accompanying tables summarize our conclusions on the state of strategic defense technology and our recommendations, with budgetary cost estimates of the more costly recommendations.

# STRATEGIC DEFENSE TECHNOLOGY

| | SYSTEM FEASIBILITY | COMPONENT AVAILABILITY |
|---|---|---|
| • AIR DEFENSE | | |
| OVER-THE-HORIZON RADAR | A | A |
| DEW LINE IMPROVEMENTS | A | B |
| SPACE-BASED INFRARED | C+ | C |
| SPACE-BASED RADAR | C+ | C+ |
| CRUISE MISSILE DETECTION - AIR | C | A- |
| - GROUND | C | A |
| • BMD | | |
| ENDO-ATMOSPHERIC NUCLEAR KILL | B | A |
| EXO-ATMOSPHERIC NON-NUCLEAR KILL | C+ | C |
| ENDO-ATMOSPHERIC NON-NUCLEAR KILL | C | C |
| • DIRECTED ENERGY WEAPONS | | |
| PARTICLE BEAM | D | D |
| SPACE-BASED LASERS | D | D |

SYSTEM FEASIBILITY

A = ESTABLISHED BY TEST
B = ESTABLISHED BY ANALYSIS
C = CAN BE ESTABLISHED
D = UNKNOWABLE AT THIS TIME

COMPONENT AVAILABILITY

A = TECHNOLOGY IN HAND
B = PROBABLY AVAILABLE WHEN NEEDED
C = UNCERTAIN - NEED MORE EFFORT
D = UNKNOWABLE AT THIS TIME

9-23

# RECOMMENDED ACTIONS - TECHNOLOGY

- HIGH PAYOFF, SMALL DOLLARS
  - CRITICAL ASSESSMENT OF EXO-NNK SYSTEM AGAINST REACTIVE THREATS
  - STUDY OF DEFENSE OF SBIR, SBR, AND SBL SATELLITES
- HIGH PAYOFF, BIGGER DOLLARS
  - ENDO-NNK SIMULATION AND FEASIBILITY ASSESSMENT ($100M)
  - AGGRESSIVE PROGRAM IN CRUISE MISSILE, ETC., DETECTION
    - -- GROUND BASED ($30M)
    - -- AIRBORNE (FEW $100M)
  - VIRGOROUS ABRES PROGRAM FOR UNDERSTANDING OFFENSE/DEFENSE INTERACTIONS (~ $150M/YR)
- WAIT AND WATCH (AND PAY)
  - ITSS WORK ON SBR
  - TEAL RUBY EXPERIMENT ON SBIR
  - DARPA LASER DEMONSTRATION PROGRAMS
- INCREASED COMPONENT TECHNOLOGY (10's OF $M's)
  - LWIR SYSTEM COMPONENTS FOR SPACE (EXO-NNK, SBIR, SPACE SURVEILLANCE, ETC.)
  - SHORTER WAVELENGTH HIGH ENERGY LASERS
  - ACCURATE AND AGILE HOMING MISSILES (ENDO-NNK)
- PHENOMENOLOGY PROGRAMS (10's OF $M's)
  - LWIR TARGET AND BACKGROUND DATA
  - HARDENING AGAINST LASER DAMAGE

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Annex 10

INTEGRATED STRATEGIC DEFENSE PROGRAM (U)

10.1 RATIONALE (U)

(U) In this annex we array the recommendations of the panels into a set of programs, attempting to realize a coherent programmatic view of strategic defense. The method employed is that of Mission Area Analysis (MAA). In Mission Area Analysis, the defense mission is defined, our ability to accomplish it over time is assessed, and deficiencies emerge; alternative programs for correcting these deficiencies are developed, and selection of which programs to support is made using cost-effectiveness analyses. This process is imperfect but gives meaningful insights into a very complex structure of military systems and subsystems. The mission area of strategic defense includes warning, space defense, air defense, ballistic missile defense, civil defense, and all the command, control and communications associated with them. The mission of strategic defense is defined as the active and passive defense measures required to enhance strategic deterrence. Evidently strategic defense is only useful insofar as it contributes to deterrence. Deterrence, of course, is a complex entity which has recently been expanded to include endurance. Its subtleties are discussed in the report of the policy panel (Annex 3). For the purpose of synthesizing programs a relatively simple statement suffices.

~~(S)~~ Deterrence is certainty (in the eyes of the Soviets) that we have survivable capability which at any level of conflict and at all times, can cause consequences which the Soviets would consider unacceptable. (To achieve this requires a favorable exchange ratio, at all levels of conflict and at all times, plus the ability to execute the forces at those levels and times.)

(U) The underlined portions are new. The sentence in parentheses allows us to measure our ability to carry out the Strategic Defense Mission and identify deficiencies.

## 10.2 DEFICIENCIES (U)

~~(S)~~ Nearly all the deficiencies arise as the result of the endurance requirement which forces the contemplation of protracted nuclear war.

(b)(1)

[redacted]

(b)(1)

[redacted]

## 10.3 PROGRAM INTEGRATION (U)

(U) All of these deficiencies can be redressed over time with appropriate programs. A set of such programs has been developed from the recommendations of the panels (although in some cases the specific recommendations have been generalized or expanded to subsume two or more ideas). The results of this work are arranged in Tables 1 through 6. (An Addendum provides a glossary of terms for those not familiar with the acronyms, abbreviations and jargon in this part of the defense community.) A priority has been assigned to each program based on the function it supports as shown in Table 7. These priorities are the same as discussed in Sections IV and XII of Volume I. Table 7 also contains the total cost of the programs included in each priority. The philosophy for prioritizing is that the most important programs are those which assure our capability to utilize present forces, second are those which enhance the survivability of those forces, third are the means for those forces to retain substantive effectiveness for protracted periods (say, several months) after one or more attacks has occurred, and last, to protect our population and industry to a level which mitigates the asymmetry in this capability between ourselves and the Soviets. Table 8 provides a cross reference for each of the major strategic defense missions, the programs listed in Tables 1 through 6 and the priority assigned.

(U) The array of programs provides several insights. We can see immediately that enduring survivability of the essential portions of strategic defense will cost multiple billions of dollars in the next decade. Also obvious is that little can be done in the near-term; we can change procedures, reorganize, reshape our way of viewing strategic defense, but little else. We can discern, too, that there are always alternative ways of accomplishing the same objective (e.g., to be made enduring, $C^3$ nodes can be proliferated, made mobile or defended). In some of these cases the situation is clear enough so that the DSB recommends a choice. In others, further study is required. As Table 7 shows, the set of programs to preserve the survivability of our strategic forces and programs to give those forces endurance are approximately equal and large in cost, while initiatives to assure the utilization of our present forces are substantially less. Civil defense costs are not chargeable to DoD.

(b)(1)

(b)(1)

[redacted]

(b)(1)

(b)(1)

(b)(1)

(b)(1)

[redacted]

(b)(1)

[redacted]

(b)(1)

(S) Perhaps the most useful insight emerging from the synthesis is that the "culture of endurance" has not had time to diffuse through the defense community. Many of the problems which arise in protracted nuclear war have not been discussed or analyzed in enough depth to allow confident decisions. For example, the vital importance of reconnaissance to both sides after a nuclear exchange poses requirements for very complex systems to be operable in extremely stressful circumstances. Not enough thought has been given this subject by competent groups of people to permit useful program projections. The process of cultural diffusion should be hastened--an outcome which may be the most important achievement of the 1981 DSB Summer Study.

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Annex 10 - Attachment A

GLOSSARY (in order that terms appear in the tables) (U)

Table 1 (U)

(b)(1) [redacted]

(U) OTH-B is over-the-horizon Backscatter radar.

~~(S)~~ DEW IMPROVEMENT is updating the Distant-Early-Warning System across Canada so as to detect low-flying (b)(1) [redacted] aircraft.

(U) JSS/ROCC is the Joint Surveillance system (46 radars around the periphery of the U.S. which belong to both the FAA and the Air Force and are used for aircraft surveillance) and Regional Operational Control Centers (of which there are five in the United States and two in Canada) from which the U.S. and Canadian Air Forces control the aircraft in their coverage.

(U) AWACS is Airborne Warning and Control System.

(b)(1)

[redacted]

<u>Table 2</u> (U)

(U) ALCS III is the third-generation Air-Launch Control System for Minuteman.

(U) EC-X is a new command and control aircraft.

(U) EHF COMSAT is Extremely High Frequency (wavelength ~) Communications Satellite.

(U) MORE/BETTER E-4B's is procuring more Airborne Command Posts and upgrading them.

(U) NCA is the National Command Authority.

(U) $C^3$ NODES are those command control communications locations in the United States which contain ganglions of crucial communications lines. These may be major terminal locations or vital relay points.

(U) SSBNs are nuclear submarines capable of launching ballistic missiles.

(U) FORCE STATUS REPORT-BACK is a channel of communication from the missile launch point back to the commander which provides information on force status.

Table 3 (U)

(b)(1) [redacted]

(U) MINUTEMAN GUIDANCE IMPROVEMENT is essentially a software upgrade which gives the missile system better accuracy.

(b)(1) [redacted]

(U) M-X/MPS is M-X deployed in the Multiple Protective Shelter basing mode wherein a few missiles are deceptively located among a large number of shelters.

(U) BMD is Ballistic Missile defense, sometimes called ABM (Anti-Ballistic Missile Defense).

(U) OVERLAY is an exo-atmospheric BMD system which uses optical components and provides defense leverage for underlying atmospheric systems or acts as a wide area defense on its own.

(U) MAKE AWACS AND FIGHTERS ENDURING means providing facilities, logistics and tactics necessary to make these systems as survivable as practical after a nuclear exchange.

(U) HAWK is a ground-mobile Army air defense system.

(U) PATRIOT is a more advanced mobile, ground-based air defense system.

(U) ENDURING ARMED SURVEILLANCE PLATFORM is a self-contained system, survivable after a nuclear exchange, which can do surveillance and long-range strike.

Table 4 (U)

(U) SR-71s & U-2s are strategic reconnaissance and surveillance aircraft.

(U) F-15/ASAT is the current program for using miniature homing vehicles, Patriot missiles, boosters on F-15s for anti-satellite operations.

(U) JSTPS is the Joint Strategic Target Planning Staff.

(U) SPACE CATALOG contains all the orbital elements of about 4500 artificial earth satellites.

(U) LWIR is Long Wavelength Infrared in the region between eight and 24 microns wavelength.

Table 5 (U)

(U) BASE ESCAPE: ENHANCE WITH PASSIVE MEASURES refers to the various steps which can be taken to flush the bombers more effectively, such as making the bombers harder, placing more of them on alert, increasing their readiness, dispersing them to more bases and/or inland bases, etc.

(U) PENETRATION refers to the bomber's ability to penetrate enemy air defenses and reach assigned targets.

Table 6 (U)

(U) CRITICAL SERVICES are medical, food, housing and social services.

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Annex 11

ARMS CONTROL IMPLICATIONS

ABM TREATY AND ITS 1974 PROTOCOL - KEY TERMS (U)

(U) The ABM Treaty is of unlimited duration.

(U) By the terms of the Treaty, the sides will conduct a review of the Treaty every five years after entry into force (3 October 1972). However, amendments may be proposed at any time.

(U) A party may withdraw, with 6 months notice, if it decides that extraordinary events related to the subject matter of the Treaty have jeopardized its supreme interests.

(U) In this connection, it is important to note that the U.S. stated unilaterally on 9 May 1972 that its supreme interests could be so jeopardized if an agreement providing for more complete strategic offensive arms limitations (than those contained in the SALT I Interim Agreement) were not achieved within five years. This is reinforced in the legislative history of the instrument of ratification.

LIMITATIONS (U)

(U) Each side is permitted ABM defenses at one site: either centered on its national capital (the USSR choice), or centered more than 1300 km from the national captial and containing ICBM silo launchers (the U.S. choice). The radii of the deployment areas are each 150 km. Each side is permitted to exchange its deployment site location to the other choice, one time.

(U) The ABM system will consist of no more than 100 ABM launchers and no more than 100 ABM interceptor missiles at launch sites, and:

- In the case of a national captial defense, ABM radars within no more than six complexes having a diameter no greater than 3 km each. (But the Soviet Try-Add radars don't count.)

- In the case of a silo defense, two large, phased-array radars (power-aperture equal to or greater than 3 million watt-meters$^2$) and no more than 18 smaller ABM radars.

PROHIBITIONS (U)

(U) The following are prohibited.

- Development, testing, and deployment of ABM systems or components (present or "future" types) which are sea-based, air-based, space-based, or mobile land-based.

- Development, testing, and deployment of launchers for launching more than one ABM interceptor missile at a time.

- Development, testing, and deployment of systems for rapid reload of ABM launchers.

- Development, testing, and deployment of ABM interceptor missiles for the delivery of more than one independently guided warhead per missile.

- Giving non-ABM missiles, launchers, or radars capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and testing such components in an ABM mode.

- Deployment of ABM systems based on other physical principals and including components capable of substituting for missiles, launchers, or radars. An Agreed Statement provides that limitations on such systems and their components would be subject to discussion in the SCC and agreement via amendment. Note, however, that the development and testing of such systems or components which are fixed and land-based are permitted.

(U) There are some important definitional issues regarding the foregoing prohibitions. They include:

- When does "development" or "testing" begin? The U.S. interprets this to be the initiation of field testing of the components (as opposed to unverifiable laboratory testing).

- What are "ABM systems or components"? For example, could a component of a space-based laser ASAT weapon be considered an ABM component on the basis of its having potential ABM capability? Such questions must be handled on a case-by-case basis, as a function of the system's actual (or apparent) capability and, perhaps more importantly, how it is tested (i.e., in something which could be considered an ABM mode"?).

SOVIET PROGRAMS AND THE ABM TREATY (U)

(~~S~~) The Soviets currently give <u>no</u> indication of wanting to change or to withdraw from the ABM Treaty. On the contrary, they appear to want to keep it as it is.

- They have maintained an active ABM R&D program since the signing of the Treaty, and most elements of that program appear to be compatible with the Treaty.

- They have underway a significant upgrading of the Moscow system, and this appears to be fully consistent with the terms of the Treaty.

- There are no indications that they want to pursue ICBM silo defense, although this is a possible option for preserving the survivability of their fixed ICBMs.

- They have options for preparing for a broader, country-wide ABM defense which do not at this time require actions inconsistent with the ABM Treaty (although in some cases this is a matter of interpretation).

  -- They could produce and store (in fact may be producing and storing) rapidly deployable ABM components, such as those they are now developing.

  -- They are developing an ATBM system which could have some ABM capability.

-- Their upgraded air defenses could provide some ABM capability.

-- Their peripheral, large, phased-array radars could provide a combined early-warning/battle-management role with the above.

U.S. PROGRAMS AND THE ABM TREATY (U)

~~(S)~~ The ABM options under consideration by the U.S. would, at some point, conflict with the ABM Treaty.

<u>LoAD Defense of M-X/MPS</u> (U)

- Prohibition on development, testing, and deployment of mobile land-based ABM systems or components. The "mobile defense unit" would contain both a mobile ABM radar and mobile ABM launchers. (Note that the mobile defense unit might be considered to be a launcher for launching more than one ABM interceptor missile at a time from a single launcher, which is also prohibited.) Field testing, the U.S. definition for start of "development", of the mobile defense unit need not start before 1987-88, or 1985-86 with an accelerated program.

- Limit to a single deployment area near Grand Forks, ND, or Washington, DC, of radius no greater than 150 km (considerably smaller than the Utah-Nevada deployment area). Limit of 100 launchers and 100 interceptor missiles and limit of 18 "small" radars (LoAD defense of 200 M-X/MPS missiles would require up to 600 interceptor missiles and launchers and 200 radars). Deployment could occur in about 1989-1990, in an accelerated program.

Defense of ICBM Silo Launchers -- Low-Altitude Portion (U)

~~(S)~~ - Prohibition on development, testing, and deployment of mobile land-based ABM systems or components (1985 for earliest testing of the radar in a mobile configuration).

~~(S)~~ - Deployment areas other than Grand Forks (i.e., other Minuteman fields). More than 100 launchers/missiles and 18 "small" radars (up to 5200 launchers, 2000 interceptor missiles, and 84 to 168 radars). Deployment could occur in 1986 with an accelerated program.

Defense of ICBM Silo Launchers -- Overlay (U)

~~(S)~~ - Prohibition on development, testing, and deployment of interceptors for the delivery by each interceptor of more than one independently guided warhead. The overlay system would utilize interceptors which are each equipped with multiple non-nuclear kill vehicles, each capable of attacking an incoming object. Field testing of the multiple-warhead interceptor could occur in 1989-90, or 1986-87 with an accelerated program.

~~(S)~~ - Prohibition on deployment of ABM systems or components based on other physical principles and capable of substituting for existing ABM systems or components. The forward acquisition system probe would contain an LWIR sensor, together with extensive data processing and communications, and would substitute for a radar in the ABM system. Deployment of such a probe could occur in the mid-1990s, in the early 1990s with an accelerated program.

WHAT POSTURE SHOULD THE U.S. ADOPT REGARDING CHANGING OR WITHDRAWING FROM THE ABM TREATY? (U)

~~(S)~~ All U.S. ABM options under active consideration are inconsistent with the ABM Treaty. Actual conflict with the Treaty will not be likely to occur before 1985. However, it will be necessary to adopt a strategy for dealing with the Treaty well in advance of that date, especially from the perspective of obtaining Congressional approval of funds for an ABM development program of this magnitude that is likely to lead to deployment. This strategy must take into account our long-term objectives for our strategic offensive and defensive forces. Relevant considerations include the following:

(U) - The Soviets appear to prefer keeping the Treaty as it is. It is unlikely that they would readily agree to modifying it in a manner which permits us to mitigate a problem they have taken some pains to cause (the vulnerability of our ICBMs). On the other hand, they may prefer a modified Treaty to none at all, and so in the end might accept U.S. proposed modifications. Soviet interest in an ABM defense of their ICBMs, say to protect them against attacks by M-X or Trident II, could lead them in this direction. The Soviets would certainly seek a significant negotiating price (such as broadening the Treaty in ways that meet their defense needs). They will also be likely to stretch out such negotiations in ways which will complicate the U.S. decision process.

~~(S)~~ -- The Soviets are currently in a better position to deploy an ABM system than is the U.S. They could react to U.S. attempts to change the Treaty (or their perception that the U.S. was resolutely embarked on a course which would require either a change in it or U.S. withdrawal from it) by rapidly deploying an ABM area defense, e.g., based on their ABM-X-3 system. This could markedly affect the capabilities of the U.S. ballistic missile forces, both in actual attrition and in virtual attrition [redacted] (b)(1) On the other hand, even if we seek <u>no</u> change in the Treaty, the Soviets could themselves abrogate the Treaty, and in fact would be likely to do so if they viewed it in their interest.

(U) -- We should not expect the Soviets simply to stand by while we make apparent preparations to develop and deploy a system which is contrary to the ABM Treaty. At a minimum, we should expect them to argue strongly against our program, both in the Standing Consultative Commission and publicly. They might themselves use such U.S. programs as a pretext for threatening to withdraw from the Treaty, attempting to blame the U.S. for this possibility. They would also argue with our allies that this was yet further evidence that the U.S. was not serious about arms control, using such claims to undermine NATO's LRTNF program.

(U) - Relationship of ABM Treaty to an agreement to limit strategic offensive arms.

-- When it signed the ABM Treaty, the U.S. noted the importance of this relationship, linking continued U.S. participation in the ABM Treaty to the achievement (no later than in 1977) of comprehensive limitations on strategic offensive arms. These have not been achieved.

-- It was the intent of the U.S. in SALT I and in SALT II to maintain the survivability of its ICBM force by limits on offensive arms. The SALT I Interim Agreement failed to do this, as did SALT II. It is this failure which is now necessitating consideration of ABM defense of ICBMs.

-- Accordingly, U.S. efforts to seek modification of the Treaty, or U.S. withdrawal from the Treaty, would be fully consistent with its position at the time the Treaty was signed.

(U) - Before embarking on an ABM program which will conflict with the Treaty, the U.S. must decide on the approach it intends to take regarding the Treaty. This is necessary first as part of the process of ensuring that this course of action is in the U.S. interest, and second for convincing the Congress and the public that we have thought through the implications of such a program. This is particularly important because of the importance many attach to the ABM Treaty as the foundation (and only firm remaining vestige) of strategic arms control.

(U) -- The most straightforward approach would be for the Administration to declare that the Soviet buildup in accurate ICBM RV's has made our ICBM force vulnerable to a Soviet strike and that to protect our national security we must take steps to rectify this situation. Doing this requires the development and deployment of an ABM system for defending our ICBMs, and we must proceed with this vital program despite its implications for the ABM Treaty. We will at an appropriate time seek to modify the Treaty to accommodate this program, but failing that will withdraw from the Treaty, in accordance with Article XV of the Treaty.

(~~S~~) -- But as a matter of tactical application, we might want to take advantage of the fact that actual conflict with the terms of the Treaty would not occur until 1985. In view of this, we may want to identify milestones in the ABM program at which point we might make such a declaration, based upon the satisfaction of certain criteria regarding the system's feasibility, cost, and/or effectiveness. In this case we would at this time declare only that we were considering such an ABM deployment, and that a deployment decision would depend on a number of factors, including Soviet willingness to undertake meaningful reductions in offensive force. This approach could postpone some of the domestic and foreign furor that proposing changes to the Treaty would cause, as well as aid in holding off Soviet complaints about U.S. activities (or perhaps Soviet actions vis-a-vis the Treaty).

(U) -- Another consideration is the degree of change to the Treaty the U.S. ABM deployment would require. As is pointed out in the annex to Section 8, options exist, in the case of defense of an MPS ICBM deployment, to deploy a limited ABM system which significantly increases the price to the attacker but only requires one to three hundred interceptors. Modification of the Treaty to accommodate such a system could be defended as being fully consistent with the objectives of the ABM Treaty.

~~(S)~~ -- With regard to interactions with the Soviets, the U.S. could wait until about one or two years before conflict with the Treaty is expected, and at that time engage the Soviets in negotiations on the required modifications to the Treaty. If the Soviets were unwilling to accommodate the changes we proposed, we would be in a better position to place the onus of failure of the Treaty on them, if we at a later time withdrew from the Treaty to carry out the ABM program. Soviet unwillingness to agree to significant limitations on strategic offensive arms would strengthen this position. A problem with this approach is that it may be in conflict with public statements required to assure proper funding and authorization to procede.

~~(S)~~ -- The U.S. posture at the 1982 ABM Treaty review would of course depend on the tactical approach selected. If we choose immediately to declare our intent to modify the Treaty, we would appropriately use the review to initiate discussions with the Soviets on such modifications. If we choose to postpone a declaration of intent to seek modification of the Treaty, we would probably want a relatively low-key review of the Treaty in 1982.

UK, FRENCH FORCES (U)

(U) The British and the French have already expressed concern regarding the effect on their deterrent forces of relaxing the constraints of the ABM Treaty.

~~(S)~~ We should handle this by adopting the position that their security rests far more heavily on the strategic capabilities of the U.S. than on their minimal forces. [redacted] (b)(1) Accordingly, the steps necessary to ensure adequate U.S. strategic force capabilities must be taken, even though they may result in some degradation of the deterrent value of (b)(1) [redacted]

(b)(1) [redacted]

OTHER ARMS CONTROL IMPLICATIONS OF STRATEGIC DEFENSE (U)

<u>Defense/Offensive Interaction</u> (U)

(U) The U.S. would probably need more offensive capability, if there were an increased Soviet ABM capability under a relaxed ABM Treaty. (Increased use of penetration aids could compensate for this, but at the cost of reduced useful payload.) This would make the achievement of any offensive constraints, and especially constraints at considerably reduced levels, more difficult to achieve.

Air Defenses (U)

(~~S~~) The deterrent effect of the U.S. bomber force would be enhanced if there were limits on Soviet air defenses. However, it is difficult to envision the achievement of significant limitations on strategic air defenses, given the adamant refusal of the Soviets even to discuss such limits in the past, the extent of their air defenses, and the importance of those defenses as a protection from third countries.

Civil Defense Limits (U)

(U) Civil defense limits are also difficult to envision. Civil defense is likely to affect arms control by being an added element in the strategic equation, which must be considered in evaluating possible arms control scenarios.

$\underline{C^3I}$ (U)

(b)(1)

[redacted]

ASAT (U)

(~~S~~) A recent DoD study concluded that it is unlikely that an ASAT Treaty would be in the U.S. interest, in large part because of the monitoring problems associated with any treaty having significant limitations. The 1980 summer study on space warfare concluded that, if ASAT arms control were to be pursued, consideration should be given to developing agreed "rules of the road" which could help prevent surprise attack of space assets.

CONCLUSIONS (U)

(U) The U.S. should proceed with the steps necessary to ensure that it can unilaterally meet its defense needs. It must not rely on arms control to do this. It is exceedingly unlikely that strategic offensive arms control will relieve the stress on our ICBM force, particularly if it is silo-based. Also, the Soviets are unlikely to let the ABM Treaty stand in the way on an expanded Soviet ABM force, if they decide they need such a force.

~~(S)~~ However, because the potential conflicts with the Treaty would not occur until 1985, we should not unnecessarily take steps which would foreclose future arms control options, including possible retention of the ABM Treaty. The Administration is committed to meaningful arms reductions, and arms control can limit the threat we face. Also it may be in our interest to postpone the political consequences, both domestic and foreign, of moving in a direction counter to the ABM Treaty.

RECOMMENDATIONS (U)

(U) USDP/USDRE should develop a plan for handling the arms control aspects of the M-X basing/ABM decision.

- This plan must be submitted coincident with any new program recommendation involving ABM.

*The information on this page is Unclassified.*

- In particular, a forthright public statement of policy should be made at the opening of public consideration of any new ABM program.

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(U) As always, a well conceived and integrated plan is best. In particular, a well-conceived plan would include all forces that are useful to mount an attack aimed at thwarting the attacker's war aims -- not just those U.S. forces most threatened (by the attack being launched from under).

(U) For the 1980's, U.S. ICBM's have, warhead for warhead, best effectiveness against Soviet silos; penetrativity, lethality, and timeliness. Without a U.S. ICBM LUA plan, counterforce outcomes are U.S. unfavorable, at least until 1990. (To be sure, outcomes could improve gradually before 1990 if currently proposed programs come to fruition). With a U.S. ICBM LUA plan, the best case outcomes (Soviets ride out U.S. LUA attack) are markedly improved -- but clearly this best case is not enforceable. However, even the worst case military outcomes (Soviets LUA under U.S. LUA) are noticeably improved, since a well-conceived U.S. LUA would take under attack many important, timely targets other than silos such as mobile forces and command and control facilities.

NUCLEAR RELEASE FOR BMD - A SPECIAL NEED (U)

(U) In order for active BMD to provide the high payoff performance described in this report, three ingredients are needed: 1) deception for offensive and defensive components (in particular, deception within a set of hardened shelters); 2) preferential defense of only a portion of the offense components; and 3) evaluation of performance using offense reasonable rules.

(U) It is possible for the enemy to undercut this high payoff from BMD by multiple shoot-look-shoot attacks, especially light, probing initial attacks. However, these tactics are unreasonable if offensive forces can be launched before the attacker's second wave. That is, if the attacker's cannot be certain he has time to look, then it is unreasonable for him to evaluate his performance using shoot-look-shoot. This U.S. threat to launch before the second "shoot" needs an effective offensive punch, in particular a significant counterforce punch to threaten the attackers second "shoot" forces.

(U) Thus active BMD, for high payoff, also needs the ability to launch offensive forces before the attackers "look" and attack with a second wave. It is crucial to note that this must be accomplished with $C^3I$ assets that may be damaged, and with the NCR destroyed -- since attacks on the $C^3I$ and the NCR would reasonably accompany the attacker's initial, probing attack.

SPECIFIC CONCLUSIONS AND RECOMMENDATIONS (U)

(U) Specific conclusions and recommendations for nuclear release procedures, Launch Under Attack (LUA), and BMD can be found in Figures 12.1, 12.2, and 12.3 of this section.

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Report of

Defense Science Board

1991 Summer Study

On

# BALLISTIC MISSILE DEFENSE (U)

FEBRUARY 1992

Office of theDirector of Defense Research& Engineering

Washington, D.C. 20301-3140

Classified By: SDIO DIR 5230-M

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This advance copy is provided to the following offices for the purposes of internal review and comment.

Secretaries of the Military Departments

Chairman of the Joint Chiefs of Staff

Under Secretaries of Defense

Director, Strategic Defense Initieative Organization

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This report if a product of the Defense Science Board (DSB). The DSB is a Federal Advisory Committee established to provide independent advice to the Department of Defense. Statements Opinions, Recommendations, and Conclusions in the report do not necessarily represent the official position of the Department of Defense.

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

MEMORANDUM FOR SECRETARY OF DEFENSE
UNDER SECRETARY OF DEFENSE FOR ACQUITION

SUBJECT: Report of the Defense Science Board (DSB) 1991 Summer Study on Ballistic Missile Defense - ACTION MEMORANDUM

I am pleased to forward the final report of the DSB Summer Study on Ballistic Missile Defense (BMD), which was chaired by Mr. Daniel Fink, Mr. Fred Hoffman and Mr. William Delaney. The objective of this study was to consider the requirements for tactical and theater ballistic missile defenses; their interaction and interfaces with CONUS BMD; recommendations for development and deployment options; the necessary technological underpinning; ABM treaty implications and other related policy issues.

The task force focused on theater missile defense and emphasized active defense against tactical ballistic missiles. The task force concluded that both near-term and mid-term approaches to active theater BMD are well positioned. An aggressive schedule to upgrade the Patriot and the upgrade of the Navy's Aegis were the more significant near-term recommendations.

The SDIO efforts involving the Ground Based Radar and the Theater High Altitude Area Defense missile were highlighted as sound approaches to counter expected theater missile threats. The lethality of our conventional defensive warheads against certain classes of enemy chemical and biological warheads was a task force concern.

I recommend that you review the Executive Summary and the management issues and recommendations (pages 28-30) which highlight the findings, recommendations and implementation actions.

John Foster Jr.
John S. Foster, Jr.
CHAIRMAN

ATTACHMENT (S)

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE
BOARD

Dr. John S. Foster, Jr.
Chairman, Defense Science Board
The Pentagon
Washington, DC 20301-3140

Dear Johnny:

Enclosed is the Final Report of the Defense Science Board/Defense Policy Board Task Force on Ballistic Missile Defense (BMD), which was part of the 1991 Defense Science Board Summer Study.

We focused our attention on theater missile defense and emphasized active defense against tactical ballistic missiles (TBMs). We believe the study and its results are particularly timely in light of the Desert Storm experience coupled with the continuing proliferation of TBMs and associated technologies among Third World nations. The threat to U.S. forces overseas and to our allies and friends exists and is likely to increase.

Overall, the Task Force concluded that the United States is favorably positioned with both near-term and mid-term approaches to active theater BMD. We recommend an aggressive schedule to upgrade the Patriot as our major near-term response. The result will be a system much improved over that which we were able to field in Desert Storm. The upgrade of the Navy's Aegis is also an important part of our recommendations for the near-term.

We also recommend proceeding with the SDIO developments involving the Ground-Based Radar and the Theater High Altitude Area Defense missile as a sound approach to counter the more difficult theater missile threats our forces can be expected to meet within the next decade. A variety of space systems can provide critical alerting and support to all of these active defense systems, and we highlight the promising R&D in that area.

The Task Force is concerned with one area of technology that is critical to the success of all future theater missile active defense systems: the lethality of our conventional defensive warheads against certain classes of enemy chemical and biological warheads. We need to sustain a strong national effort in technology, development, and experimentation in this field. We recommend the continuation and enhancement of SDIO and DNA efforts in this area.

We are all very pleased to have participated in this important DSB/DPB endeavor.

| | | |
|---|---|---|
| Daniel J. Fink | Fred S. Hoffman | William P. Delaney |
| Co-chairman | Co-chairman | Co-chairman |

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## APPENDICES

## LIST OF FIGURES (U)



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## EXECUTIVE SUMMARY: BALLISTIC MISSILE DEFENSE TASK FORCE (U)

(U) The Task Force on Ballistic Missile Defense focused its attention on theater missile defense (TMD). This was a combined Task Force of the Defense Science Board and the Defense Policy Board so that both technical and policy issues of ballistic missile defense (BMD) were addressed. Our focus was on active defense, that is the intercept and negation of the enemy's ballistic missile (BM) warheads after launch.

(U) Theater ballistic missile (TBM) threats are proliferating, but the situation is different than it has been during the preceding 40 years of Soviet BM development. First, Third World Nations can obtain BM systems by simple transfer. Thus, these systems can arrive suddenly and without warning. Second, these systems will not be tested nearly as vigorously by the developer as Soviet systems were tested; they may be tested rarely by the users. Thus, we may have little insight into or information about the threat specifics. Our TMD, therefore, must be designed with substantial flexibility to accommodate these uncertainties.

(U) Most of today's threats are limited-capability Scuds and Scud variants. Much more capable systems are likely to be part of the threat in the future, and these need to be factored into our planning for TMD systems. One example of the more capable threat is the Chinese CSS-2 missile, which has a range of 3000 km—about five times that of the Iraqi Scud variant.

~~(S)~~ With regard to implications of the ABM (Anti-Ballistic Missile) Treaty for TMD, the Task Force recommends that we exploit the existing latitude within the Treaty to proceed with our TMD development programs, avoid bilateral attempts to clarify the distinction between ABM and TMD, and reopen the Treaty for revision only if we are prepared to press for our full long-term objectives.

~~(S)~~ The Task Force considered upgrading the Patriot system and strongly recommends these improvements. By the year 2000, there will be approximately 200 Patriot batteries with some 10,000 interceptor missiles worldwide. Upgrading existing systems permits us to capitalize on this inventory and infrastructure. The upgrade is relatively straightforward and can dramatically enhance Patriot's capability against TBMs.

(U) A similar set of arguments leads the Task Force to recommend that the Navy's Aegis system also be upgraded to have significant capability against TBMs. Importantly, the Navy may have the only on-the-scene TMD capability at the onset of many conflicts and will be sorely needed for defense of both sea and air ports-of-entry and for protection of amphibious landing forces. The Navy's presence and large ship platforms coupled with modern interceptor and sensor technologies convince the Task

Force that the Navy can make a substantial TMD mission contribution beyond traditional Navy missions.

(U) An important question is whether new and more advanced TMD systems are needed beyond the upgrade of Patriot and Aegis. The Task Force concludes that more advanced capabilities are necessary and should be pursued aggressively. The primary reason for this conclusion is that more advanced threats (e.g., longer range threat missiles, more threatening front ends, and technologies that can make warheads more difficult for our TMD systems to find and kill) require more advanced defenses. The Strategic Defense Initiative Organization (SDIO) is developing a ground-based system comprised of a ground-based radar (GBR) derivative and the Theater High Altitude Area Defense (THAAD) missile, which the Task Force concludes is well matched to the advanced system role. The GBR also can be a valuable cuing source to a system such as Patriot.

~~(S)~~ The Task Force's major technical concern was the issue of the lethality of our conventional defensive warheads against certain classes of offensive warheads—principally those with chemical or biological submunitions. The DoD needs to support a substantial lethality-enhancement program. Additional weight and volume need to be included in our new interceptor designs to accommodate lethality-enhancement devices or techniques.

(U) Space systems, such as the DSP (Defense Support Program) system and its upgrades*, and more capable systems, such as the Brilliant Eyes (BE) satellite constellation, can provide significant contributions to all TMD systems. A cue from space providing the location of a BM launch or a more exact threat-missile flight path can allow a ground-based TMD system to defend areas two to four times larger than could be defended without the assistance from space. Thus, the Task Force recommends a vigorous program of upgrades and new developments in the area of space systems.

(U) The Task Force comments on a number of management issues related to US TMD efforts. TMD is a new mission; it is a National mission; and it is a joint-Services mission, which requires substantial effort and cooperation between the Services and the SDIO. This challenge arrives at a time when budgets, manpower, and forces are shrinking substantially. The Task Force makes several recommendations to help sustain a concerted attack in this important area.

*The Task Force considered FEWS to be the follow-on to the DSP system. Throughout this document and appendices, therefore, "DSP" is used to mean not only the existing system but FEWS as well.

## I. INTRODUCTION (U)

(U) At the request of the Under Secretary for Defense (Acquisition), the Joint Defense Science Board/Defense Policy Board Task Force on Ballistic Missile Defense was formed on May 15, 1991 "to consider the requirements for tactical and theater ballistic missile defenses; their interaction and interfaces with CONUS BMD; recommendations for development and deployment options; the necessary technological underpinning; ABM Treaty implications and other related policy issues." The Terms of Reference (TOR) further elaborated this task by setting forth a series of topics for the Task Force to address (see appendix A).

(U) In conducting its work, the Task Force recognized that TMD, broadly defined, comprises four elements: active defense against incoming BM warheads, passive defense of military and civilian targets, counterforce wherein theater missile launchers are located and destroyed before they can launch their missiles, and the command and control structure that relates these elements. Further, the theater missile threat can include cruise missiles (CMs) and air-to-surface missiles. The TOR, however, made active defense against surface-to-surface BMs the central focus of the Task Force. Considerations of time, resources, and interrelatedness dictated how far the Task Force pursued the associated topics listed in the TOR or included within the full scope of TMD.

(U) The Task Force brought together a talented and experienced group of individuals who were assisted by a knowledgeable cadre of Government Representatives. Task Force members are shown in table 1.

TABLE 1.—Members of the Task Force on Ballistic Missile Defense (U)

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*Defense Science Board **Defense Policy Board #Government Representative

(b)(6) [redacted]

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(U) Topics considered by the Task Force and discussed in this report are

- (U) The Threat
- (U) US National Security Objectives
- (U) ABM Treaty Issues
- (U) Patriot Upgrades
- (U) Lethality of Defensive Warheads
- (U) Countermeasures
- (U) Advanced TMD Systems
- (U) Navy Role in TMD
- (U) Space Systems Contributions
- (U) Management Issues
- (U) Recommendations

(U) In addition, there are five appendices; the last four consider specific topics in more detail.

- (U) Appendix A: Terms of Reference
- (U) Appendix B: How Much Footprint Is Needed in a TMD System?
- (U) Appendix C: Lethality of TMD Warheads
- (U) Appendix D: Countermeasures—Penetration Aids
- (U) Appendix E: Related Issues

## II. THE THREAT (U)

### A. CHANGES IN THE INTERNATIONAL ENVIRONMENT (U)

(U) The Task Force convened at a time when events were forcing fundamental reassessment of US strategy and priorities—a reassessment likely to continue well into the future. The demise of the Warsaw Pact and the economic (and possible political) collapse of the Soviet Union provide a context for a turn in Soviet policy from one of hostility to one of cooperation. The unsuccessful coup that greatly accelerated the process of change in the Soviet Union occurred during the course of the Task Force's 1991 Summer Study. These events point to the disappearance of the major threat that has driven US strategy. But Soviet general purpose forces remain the preponderant military power in Eurasia; no appreciable slackening in Soviet strategic programs is yet evident; and the outlook for continued peaceful, democratic change and economic recovery is far from reassuring.

(U) With the attenuation of the traditional Soviet threat, more diverse threats have been intensifying. Signs of a possible collapse of central authority in the Soviet

Union have made the West apprehensive about the stability of control over Soviet strategic forces as some of the increasingly autonomous republics have asserted control over military forces within their borders. Well before the recent Soviet changes, the spread of BMs and of the technologies for manufacturing and upgrading them had become an increasing concern, heightened by the associated spread of technologies for nuclear, biological, and chemical (NBC) weapons of mass destruction. Iraq's attempt to use the Scud missile for strategic as well as tactical benefits during Desert Storm greatly intensified this concern as did the discovery after the conflict that the international community had vastly underestimated the extent and achievements of Iraq's advanced weapons programs and that it may now be underestimating those of Iran. Most recently, President Gorbachev's response to President Bush's October initiative speeding the deactivation of strategic missiles and withdrawing a large part of our theater nuclear missiles from forward deployment has included a new expression of willingness to consider limited deployment of BMDs; a restatement of Soviet opposition to deployment in space was notably absent.

## B. THE THEATER BALLISTIC MISSILE THREAT (U)

(U) Assessing the TBM threat as a basis for our TMD program calls for a different process than the one the United States has been dealing with the Soviet threat. For over 40 years we have been tracking Soviet military forces, estimating their order of battle, and observing closely the development, testing, and strategic use of their technologies. In our requirements process, we assumed we could rely on continuity in the development of Soviet posture to project the threat to be countered. The recent changes in the international environment indicate that this approach is irrelevant to the planning processes we now need, especially in relation to the TBM threat.

(U) A body of data and experience such as that accumulated on the Soviet military is lacking for the assessment of the threat our TMD systems will have to counter. Third World countries that acquire weapons or technology by transfer from more developed countries are the most likely source of TBM threats. While the supplier countries *may* test during development, the United States does not maintain the level of surveillance over all of them that it does over the Soviet Union and may not, therefore, acquire technical data even if they do test. Even more troublesome, the transferred weapons or technologies will not, in general, be the tested versions, and the recipient countries rarely test before using. Consequently, we can count on little or no warning time between seeing a new or modified threat and facing it in the field. Under such circumstances, we cannot base our requirements and acquisition processes on estimates of a time-phased threat with well-defined characteristics. Our systems design and acquisition process will require built-in flexibility and fast response to meet threats as they appear.

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## III. US NATIONAL SECURITY OBJECTIVES IN THEATER MISSILE DEFENSE (U)

### A. THE RECENT HISTORY OF THEATER MISSILE DEFENSE AS AN ELEMENT OF BALLISTIC MISSILE DEFENSE POLICY (U)

(U) Protection against BMs attacking theaters of operations has been an objective of the Strategic Defense Initiative (SDI) since its inception. In his 1983 speech announcing the SDI, President Reagan referred to its mission as that of protecting "our own soil or that of our allies." In 1983, the Future Security Strategy Study (conducted by White House directive in parallel with the Defense Technology Study) concluded that defense against theater ballistic missiles "is an intermediate option [on the path to President Reagan's goals for the SDI] . . . that might be available relatively early . . .. Such an option addresses the pressing military need to protect allied forces as well as our own theaters of operations from either nonnuclear or nuclear attack." The role of SDIO technologies in theater defense was also recognized in the review of the SDI directed by Ambassador Cooper in 1990 and in the 1990 Defense Science Board Summer Study on Research and Development Strategy for the 1990s.

(U) It should be noted here that from its inception, the SDIO has sought to foster allied cooperation in the development of technology, emphasizing allied interest in the development of advanced TMDs.

(U) In his State of the Union Address in January 1991, President Bush announced that he had directed "that the SDI program be refocused on providing protection from limited ballistic missile strikes, whatever their source . . . to deal with any future threat to the United States, our forces overseas, and our friends and allies." In response, the Department of Defense (DoD) formulated the defense concept of Global Protection Against Limited Strikes (GPALS). On February 7, 1991, Secretary Cheney testified before the House Armed Services Committee that GPALS "includes theater missile defense to protect US and allied troops deployed abroad" and that the "SDIO has been charged with developing advanced defense technologies to deploy much improved, transportable theater missile defenses within the next 5 years." Experience in Desert Storm involving Scud missiles and Patriot defenses against them has also intensified interest in the role of BMD in regional contingencies to protect US forces as well as allied forces and territory.

(U) Even before Desert Storm, the Congress demonstrated increasing interest in systems for protection against limited strikes and, especially, in TMD. In its FY 91 budget action, the Congress *increased* the TMD authorization from the $144 M requested by the SDIO to $180 M; it also created the Theater Missile Defense Initiative and provided an additional $218 M to fund it. It is significant that this support for TMD was provided at the same time the overall SDIO authorization was reduced from $5.15 B to $4.15 B.

(U) In response to a Conference Committee request that DoD "establish a centrally managed tactical ballistic missile defense research and development program under the auspices of the Office of the Secretary of Defense," the Secretary designated the SDIO as that management office. The House Armed Services Committee *Summary of Major Actions by the House-Senate Conference on the FY 92 Defense Authorization Act* (November 1, 1991) makes is clear that congressional support for TMD will continue through FY 92. The Conference allocated $842 M to TMD, only slightly less than the $855 M requested by the Administration; the Conference explicitly prohibited the SDIO from reprogramming the funds for other purposes. The Conference directed "the Secretary of Defense to aggressively pursue the development of a range of advanced theater missile defense options, with the objective of deploying such improved systems by the mid-1990s" and adopted a provision "urging the President to discuss with the Soviets the feasibility and mutual interest of amending the ABM Treaty."

(U) In sum, new factors are making it more urgent to deploy limited but capable BMDs while previous centers of opposition to BMD programs are showing increased willingness to support or consider deployment of, at the least, systems of limited capability and particularly systems for TMD. The Task Force identified needs and opportunities for action in the short term while protecting and advancing options to realize longer term goals.

## B. DISTINCTIVE ASPECTS OF THEATER MISSILE DEFENSE OBJECTIVES (U)

(U) To deter attacks on allies and friends of the United States in regional conflicts poses different problems than did deterring a Soviet attack on Western Europe. Although the credibility of US threats to use its strategic nuclear forces to respond to a conventional attack by the Soviet Union has long been questioned (such a response is incompatible with the state of mutual deterrence supposed to have existed between the United States and the Soviet Union), the unquestioned and vital US interests in the independence of Western Europe were generally believed to be sufficient to deter Soviet attack. Few, though, believe that an analogous state of mutual deterrence would keep leaders such as Saddam Hussein from exercising local military superiority against their neighbors.

(U) Third World adversaries may be far less powerful but more difficult to deter than the Soviet Union. The rationality of specific leaders will often be less reliable and their hold on power less secure than was commonly believed to be true of Soviet leaders. To deter Third World leaders, the US posture—that we will oppose aggression in conflicts that those leaders may see as involving their vital interests but which they believe are (or could be made to seem to be) peripheral to our interests and to the interests of those who might cooperate with us—must be credible. Moreover, in future conflicts, it would be imprudent to count on all the advantages that contributed to the outstanding success of Desert Storm. The sensitivity of public opinion in the West to friendly casualties and to widespread civilian casualties among our adversaries rules out a strategy of massive retaliation as an effective deterrent to regional aggression. Experience shows that threats of extreme response lack credibility in the eyes of regional aggressors, creating a situation in which the likelihood of conflict is higher than it has been in Central Europe.

(U) Stability is such cases requires a clear US capability to intervene in a way that is politically acceptable as well as militarily effective. In particular, we should not assume that we will have as much time to deploy our forces before combat begins. The United States might face the task of deploying forces while under attack. BMs carrying NBC warheads would pose a special threat to logistics operations during large-scale deployment with its inevitable concentration of assets in a relatively small number of critical facilities. Such a possibility means that BMD could be needed at the outset of a deployment and has important implications for the character of the TMD systems we develop.

(U) The spread of weapons of mass destruction is giving new prominence to the TMD task of protecting allied populations and infrastructures in addition to US and allied forces. This task is often characterized as "non-military," but such a characterization misses the point. The ability to intimidate the object of aggression or a neighbor that might cooperate with the United States in resisting aggression may have profound strategic impact. In the future, it may be necessary for the United States to offer a degree of protection against terror attacks as a condition for obtaining strategic access to a theater of combat. And, as the range of Third World BMs increases, they will allow aggressors to threaten potential US coalition partners remote from the scene of aggression. For example, with such a longer range capability, Saddam Hussein might have made it much harder to obtain the cooperation of some European countries in the recent crisis. Longer range will also permit countries to intervene in conflicts remote from their own territory.

(U) The unpredictability and variety of the threats makes it especially essential to build flexibility into our TMD design and acquisition processes. It also should warn against driving the processes by adopting extreme performance requirements that may delay or prevent the United States from acquiring capabilities useful against many plausible threats.

## IV. ABM TREATY ISSUES (U)

### A. THE ABM TREATY AND THEATER MISSILE DEFENSE (U)

(U) For the 8 years since its inception, the large and highly visible SDI program has had as its ultimate aim the deployment of an effective National Missile Defense (NMD). It has done so within the ambiguous limits set by the ABM Treaty, a treaty designed to prevent such a deployment. The technical community was not directed to lay out an optimal development plan but, instead, to proceed within Treaty constraints until the United States made a decision to deploy. As a result, there is no baseline reference program permitting the Task Force to assess the Treaty's impact on the SDI program. Of special interest to the Task Force, however, is the fact that the Treaty's impact extends beyond our NMD efforts to affect TMD programs.

(U) Nowhere does the ABM Treaty explicitly refer to TMD. It addresses only so-called "ABM systems" and defines them as defenses against "strategic missiles." The Treaty is an issue because the distinction between the performance and technical capabilities of ABM and TMD is unclear today and likely to become progressively less clear as TBM threats grow in range and capability and as technology increases the effectiveness of defenses against them.

(U) Further, the Treaty issue has acquired urgency with the emergence of a consensus in favor of deploying a limited NMD and an even broader consensus for initiating deployment of a TMD system by mid-decade. If the TMD mandate is taken to include deployment of a system such as the THAAD/GBR, there are important implications both for program management (discussed in section XI) and for the US approach to the ABM Treaty.

(U) As noted above, among the actions of the House-Senate Conference on the FY 92 Defense Authorization Act is a request that the President initiate discussions with the Soviet Union leading to revision of the ABM Treaty. Earlier, the Senate, in approving the Missile Defense Act of 1991, listed among the proposed objectives not only making the revisions necessary to permit an effective NMD but also clarifying the distinction between ABM and TMD systems. The Soviet Union recently proposed that we agree on missile performance limits beyond which testing would be prohibited under Treaty. In 1972 Senate testimony during the ABM Treaty ratification process, the Administration asserted its unilateral understanding concerning the altitude and speed of interceptor missiles permitted under the Treaty's limits on testing (the "Foster box"). In practice, however, we are approaching another ABM Treaty 5-year review period, which will also add to pressures to consider revisions.

(U) Policy toward revising the Treaty must, therefore, consider both how the Treaty or revisions to it impact the TMD program and how resolution of the TMD Treaty issues might impact a global defense such as GPALS. The Task Force has identified four policy alternatives.

1) Exercise our latitude under the Treaty and do not pursue early revisions.

2) Take up the Soviet initiative to agree on missile performance limits beyond which testing would be prohibited.

3) Revise the Treaty for short-term objectives such as those in the Senate-passed Missile Defense Act.

4) Reopen the Treaty only for revisions sufficient to permit effective BMD development programs in pursuit of long-term goals such as deployment of GPALS and subsequent system growth when desirable.

## B. FINDINGS ON THE ABM TREATY (U)

(U) Deciding which of these alternatives to pursue depends upon the judgments made about, first, the likelihood that we could reopen the Treaty within a reasonable time after making limited revisions and, second, how far we can proceed under the latitude permitted in the Treaty without revisions.

~~(S)~~ Regarding the likelihood of reopening Treaty discussions after making limited revisions, the ABM Treaty not only is of indefinite duration but also has a high policy profile. A revision for limited ends, such as greater short-term freedom in TMD, would be interpreted by many as reinforcing the commitment to the revised Treaty and might make it harder, or even impossible, to proceed with any longer term and broader BMD goals.

(U) Regarding the latitude permitted under the existing Treaty, to establish a working definition the latitude for testing and deploying advanced TMD systems, such as the THAAD/GBR, two approaches have been suggested: 1) Take the Soviet SA-12 system as defining the permissible limits of capability for testing or deploying a TMD and 2) Take as the lower bound of an ABM system the capability to intercept (or having been tested against) a "strategic missile," defined as the least stressing missile in the Soviet inventory as of the relevant date. Neither offers full freedom for the TMD options under consideration, and congressional reaction to either is uncertain.

~~(S)~~ Regarding the first approach, the THAAD/GBR will likely be more capable than an SA-12-class system. Regarding the second approach, by 1994 the SSN-6 with a burnout velocity of (b)(1) [redacted] will be the leas [redacted]
(b)(1) inventory. However, we will probably want to test [redacted] After the SSN-6 and the SSN-7 have been retired from the Soviet inventory, the SSN-18 MOD 1 with a (b)(1) [redacted] will define this limit, and that should be sufficient for THAAD/GBR. However, a more advanced TMD system—one that uses the THAAD interceptor and a BE satellite constellation for sensing—will probably encounter Treaty problems unless revisions are made to remove all limits on sensors.

(U) Under the second and third policy alternatives, the United States would seek to reach agreement with the Soviet Union on, among other matters, a distinction between ABM and TMD that gives us the latitude we need to pursue our advanced TMD programs. Despite the attractiveness for the short term, such revisions incorporated into a Treaty of unlimited duration could create serious problems in the long term. If the revisions are too modest in the latitude they allow for TMD systems, we will be unable to keep up with the threat or take advantage of advancing technology. If the revisions permit greater latitude for TMD, however, increasing TMD's overlap with ABM and permitting free deployment of the former while continuing to restrict the latter, we must take into account the geostrategic asymmetry between the United States and the Soviet Union (or its successor states). While our TMD would be intended for deployment overseas, the Soviet's would be operationally deployed to meet TBM threats within its home territory. In numbers plausible for the TMD mission and with continuing technological advances, a future Soviet system approximating or exceeding the capability of THAAD/GBR might well impinge on the strategic balance, especially if strategic forces are reduced substantially below the START levels.

(U) The Task Force recommends, therefore, that the United States exploit existing latitude within the Treaty to proceed with its TMD development programs, avoid bilateral attempts to clarify the distinction between ABM and TMD, and reopen the Treaty for revision only if the Administration is prepared to press for its full long-term objectives.

## V. PATRIOT UPGRADES (U)

### A. INTRODUCTION (U)

(U) TMD includes a number of existing or proposed active defense components and systems such as Patriot, Aegis, THAAD, GBR, ERINT (Extended Range Interceptor), Arrow, DSP, BE, and Brilliant Pebbles (BP). These include ground-based, sea-based, and space-based components and systems. The Task Force placed particular emphasis on Patriot (and its upgrades), Aegis, THAAD/GBR, DSP, and BE.

### B. PATRIOT TODAY (U)

(U) Patriot is our most advanced ground-based air-defense system. Deployment began in 1985 and today represents a US investment of approximately $12 B. Allowing for foreign sales and some production by allies, the worldwide Patriot inventory would be about 10,000 missiles by CY 2000. The modifications (PAC-1 and PAC-2) to allow intercept of short-range BMs are relatively recent and represent a cost of $140 M, which is little more than 1% of the US investment to date.

~~(S)~~ While the Patriot PAC-2 did well in Desert Storm,[*] it has limitations. The size of the defended area and the altitude at which intercepts can be made are both

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[*]There is continuing debate on just how well Patriot performed in Desert Storm. The Army's investigations conclude that Patriot had a relatively high kill probability against the modified Scud, even though the Scud had unexpected characteristics that created some difficulties for Patriot. (See section VII: Countermeasures.) Those who argue that Patriot did poorly generally focus on the issue of the lethality of the Patriot warhead. (See Section VI: Lethality of Defensive Warheads.) The issue may never be firmly resolved due to a lack of *detailed* data on the actual intercept events.

The Task Force observes that there are an infinity of ways in which a complex system such as Patriot will not work well in its first actual combat, particularly against a threat with some "surprises." Our view is that the system performed quite well in a technical sense. Radars, missiles, computers, and command and control hardware all functioned reliably, and the operators were able to adapt quickly to the surprises in the threat. Although Patriot's performance was not perfect, the results could easily have been dramatically worse.

limited. The size of the Patriot elements is such that they cannot be carried on C-141 or C-130 aircraft without extensive disassembly; this, of course means that reassembly in the field, possibly while under attack, is also required. [redacted] (b)(1) These topics will be discussed below.

## C. POTENTIAL PATRIOT UPGRADES (U)

~~(S)~~ There are straightforward modifications to Patriot that can greatly increase its robustness against such threat variations. These modifications include [redacted] (b)(1) The Task Force addressed them collectively as "Patriot upgrades."

(U) The total cost (R&D and production) of the Patriot upgrade program is about $1.8 B; this includes procuring 1,000 new missiles with the new seeker and retrofitting the radars. The Army's milestone schedule for the full PAC-3 change allow an Initial Operating Capability in 1997 with some QRP modifications fielded in 1993.

(U) An important question concerning these upgrades is how much more TMD capability they will yield. One standard measure of defense system capability is footprint—the contour that encompasses all points on the ground defended by a single battery against a particular threat missile. Footprint is not the full measure of capability. Intercept altitude, lethality, and countermeasure resistance—among other factors—also are important variables, but more capable systems, overall, tend to have larger footprints so we use it to illustrate relative capabilities of various systems. The size of the footprint varies with both target and defense system characteristics. Factors that increase the target detection range and the defensive-missile-to-target-missile velocity ratio will increase the footprint. Thus, the footprint is larger against shorter range TBMs (which have a lower velocity) and higher signature TBMs and for systems with better radar sensitivity and high defensive missile speeds.

(b)(1) [redacted]

(b)(1)

(b)(1) [redacted]

## D. FINDINGS ON THE PATRIOT (U)

(U) The Task Force is convinced that upgrades to the Patriot missile make sense and recommends that the planned upgrades proceed with deliberate haste. The principal arguments for vigorously proceeding are summarized below.

(b)(1) [redacted]

(b)(1) [redacted]

## VI. LETHALITY OF DEFENSIVE WARHEADS (U)

~~(C)~~ The Task Force's major technical concern involved the lethality of our conventional (as opposed to nuclear) defensive missile warheads against some of the offensive warheads expected to be deployed. Biological and chemical warheads do not need to be sophisticated to cause concern. Some relatively low-technology mechanizations of a submunition warhead to dispense biological or chemical agents cause substantial concern. Lethality is a complex topic that is treated in appendix C. A synopsis is provided here.

(b)(1) [redacted]

(U) Figure 2 depicts two types of warheads used to deliver biological and chemical agents. The bulk warhead holds the agent in one large container. This container can be ruptured readily by the near miss of a fragment warhead or the impact of a hit-to-kill (HTK) warhead. The agent itself would, in most cases, be dispersed by the wind to nonlethal densities provided the intercept occurred at a sufficiently high altitude

(b)(1) [redacted]

(b)(1)

## VII. COUNTERMEASURES (PENETRATION AIDS) (U)

### A. INTRODUCTION (U)

(U) Penetration aids (PENAIDS) appear in the reentry object train automatically, even for the simplest missile system. The Scud is a good example because we have data from its use in Desert Storm, the Iran-Iraq War of the Cities, and Afghanistan. Two PENAIDS come "free" with the Scud system: fragmentation of the unseparated missile tank and spiral maneuvering that results from the aerodynamic forces acting on the asymmetric, partially fragmented tank. In addition, high-rate attacks were used in the conflicts cited—up to 25 missiles per hour in the War of the Cities and up to 10 per hour (with as many as 7 in the air simultaneously) in Desert Storm. Countermeasures are discussed in more detail in appendix D. The following summarizes the Task Force's considerations on this topic.

### B. PENETRATION AID POSSIBILITIES (U)

(b)(5)

[redacted]

### C. THEATER MISSILE DEFENSE SYSTEM RESPONSES (U)

(U) The US defense community has a high level of sophistication in both the design of PENAIDS and the corresponding counter-countermeasures. Accordingly, the Task Force is confident that a TMD system can be designed to cope with the PENAIDS that an unsophisticated threat presents and, in effect, drive the threatener to need levels of technology that are beyond its reach. Furthermore, to avoid surprises and to adapt to knowledge obtained by observation—in operation or via intelligence—of potential threats, flexibility in the TMD system software (algorithms, mode variations, etc.) is a necessary attribute.

(b)(1),(b)(5)

[redacted]

## D. FINDINGS ON PENAIDS (U)

(b)(1)

[redacted]

## VIII. ADVANCED THEATER MISSILE DEFENSE SYSTEMS (U)

(U) Substantial gains in performance are anticipated for the upgraded Patriot. A logical question is whether there is a need for more advanced systems.

### A. THE NEED (U)

(U) The Task Force is persuaded that we need to move ahead with R&D on advanced systems for the following reasons:

- (U) • More capabable tactical missile threats are very likely to appear in the near future. These may include higher velocity missiles, increasing countermeasures, and more destructive warheads that may be harder to kill than Scud warheads.
- (U) • Larger footprints are required against these threats to allow better coverage of targets, less susceptibility to local saturation or exhaustion, and more battlespace to deal with difficult threats and to employ shoot-look-shoot tactics, which permit fewer batteries to be deployed and reduce cost and overhead.
- (U) • Improved lethality is needed against these threats and can be achieved with HTK or higher altitude intercepts (improved mission kill).

~~(S)~~ In summary, the Task Force expects to see a relatively rapid evolution of offensive missile capability over the next 10 years. [redacted] (b)(1)

~~(S)~~ The table illustrates that the upgraded Patriot footprint will shrink to an undesireably small size in the face of increasing attacking missile capability. This shrinkage is the main reason to move ahead with a vigorous R&D program on advanced TMD systems.

(b)(1) [redacted]

## B. ADVANCED SYSTEM POSSIBILITIES (U)

(U) There seem to be only a few generic approaches for more advanced capability: a more advanced ground-based system, a system relying heavily on space sensing with, perhaps a space-based kill mechanism; and an airborne system using some form of directed energy kill mechanism. Arguments of technological maturity strongly favor the ground-based approach (but with substantial assistance in cuing from space sensors). The SDIO is pursuing an advanced ground-based system, the principal components of which are the TMD-GBR and the THAAD missile. The Task Force believes these components are well matched to the advanced TMD system role.

## C. THAAD/GBR (U)

(U) The THAAD/GBR is still a "paper" system with no major system hardware completed. It is envisioned to have the following features:

(U) • TMD-GBR

(b)(1) [redacted]

(U) • THAAD

(U) — High-altitude, HTK missile (smaller than Patriot)

(b)(1) [redacted]

(U) • Transportability

- ~~(S)~~ — C-130 compatible
- ~~(S)~~ — Fewer airlift aircraft required than for Patriot

(b)(1)

[redacted]

(b)(1) [redacted]

## IX. THE NAVY ROLES IN THEATER MISSILE DEFENSE (U)

### A. NAVY MISSIONS (U)

(U) The Task Force is convinced that the Navy has important roles to play in TMD. The Navy will be present at most crisis spots and, importantly, it does not need an invitation or the permission of foreign leaders to be there.

(U) One can argue that ships at sea are not very vulnerable to BMs with nonnuclear warheads. However, the Navy has two important missions that force it into defense of more static targets than ships at sea. First, it must defend our ports-of-entry so we can introduce military equipment and personnel into the conflict area. A port under daily attack by chemical weapons will, essentially, come to a grinding halt. Second, the Navy needs to defend amphibious forces as they go ashore and before they are dispersed well enough inland to have some natural protection against chemical warheads. Figure 4 illustrates a tactical missile attack on a Saudi port during Desert Storm. A Scud missile achieved a near miss; if it had hit the ammunition storage area on the end of the pier, the ensuing damage to Navy ships and port operations could have been catastrophic.

## B. THE AEGIS SYSTEM (U)

~~(S)~~ Today there are about 16 Navy ships equipped with the Aegis system with the vertical-launch missile magazine; about 50 ships are expected to be so equipped by CY 2000. Their inventory will include thousands of Aegis missiles. Currently, the Aegis system has limited TMD capability with no capability against TBMs with ranges greater than 200 km. Possibilities for upgrades to Aegis are being addressed in a number of Navy studies. The Navy Research Advisory Council (NRAC) 1991 Summer Study was a key study, which—not surprisingly—found that Aegis (like Patriot) can be upgraded to have a substantially improved TMD capability. The Task Force agrees and recommends that the system be upgraded to perform the conventional Navy missions of

- Defense of ships and task forces,
- Defense of ports, and
- Defense of amphibious operations.

(U) The Task Force is convinced that the Navy can play a larger role, one that goes beyond its traditional missions. The role we envision is using ship-borne systems to provide *regional* TMD by creating a defense envelope that would extend many hundreds of kilometers around the ship. Such a defense would require new interceptor missiles, new radars, and a strong reliance on space sensors for warning *and* cuing.

(U) The Navy possesses the unique ability to provide defenses in a threatened region before diplomatic negotiations have provided the strategic access necessary to deploy land-based defenses. Indeed, in a crisis, the protection offered by ship-borne defenses may be critical in gaining the cooperation of potential coalition partners and inducing them to grant the access to their territories required for land-based forces. Ship-borne capabilities also may be critical in defending against attacks on ports and airfields that could disrupt the vulnerable early stages of a deployment until the defensive mission can be assumed by land-based systems. This broader regional mission creates a requirement for advanced defensive capabilities not only to meet future threats but also to provide extended the footprints necessary to protect allied territory and US forces inland.

(b)(1)

[redacted]

## X. SPACE SYSTEM CONTRIBUTIONS (U)

### A. STEREO DSP, BRILLIANT EYES, BRILLIANT PEBBLES (U)

(U) The Task Force was impressed with the variety of contributions that space systems can make to TMD. Table 3 shows the breadth of the potential contributions from three space systems: SDSP, BE, and BP. (As noted earlier, the Task Force considered FEWS to be the follow-on to the DSP system; therefore, "DSP" is used to mean not only the existing system but FEWS as well.

(U) The SDSP system uses two DSP spacecraft to view a launch event to improve the metric accuracy of the tracking and trajectory prediction. BE is a distributed satellite system that will use IR sensors to track threat missile from launch through midcourse and reentry. It will use three IR sensors: a short-wavelength sensor to track the missile during burning, a mid-wavelength sensor to track upper stage burning, and a longer wavelength sensor to track the warm reentry vehicle during the midcourse phase of flight. The BE satellites would be deployed at 1600-km to 1700-km altitude and be deployed in an initial constellation of 18 satellites.

(U) BP is a space-based intercept system that would kill an enemy missile during its boost phase. It would work best against the longer range threats such as the CSS-2 missile and would not work very well against the shortest range tactical missiles. The Task Force considers BP to be a more distant TMD element than is the THAAD/GBR system.

TABLE 3.—Space System Contributions to TMD (U)

| | SDSP | BE | BP |
|---|---|---|---|
| Alerting | X | X | |
| Launch Point Location | X | X | |
| Radar Cuing | X | X | |
| Threat Intelligence | | X | |
| Discrimination | | X | |
| Midcourse Interceptor Control* | | X | |
| Space Intercept* | | X | X |

*Treaty concern UNCLASSIFIED

(U) The first contribution of space systems is "alerting," that is recognizing that a missile has been launched and sending a message used to turn on radars and warn personnel. This is a most important function because it is impractical and inefficient to maintain TMD systems such as Patriot and THAAD/GBR in a continual state of full readiness and full surveillance operation.

(b)(1) [redacted]

(U) The benefit of cuing the radar was demonstrated in the discussion of system footprints. Under uncued operation, the GBR searches a relatively large threat volume and, when the incoming object is detected, tracks it for eventual intercept. Space systems, by providing early launch detection, launch point location, and (initially) crude trajectory information, can allow the cued radar to search a much smaller threat volume and, thereby, detect the threatening objects at substantially longer ranges. This leads to the much larger areas that can be defended, as illustrated in figures 1 and 3.

(U) Threat intelligence would be an important benefit of the BE space system. Recall the earlier concern that we might not have complete intelligence on TBM threat specifics because of the lack of testing by the developer and the user. If untested missiles were being used in a war in which we were not involved (e.g., the Iran-Iraq War, the conflict in Afghanistan), a substantial satellite constellation such as BE could collect unique and valuable intelligence data on those missiles.

(U) Another potential benefit of space systems is discrimination. The multispectral IR capability of a BE satellite will allow it to contribute to discrimination of threat objects from non-threat objects such as balloon decoys or fragments originating from the intentional breakup of the missile rocket body. Decoys, fragments, and other PENAIDS can cause substantial confusion to GBRs during the exoatmospheric phase of the missile flight. The combination of radar and IR sensor data can be a powerful approach to mitigating this confusion. IR optical viewing of the threat complex is also a powerful tool for overcoming electronic jamming attacks on the GBR.

~~(S)~~ The last two potential contributions to TMD of space systems shown in table 3 involve those systems more directly in the intercept of the threat missiles. This may cause ABM Treaty concerns. Midcourse interceptor control commits a ground-based interceptor based on BE's detection and tracking of the threat. In one scenario, the ground radar may be involved prior to intercept to direct the interceptor; the interceptor acquires the target and makes the kill. However, the ground radar may not need to be involved at all if the space information is sufficient to direct the interceptor's acquisition of the target for final tracking and kill.

(b)(1)

## B. FINDINGS ON SPACE SYSTEMS (U)

~~(S)~~ The Task Force recognizes that space systems can provide many contributions to TMD. Some of these, such as alerting, are essential to the successful operation of any ground-based system; most others provide enhanced capability to the ground system in such areas as coverage and resistance to countermeasures.

The Task Force recommends that the SDSP capability be implemented in the near term. Our understanding is that this capability can be available in the 1994 time frame and involves mainly ground hardware and software changes rather than expensive spacecraft changes.

(U) The Task Force believes that the BE capability should be pursued with an R&D program leading to the minimum experiment in space needed for a demonstration.

(U) The Task Force has no recommendation on BP as a separate TMD entity. The Task Force notes, however, the attractiveness of its "on-station," instant-defense capability and its utility as an outer layer defense against long-range TBMs.

## XI. MANAGEMENT ISSUES (U)

(U) In Desert Storm, the Patriot system performed well against the modified Iraqi Scud missiles. However, the Patriot was clearly at the limit of its capability against that threat in a number of respects. Therefore, the Task Force has a sense of urgency in moving on with improved TMD systems. The first of these is the further upgrade of Patriot, and the Task Force recommends the Army's upgrade schedule be accelerated. But the Task Force's sense of urgency does not stop with Patriot upgrades. More stressing threats than the modified Scuds exist within the Chinese, Soviet, and (perhaps) North Korean inventories and could be transferred to hostile regimes at any time. Therefore, the Task Force argues that we move ahead at a rapid pace with the THAAD/GBR system to obtain the advanced capabilities it can provide.

(U) Importantly, there is agreement on what needs to be done (e.g., upgrade Patriot and Aegis, develop THAAD/GBR, upgrade space sensors, and develop new space systems). However, there is no consensus on the pace of the pursuit of these capabilities, and the appropriate organizational structure may not be in place for the major TMD system effort required for a near-term system deployment.

(U) The Task Forces's investigation of TMD convinces us that TMD is an important *National* mission that will use systems from all the Services. The Army is involved via Patriot and will likely be involved through the advanced THAAD/GBR. The Task Force urges strong Navy involvement via Aegis upgrades and a regional TMD capability. The Air Force is involved through the important space systems such as DSP and BE. Thus, TMD is very much a *joint* Service and SDIO activity. *We need a management plan for that National, joint activity.*

(U) If there is to be a rapid push toward fielding new capabilities, we must determine who is to integrate and manage the effort. Such activities are not in the charter of the SDIO. That charter limits the SDIO to R&D with a budget limited to 6.1, 6.2, and 6.3A funds. The SDIO staff is not selected for experience in the integration and management of a major acquisition and fielding exercise. If the SDIO is to play the lead role in this area, its charter needs to be amended, its structure modified, and its staff selected to reflect these new responsibilities.

(U) With regard to the pace of our efforts, there is a lack of consensus among the SDIO, OSD staff, and the Services on how fast we need to move on the development of an advanced TMD system (i.e., THAAD/GBR). The SDIO interprets statements by the President and the Secretary of Defense concerning a substantially improved TMD capability in 1995 as cause to move rapidly on the THAAD/GBR Program. OSD staff are not seized with the same sense of urgency and seem to favor a more temperate pace. The Task Force believes there is enough ambiguity in the statements to justify both views. The Secretary of Defense can resolve the ambiguity by clearly stating what the DoD pace is to be. The Task Force's view on this issue is that we should develop the THAAD/GBR system (and upgrade the Patriot system) at as brisk a pace as does not cause substantial risk. This pace may be somewhat slower than the SDIO proposes, but it is not nearly as slow as the "business as usual" DoD procurement process. Therefore, we foresee the need for some accommodation in the development/procurement process to permit a more rapid pace.

(U) The last management issue is individual Service reluctance to move aggressively into TMD. We think this reluctance is due simply to the extreme concern with declining budgets and force levels. ("If we get involved, will we get stuck with the bill in future years?") Strong Service involvement will be required to move us to the level of TMD capability needed for the future. The Secretary of Defense needs to clarify the roles of the Services and the SDIO in this new mission area and address their concerns about funding.

## XII. "BOTTOM LINES"– OUR RECOMMENDATIONS ON THEATER MISSILE DEFENSE (U)

(U) The recommendations of the Task Force are summarized below.

(~~S~~) • The Patriot upgrades are sensible—make them quickly. Support and fund the PAC-3 modifications and accelerate the schedule to provide full capability (rather than the planned Initial Operating Capability) in 1997.

(~~S~~) • The Navy should upgrade Aegis to have a significant TMD capability. The Navy should also adopt a substantial role in regional TMD.

(~~S~~) • The growing capability of tactical threat missiles requires new, advanced, active defense systems. The THAAD/GBR system appears well matched to meet this growing threat. Therefore, continue aggressive R&D on the THAAD/GBR system.

~~(S)~~ • Lethality of the defensive warhead is a critical pacing item. DoD should support a substantial lethality program. In the meantime, our interceptor warhead developments should include a substantial weight and volume hedge for possible lethality-enhancement devices or techniques.

~~(S)~~ • Space systems provide essential cuing, countermeasure resistance, and tactical missile intelligence to all TMD systems. Therefore, we should

- implement SDSP processing for tactical missiles and
- aggressively pursue R&D on BE, leading to the minimum experiment needed to demonstrate its capability.

~~(S)~~ • We should exploit the latitude in interpreting the ABM Treaty that could allow our TMD developments. We should *not* attempt to clarify the TMD/ABM distinction in the Treaty language. We should consider ABM Treaty revision only for major objectives such as a National BMD system.

~~(S)~~ • The Secretary of Defense should provide a common understanding of

- the priority and urgency of TMD R&D and system implementation and
- Service implementation roles and budgets.

(U) These recommendations are not necessarily listed in priority order, but the Task Force clearly believes that the number one priority is the Patriot upgrade followed closely by the Navy's adoption of a more substantial TMD role. After these two recommendations, the Task Force members would argue as to what is the next priority. There is no argument, however, that *all* these recommendations are needed to build a robust National TMD capability.

# Appendix A (U)

## TERMS OF REFERENCE (U)

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(U) Over the past thirty years ballistic missile defense (BMD) issues have been debated within DoD and have been studied at length by task forces of the Defense Science Board, the Defense Policy Board and others. The initiation of the SDI Program in 1983 substantially increased the impetus and prominence of BMD research and development. During this period, for the first time, the JCS established a requirement for a strategic defense system to deter and counter the Soviet offensive arsenal. While no system has entered full scale development, substantial progress by the SDIO has been made over a wide technological dimension. In recent years the proliferation of ballistic missiles and weapons of mass destruction has heightened interest in a capability for global protection against such threats including the defense of deployed and deployable forces and the territories of our allies. The DSB, in its 1990 Summer Study recommended a defense option for a "light" defense of the U.S. to be effective against similar threats. Finally, the recent Desert Storm experience with Patriot has highlighted some of the values and limitations of a deployable ATBM capability.

(U) As part of the 1991 DSB Summer Study you are requested to organize a Joint DSB/DPB Task Force on Ballistic Missile Defense to consider the requirements for tactical and theater ballistic missile defenses; their interaction and interfaces with CONUS BMD; recommendations for development and deployment options; the necessary technological underpinning; ABM Treaty implications and other related policy issues.

(U) The Task Force should establish liaison with appropriate organizations including OUSD(P), OASD(ISP), OASD (C3I), Joint Staff, DARPA, SDIO, the Services and others as required. The Task Force should be prepared to provide "quick reaction" advice and recommendations to DoD officials upon appropriate request.

(U) It is expected that the Task Force will address issues and make recommendations on topics including:

(U) — What is the time phased spectrum of ballistic threats likely to face deployed tactical forces considering technical characteristics, numbers and operational capabilities? What countries are likely to achieve a ballistic missile capability? What generic strategic and tactical situations are deployed forces likely to encounter?

(U) — As threats proliferate and become increasingly sophisticated, what are the most likely circumstances under which the U.S. could expect a ballistic missile attack on CONUS deployed forces or allies. How should U.S. programs be structured to permit us to respond?

(U) — What are the system and subsystem options and their availability as a function of time for theater BMD? What are the lethality requirements? What is the required technological base.

(U) — What should be the relation between theater ballistic missile defense and "light" defense of the U.S. (e.g., Global Protection Against Limited Strikes [GPALS])? Between TBMD and air defense, Tactical Warning/Attack Assessment (TW/AA), tactical reconnaissance?

(U) — What role would be desirable for friends and allies in the development, production and funding of a TBMD? What role might they play in the deployment and employment of such a system?

(U) — What policy options are available to allow allies to participate in the cost and development of technologies and still provide adequate protection for U.S. technology?

(U) — What lessons were learned in the Gulf War concerning BMD?

(U) — How may ABM Treaty restrictions on strategic defenses affect the development and deployment of TBMD capability? If Treaty restrictions constrain such efforts, what policy or technological options are available to permit them to proceed?

(U) — What would be the resource requirements associated with any proposed TBMD system?

(U) — What associated needs might be raised by alternative proposed TBMD systems (e.g., requirements for transport for rapid overseas deployment)?

(U) The Deputy Assistant Secretary of Defense Strategic Defense, Space Verification and Policy (ISP), the Deputy Directors of Defense Research and Engineering for Tactical Warfare Programs and for Strategic and Theater Nuclear Forces, and the Director of the Strategic Defense Initiative Organization will sponsor this Task Force. Mr. Daniel Fink and Mr. Fred S. Hoffman will serve as Co-Chairmen. Mr. Daniel Goure, PDUSDP (S&R), will be the Executive Secretary and Col Elray Whitehouse, USA, will be the DSB Secretariat representative. It is not anticipated that your inquiry will go into any "particular matters" within the meaning of Section 208 of Title 18, U.S. Code.

# Appendix B (U)

## HOW MUCH FOOTPRINT IS NEEDED IN A TMD SYSTEM? (U)

*Daniel Shoham*
M.I.T., Lincoln Laboratory

## HOW MUCH FOOTPRINT IS NEEDED IN A TMD SYSTEM? (U)

(U) How much footprint is needed to cover typical targets is a question raised by the Task Force. A short and approximate anaylsis* was performed to gain some initial insight on the question. The assumption was made that the dominant factor in determining the necessary footprint size would be the defense of urban population rather than the defense of fixed military targets or military forces in the field. Therefore, this appendix focuses exclusively on defense of urban populations.

(U) Protection of a given percentage of the urban population of a geographical region is a reasonable defense goal. The protection provided by any theater missile defense (TMD) system footprint will depend on the particular geographic distribution of the population. To create a geographical database, we assembled information on fifteen regions.

- England and Wales
- Florida
- Greece
- Italy
- Japan
- South California
- Texas
- Saudi Arabia
- Bangladesh
- Egypt
- Israel
- Pakistan
- South Korea
- Sri Lanka
- Taiwan

(U) For each region, we listed all cities with populations above a given threshold (usually 5,000). Latitude and longitude for each city were determined. For each region, the population distribution was analyzed. Figures B1a and B1b show, as an example, the population-distribution analysis for South Korea. Figure B1a shows how 75% of the urban population of South Korea could be defended by systems with 30-km footprints and 100-km footprints. Figure B1b shows the number TMD systems needed to achieve the defense goal (percentage of population to be defended) as a function of footprint size. Similar analyses were performed for the other regions in the study. Figures B2a-B2d compare the results of the studies for South Korea with those of Saudi Arabia, Italy, and Israel.

(U) Because of the large distances between its relatively compact population centers, a country such as Saudi Arabia is probably best defended with a number of TMD systems with relatively small footprints. Israel, on the other hand, can be defended well with one TMD system with a footprint radius of approximately 100 km. Countries with relatively dense populations spread over extended areas (e.g., Italy, Japan) would benefit from systems with large footprints. Less urbanized Third World countries are, perhaps, best defended by systems with intermediate footprints. Generally, the Task Force believes that new TMD systems should strive for footprint radii in the 100- to 200-km range to permit them to defend a variety of targets.

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* (U) Shoham, Daniel, *Defense of Urban Population With Anti-Tactical Missiles: Footprint Considerations*, MIT Lincoln Laboratory report to be published.

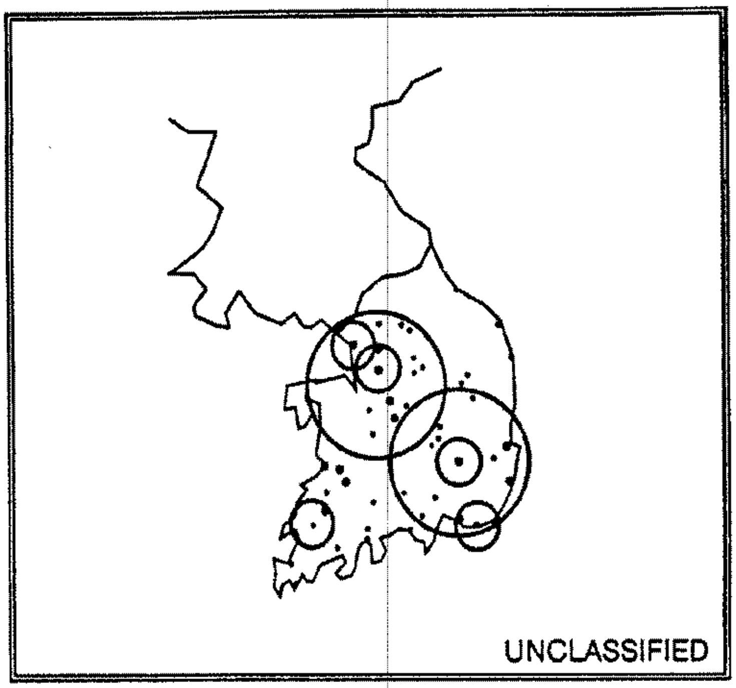


FIGURE B1a.—Defense of 75% of the Urban Population of South Korea With 30- and 100-km Footprint Systems (U)

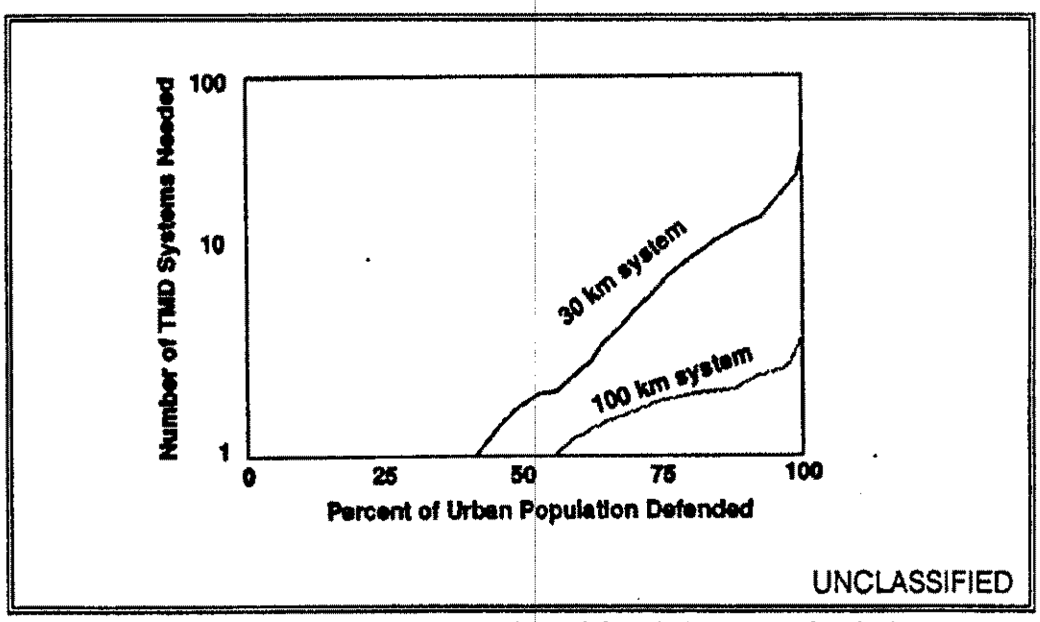


FIGURE B1b.—Percent of Urban Population of South Korea Defended as a Function of Footprint Size and Number of TMD Systems (U)

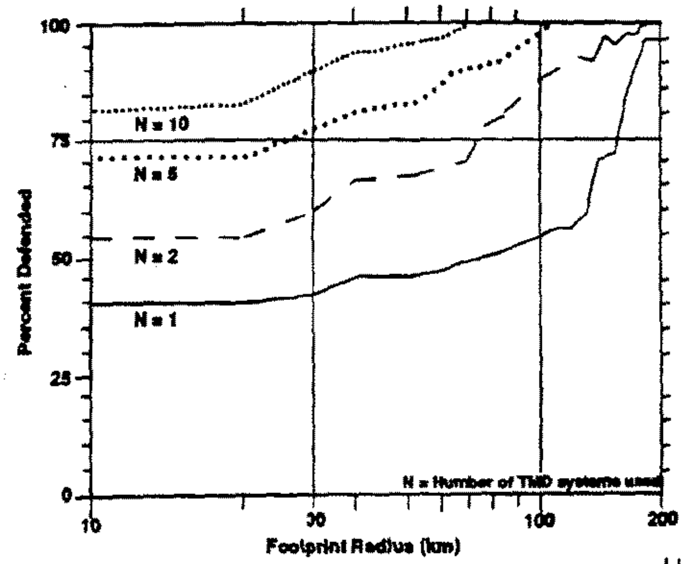


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FIGURE B2a.—Percent of Urban Population of South Korea Defended as a Function of Footprint Size and Number of TMD Systems (U)

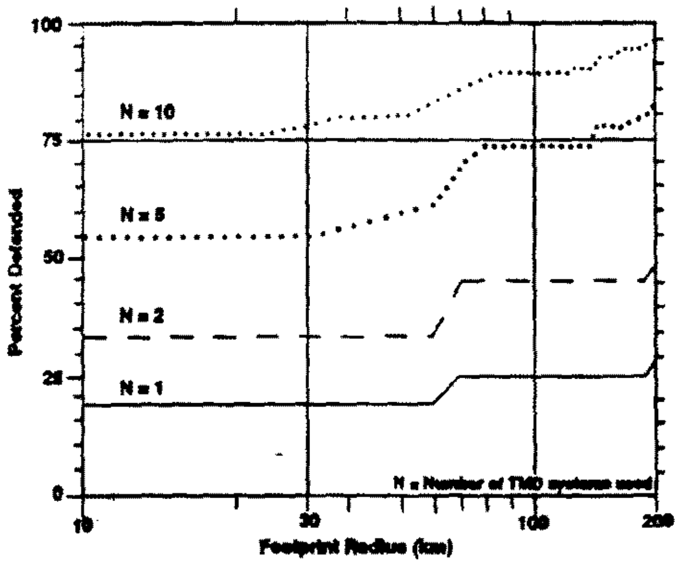


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FIGURE B2b.—Percent of Urban Population of Saudi Arabia Defended as a Function of Footprint Size and Number of TMD Systems (U)

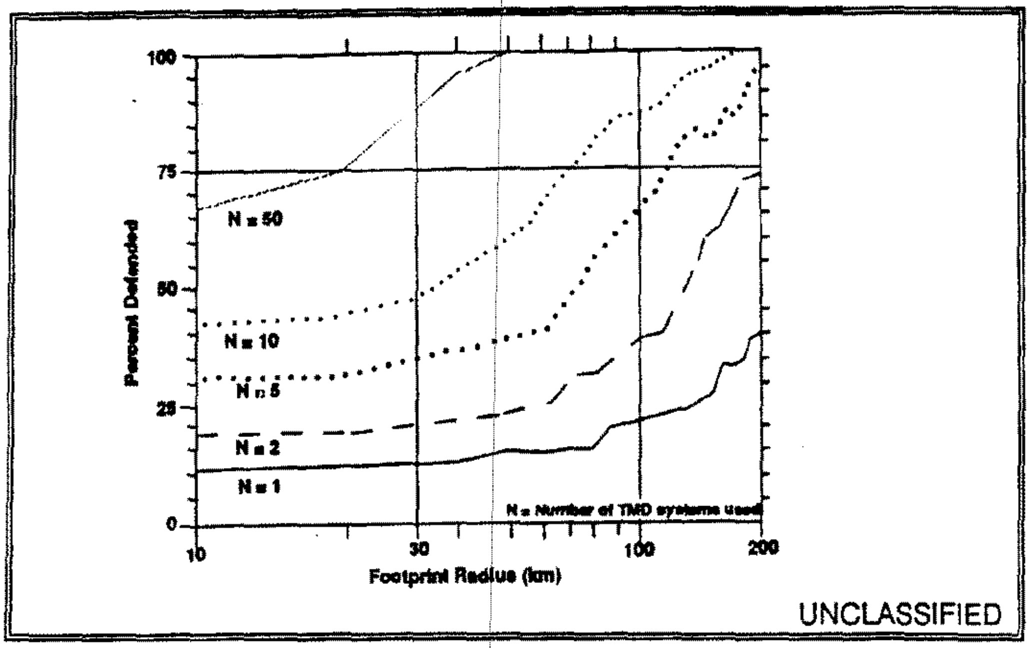


FIGURE B2c.—Percent of Urban Population of Italy Defended as a Function of Footprint Size and Number of TMD Systems (U)

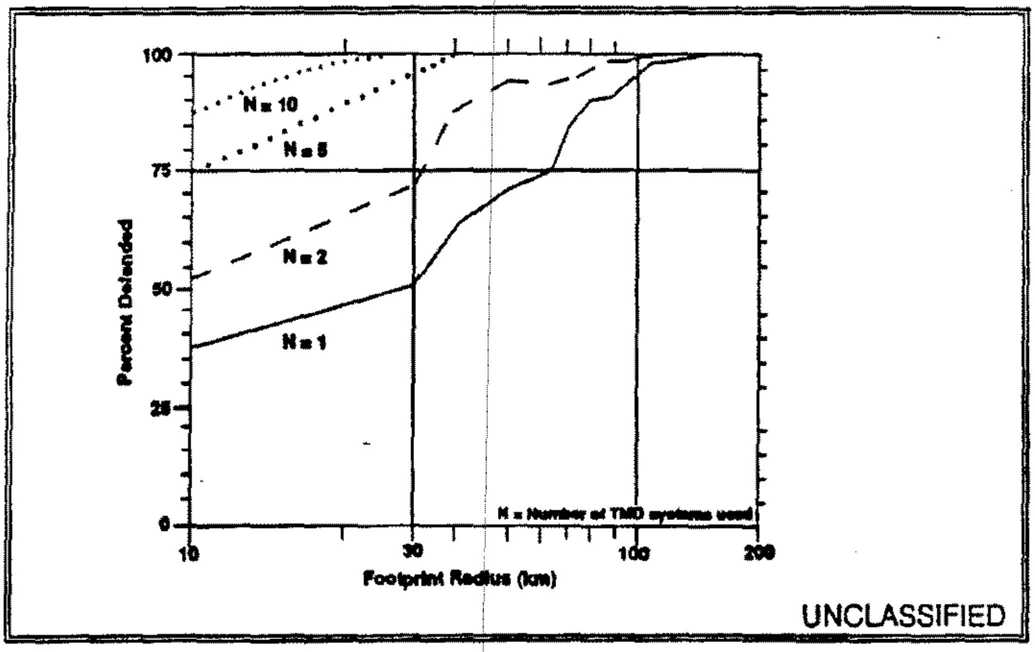


FIGURE B2d.—Percent of Urban Population of Israel Defended as a Function of Footprint Size and Number of TMD Systems (U)

(U) One cautionary note is that the TMD system footprint is only one consideration in the design or the evaluation of the system. Some of the other factors that must be considered are lethality of the defensive warhead, countermeasure resistance, available battlespace, and the role of cuing sensors.

# Appendix C (U)

## LETHALITY OF TMD WARHEADS (U)

*M. Atkins (SAIC), J. Beyster (SAIC), J. Braddock (BDM), K. Bradley (DNA), P. Castelberry (DNA), C. Smith (SAIC)*

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# I. LETHALITY OF TMD WARHEADS (U)

## A. INTRODUCTION (U)

(U) The Defense Science Board/Defense Policy Board Task Force on Theater Missile Defense (TMD) heard a number of presentations on warhead lethality issues during the spring and summer of 1991. In addition, the Task Force received a collection of reports and the results of current research. In this summary report, we present observations on the status of this critical and complex field, and we include some recommendations for further work. Although much lethality work has been performed, TMD programs must use old, perhaps outdated, information, much of which was acquired for purposes other than TMD. Many data (experimental and test) are available on which to base conclusions. There are some differences of opinion among those working in the area of lethality; so the conclusions and recommendations offered here may well be controversial. If so, the Task Force hopes its statements will focus efforts and lead to the timely resolution of key issues.

(U) Traditionally, lethality has been a well-defined quantity used in missile defense technology to describe probability of a hard kill ($P_k$) of an incoming ballistic missile given an intercept. In addition to hard kill, one can expect situations where the TMD interceptor does not destroy the incoming warhead or missile but diverts it from its intended target, i.e., mission kill. Further, the real-life situation in which the TBM warhead and the attached missile parts may not be completely destroyed so that the potential for collateral damage exists should be considered in TMD lethality studies. In view of the Desert Storm experience, we have taken the liberty of a including mission kill and collatral damage isues in our deliberations. We also include a brief discussion of those factors we believe are important to effective tactical ballistic missile (TBM) intercepts.

## B. BACKGROUND (U)

(U) The question of interceptor lethality—the ability of a defensive system that performs properly in all other respects to produce the requisite damage to the incoming warhead—has always been a substantial part of antiballistic missile (ABM) programs. In the Safeguard days, flight tests and underground nuclear tests were executed to validate lethality of the two interceptors. At the beginning of the Strategic Defense Initiative (SDI), the SDI Organization (SDIO) designated the Defense Nuclear Agency (DNA) as its single manager for research on lethality of all types of weapons under consideration. DNA has executed the Lethality Program, in part, through the appropriate laboratories and R&D centers of the Services. DNA coordinated its SDIO-funded work with its own applicable on-going programs and has adjusted the level-of-effort devoted to lethality of the various types of defensive weapons to program demands. Although there is substantial, critical technical work remaining to be done, there is now a rich background of technical knowledge and experience that ties weapons-effect research closely to the intelligence community and to defense system development.

(U) Despite the quantity and quality of work performed on ABM lethality, the Task Force found that there are significant gaps in the knowledge needed to support design of TMD systems. The amount of effort devoted specifically to TMD was relatively small until the current fiscal year, and it will not approach an adequate level until next fiscal year.

(U) It is necessary to provide some of the reasons why the answers needed for TMD cannot be found in the knowledge base that has been accumulated. The most important of these reasons is that, essentially, all prior work focused on intercepting strategic reentry vehicles (RVs) carrying nuclear warheads. While a nuclear warhead and its associated equipment are not necessarily fragile assemblies, their successful operation depends on proper functioning of a number of complex but well-understood components. Unless everything happens just right, there is no nuclear yield, and the intercept has been successful if it disrupts any of those components. (This may not be strictly true, but in the context of an SIOP exchange, it is a reasonable approximation.)

(U) TMD systems, however, will face a variety of warheads—high explosive (HE), incendiary, nuclear, biological and chemical—with the possibility that any of these (except nuclear) may be contained in submunitions. Intercept of a biological warfare (BW) or chemical warfare (CW) weapon, which consists of a large tank of agent (called a "unitary-fill" or "bulk-release" device) inside a reentry shield, involves some very trick lethality problems. Unlike a complex nuclear or HE weapon, the agents are ready to work when released from their tanks. The intercept may actually perform part of the attacker's job for it by spreading the agent around—if not on the intended target then perhaps on an equally important friendly or neutral location. However, if the intercept occurs at a sufficiently high altitude, laboratory tests show that a chemical agent will be dispersed enough to be innocuous; this intercept altitude corresponds to realistic keep-out altitude requirements for ground-based interceptors being considered by the Army. At this time, however, knowledge of BW agent dispersal has not been developed.

(U) Lethality against TBMs carrying submunitions of any type involves new considerations for the defense community. The submunitions shield each other and may be very hard so that a massive kinetic energy impact (or other equivalent intercept event) may be needed to provide assurance of killing all or a significant fraction of the submunitions.

(U) Compounding these problems, of course, is the need for the TMD designer to provide a single interceptor that will provide acceptable $P_k$ against any of the potential threat warheads because the defense operator may not know which type of warhead he is countering. While the research programs eventually will lead to optimized intercepts against each type of warhead, it is far too early to know how to design a "general purpose" interceptor.

(U) Thus far, we have discussed the TMD-unique lethality problems posed by the variety of warheads that may be encountered. Another factor that complicates the problem is that TBM trajectories are so low that the intercepts may take place at such low altitudes that aerothermal heating will not cause effective destruction of the TBM payload as happens in strategic encounters.

(U) DNA and the US Army Strategic Defense Command (USASDC), which is executing much of the TMD Lethality Program, have responded with a research program involving a roughly appropriate mix of theory, laboratory experiments needed to understand the phenomena, and large-scale field trials. One caution that we would give is to proceed at a measured pace with extensive field tests, ensuring that they are focused on real information needs and that diagnostics are adequate to make the results quantitatively useful to warhead designers. This will be no small task because there are a number of weapon systems requiring data in a timely manner.

## C. THREAT AND LEAKAGE CRITERIA (U)

(U) As shown in table C1, the warhead threat from TBMs can take many forms—conventional, conventional submunitions, biological submunitions, chemical unitary, chemical submunitions, and nuclear. Countries having TBMs are shown in figure C1, and those possibly having chemical capability are shown in table C2. Assessments of on-going activities suggest that most Arab nations, India, and Pakistan have spray tank and bomb versions of liquid chemical agents and may upgrade these to dry agents in the next 5 years. A number of Arab nations, China, and Israel probably have bulk warheads for ballistic missiles and may incorporate submunitions in the next 5 years. BW toxins could be advanced along the same lines. Genetic engineering of toxins, as well as microencapsulation, could take 10 to 20 years.

(b)(1)

[redacted]

TABLE C1.—Lethality Threat (U)

| | |
|---|---|
| PAYLOAD: | 100 kg to 500 kg |
| CEP: | 100 m to 3,000 m |
| USE: | MILITARY (small target) / POPULATION (large-area target) |
| TYPE | DETAILS |
| Conventional | |
| Unitary | High Explosive |
| Enhanced | Aluminum Shell + High Explosive |
| Standard Submunitions | Anti-material Munition |
| Hard Submunitions | Runway Penetrator |
| Chemical | |
| Unitary | Bulk Chemical Agent Dispersed During Terminal Flight |
| Submunitions | Hard or Soft Bomblets<br>Patterned Dispersed<br>Agent Dispensed on Impact |
| Biological | |
| Submunitions | Hard or Soft Bomblets |
| Nuclear | |
| Single/Multiple | Implosion Type |
| Hardened | Gun or Earth Penetrator |

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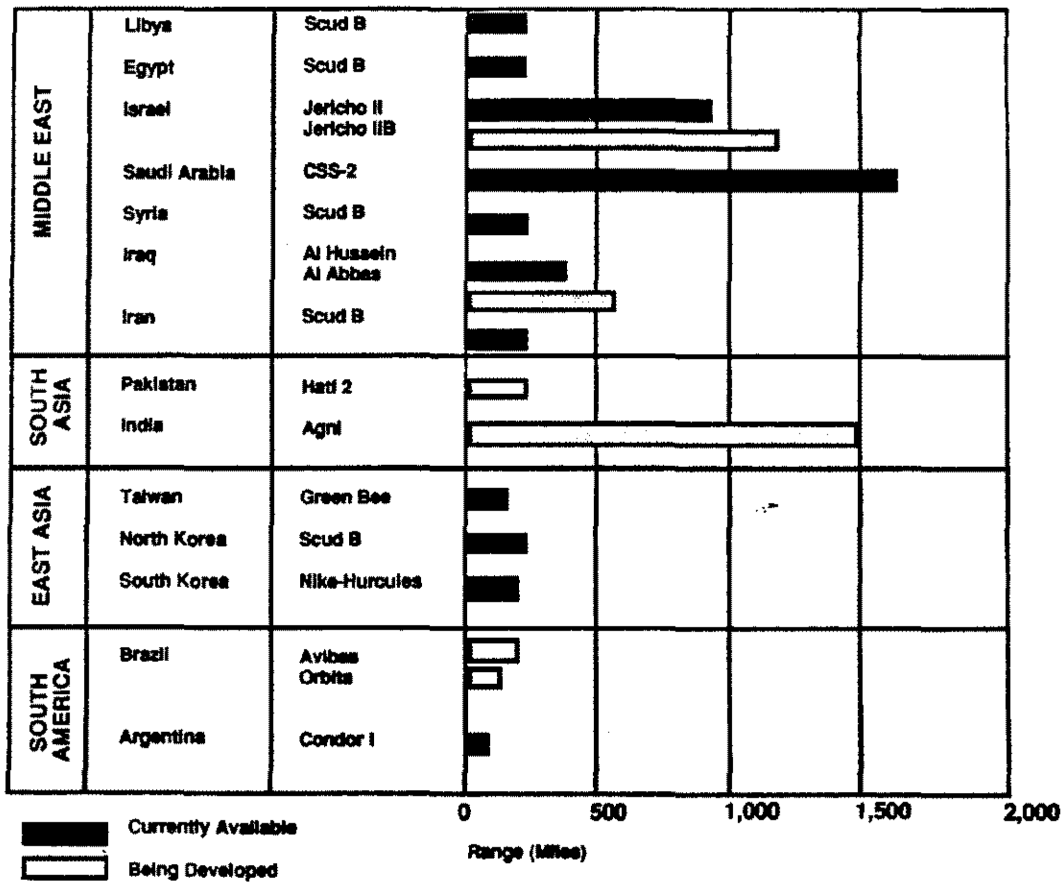
(U) Submunition warheads are a significant issue for TMD lethality. They are neither new nor high technology. For illustrative purposes, an obsolete and unclassified US chemical submunitions warhead (Honest John) is shown in figure C2. This was a tactical system, weighing about 560 kg. Before the Honest John was demilitarized (over 10 years ago), tests of agent rain from vehicles deliberately damaged at between 400- and 900-meters altitude were made. These tests showed that most of the agent released in an intercept contaminated the ground at hazardous levels.

(U) The Honest John was a tactical missile system with warhead configurations that included a payload of 368 M139-bomblets. In normal operation, the submunitions were explosively dispersed at altitude and impact about their center of mass to the target area. Each bomblet was about the size of a softball and contained 0.6 kg of nerve agent and a 0.07-kg Comp-B burster charge for agent dispersal. The bomblet illustrated had vanes, which caused it to spin between 1200 and 1800 rpm and functioned on impact with the ground. Each of the submunitions could contaminate a circular area with a 25-m diameter to a lethal level. The contents of the warhead could target an area on the order of 1-square km.




Source: "Third World Ballistic Missiles." *Scientific American*, August 1990.

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FIGURE C1.— A Survey of Third World Ballistic Missiles (U)

(U) Complete destruction of even this obsolete warhead is challenging to current lethality concepts. Test data indicate the number of defeated bomblets for submunition-type warheads may be as high as 70%. Very energetic collisions are necessary to reduce the effectiveness of the submunition-configured tactical chemical warhead, particularly because other CW munitions have been built that are much more rugged than those of Honest John. More than kinetic energy may be required for a practical and effective defense. It is not clear that just hitting these submunitions with a pellet or fragment would cause them to arm and disperse the agent prematurely. This example shows the technologies that may be readily available to those in the Third World designing new TMD systems. A chemical or biological submunition attack is a probably a real and a stressing threat to TMD systems today. Such attacks would undoubtedly be considered major escalations of a conflict and akin to terrorist attacks; our response would not necessarily be constrained to shooting down these warheads. However, it is important to have as much capability as possible to do so in improved TMD systems.

TABLE C2.—Proliferation of Chemical Weapons in the Third World (U)

| KNOWN* | PROBABLE** | POSSIBLE† | DOUBTFUL‡ |
|---|---|---|---|
| Iraq | Burma | Angola | Afghanistan |
| Iran | China | Argentina | Chad |
| Egypt | Ethiopia | Cuba | Chile |
| | Israel | India | El Salvador |
| | Libya | Indonesia | Guatemala |
| | N. Korea | Laos | Jordan |
| | Syria | Pakistan | Mozambique |
| | Taiwan | Somalia | Nicaragua |
| | Vietnam | S. Africa | Peru |
| | | S. Korea | Philippines |
| | | Thailand | Sudan |

(U) *Countries in this column are either those that have declared that they possess chemical weapons or whose use of such weapons has been definitely confirmed.

(U) **Countries listed as "probable" are those reported by US Government officials, on the record, as developing, producing, or possessing chemical weapons.

(U) †Countries in this column are those reported by Western Government officials, generally off-the-record, as seeking to acquire chemical weapons or chemical weapon production capabilities or as suspected of possessing chemical weapons.

(U) ‡Countries listed as "doubtful" are those reported, generally by domestic or foreign adversaries, as seeking to possess, possessing, or using chemical weapons but for which there is no confirmation by Western Government officials.

Source: *Chemical Weapons Posture in 1985.* UNCLASSIFIED

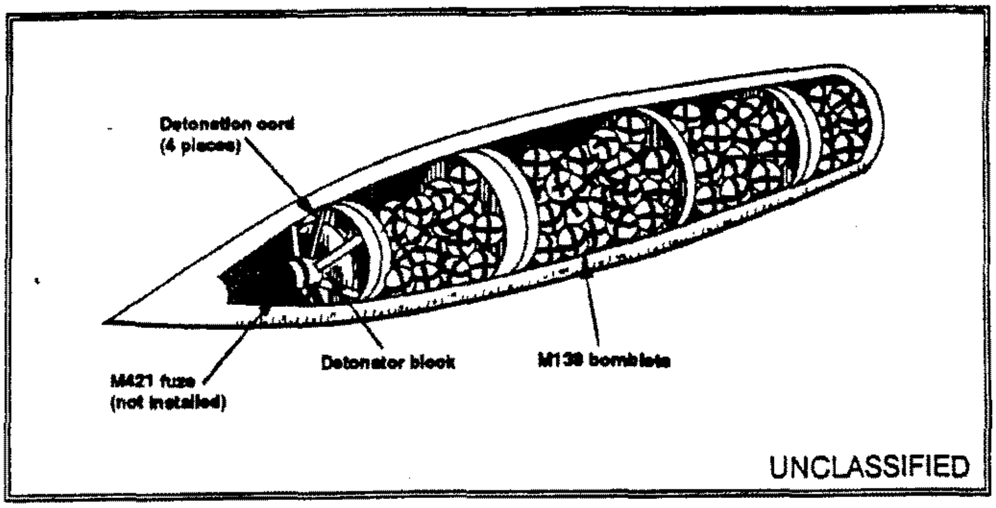


FIGURE C2.—Honest John M190 Warhead

(U) It is thought provoking to attempt to define the spectrum of threat RVs a defense must be prepared to counter in the future. Leaders in the lethality community have always recognized that they must not define threats too specifically because even should they have perfect intelligence on some existing threat vehicles, the threat will change during the lifetime of the defense system. At the same time, for many purposes, it is necessary to define some threat objects fairly specifically so calculations can be made and experiments can be performed. When considering the Soviet nuclear threat, the tendency has been to mirror-image, then perturb that image—including the time scale—with intelligence data when possible. In the TMD problem, researchers must plan against threats to which the United States may have no counterpart, that are designed and produced by unknown future adversaries, and that have unknown capabilities. They may be obtained—and employed—to meet perceived requirements that the United States may not understand well. In addition, potential Third World adversaries tend not to test; therefore, intelligence data may be sparse. At best, this situation will cause the researchers to consider a wider spectrum of possible threats, making their work more broadly applicable.

## D. LEAKAGE CRITERIA

(U) Acceptable warhead lethality for a given TMD system depends on the leakage that can be tolerated at the defended position. For that reason, the Task Force thought it advisable to make some remarks on leakage criteria in the context of TMD. The performance of active TMD systems against a threat can be characterized by their robustness to causes types of system failures. These include defense suppression, exhaustion, and saturation. Defense suppression attacks are directed against the elements of the defense system. We will not discuss such attacks. Leakage due to exhaustion occurs when the defense runs out of interceptors.

Leakage due to saturation is caused when the system's traffic-handling capabilities are exceeded (there are too many threat objects to handle at one time). In addition to leakage from exhaustion and leakage from saturation, system leakage can occur as the result of failure to detect or discriminate threat missiles, failure to intercept after detection, or failure to kill even when an intercept has occurred.

(U) Acceptable levels of missile leakage depend upon the consequences of that leakage: 1) damage to population centers and 2) damage to military targets. In most scenarios, minimal defenses are available for an attack against population centers; thus minimal leakage is important. Successful attacks against population centers can trigger retaliation against the aggressor by the country attacked or one of its allies; this retaliation may be an unwanted escalation and, therefore, low-leakage defense is doubly important. More than one tier of defense may be needed to achieve such low leakage to protect civilians. In the case of TBM attacks on military forces, low leakage is a desirable, but not as critical, because the military forces presumably are engaged or on alert and are better protected. Thus, higher leakage can be tolerated for the defense system.

~~(S)~~ Meeting these leakage criteria is not straightforward because some of the variables affecting leakage are not controllable by the defender. The numerical size, geographical focus, type of warheads, and salvo timing, for example, are determined by those launching the TBMs. What might be a relatively low-leakage defense for a limited attack could easily become a high-leakage defense through saturation or exhaustion. Thus, attainable leakage values are scenario-dependent. [redacted]

(b)(1)

(U) The larger footprints afforded by the various Patriot upgrades—QRP, QRM, PAC-3, cuing—effectively increase robustness against saturation by offering the possibility of overlapping defense coverage if supported by appropriate battle management. Compared to the PAC-2, an autonomous PAC-3 or a cued QRM PAC-2 provides almost an order-of-magnitude increase in defended area against the Al Hussein-type threat. A cued PAC-3 may offer another factor-of-four increase in defended area. Thus, a given area may be defended with a smaller number of batteries, and the batteries will still have an increased tolerance to saturation.

(U) In addition to the above factors, one must consider the significance of where the leaking warhead impacts. All locations in an urban area or military target are not of equal value, and the political and military consequences of destruction vary from none to very serious. No active defense TMD system alone can guarantee low leakage against a massively focused attack. The use of counterforce (for example, scatterable mines in launch areas, air attacks on non-active launchers, and—eventually—boost-phase attacks on launchers) to disrupt and constrain such attacks was attempted in Desert Storm to limit the size and duration of attacks. While our offensive actions against Iraqi launchers and missiles may not be credited with many kills, there is persuasive circumstantial evidence that they helped prevent the type of coordinated attacks that could have saturated Patriot's traffic-handling capabilities.

(U) Illustrative of the levels of system leakage that may be achievable are the curves in figure C3 for single-tier and two-tier defense systems. The upper curve is for a system with a probability of sensor acquisition of 95% and a single-shot $P_k$ of 85%. Leakage performance is 20% for a single interceptor shot and improves to 5% with three interceptor shots per warhead. Significantly lower leakage levels are achieved when a second tier with an independent sensor is added (lower curve).

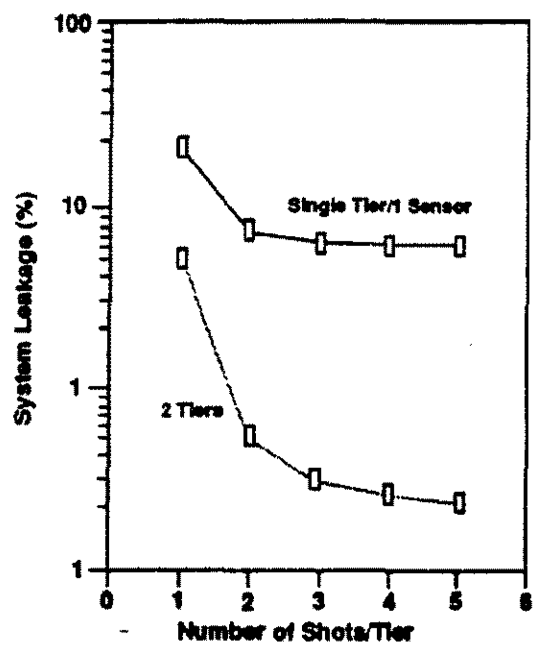


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FIGURE C3.—Multiple Shots and Multiple Tiers Are Required To Achieve Near-leakproof Defense of Geopolitical Assets (U)

(U) Corresponding leakage levels improve to 4% for a single interceptor shot per tier and approach 0.2% for three interceptor shots per tier. Such a multiple-tier system with multiple shots and independent sensors is required to achieve near-leakproof defense of geopolitical assets.

## E. INTERCEPT ISSUES

### 1. Altitude and Range (U)

(U) In general, the most desirable intercepts are as high above and as far away from the defended asset as possible. However, there are competing factors, particularly the need to control the conditions at intercept to achieve a high $P_k$.

(S) Missile fuel and steering mechanism are constraining factors for altitude-of-intercept. The single-stage Patriot must stay in the atmosphere for the endgame because it is aerodynamically steered. [redacted]

(b)(1)

(U) More insight into the agent dispersal problem and into current research approaches may be gained by a review of work on one of the simplest warhead types—bulk-fill chemical tanks inside a conventional warhead shell. First, there are eight to ten well-characterized military chemical agents that have to be considered. From the viewpoint of the offense, these vary greatly in such important characteristics as toxicity, time to toxic effect, persistence in the target area, and difficulty to manufacture, store, handle, and dispense.

(U) Doses of some agents required to cause death or incapacity are indicated in table C3. A more complete list of agents is shown and table C4, and more CW effects are shown in table C5. CW experts find it usually most accurate to express the required quantities in terms of exposure time at a given density of agent in a given area. Therefore, the exposures are usually expressed in units of milligrams-per-minute per cubic meter (mg•min/m$^3$). To approximately designate desirable keep-out zones, however, it is convenient to consider the amount of agent distributed over a given land area and to recognize that an area does of 10 mg per square meter can be assumed to be a safe level for most agents. (The safe dose for VX is lower.)

TABLE C3.—Some Chemical Agents And Their Properties (U)

| | | RESPIRATORY* | | PERCUTANEOUS** |
|---|---|---|---|---|
| | VOLATILITY† | LETHAL DOSE $LCt_{50}$ | INCAP. DOSE $ICt_{50}$ | LETHAL DOSE $LCt_{50}$ |
| AGENT | $(mg/m^3)$ | $(mg \bullet m^3/min)$ | $(mg \bullet m^3/min)$ | $(mg/m^3/min)$ |
| Tabun (GA) | 810 | 400 | 300 | 40,000 |
| Sarin (GB) | 22,000 | 180 | 75 | 15,000 |
| Soman (GD) | 3,900 | 180 | 75 | 10,000 |
| VX | 10 | 100 | 50 | 1,000 |
| Mustard (HD) | 920 | 1,500 | 200 | 10,000 |
| Phosgene (CG) | 4,000,000 | 3,200 | 1,800 | n.a. |
| Hydrogen Cyanide | 1,100,000 | 5,000 | 2,000 | n.a. |

Note: These estimates are for resting, unprotected adults; for highly active adults (e.g., soldiers in heavy combat) or children, the $LCT_{50}$ and $ICt_{50}$ could be three to four times lower.

* Median lethal and incapacitating damage for unprotected man breathing at the rate of 10 liters per minute.

** Median lethal dosage for a man in ordinary combat clothing.

† Mass of vapor per cubic meter at air of 25 °c. For comparison, the volatility of water at 25 °C is 23,000 $mg/m^3$.

Source: FM3-9, *Military Chemistry and Chemical Compounds* (Washington, DC: Department of the Army, October 1975).

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(U) Many types of dispensers have been engineered to suit the different methods of delivering chemical agents (e.g., artillery, bombs, airborne sprayers). In general the dispensers attempt to break up bulk quantities of liquid agents into droplets of an optimum size so the cloud of droplets falls over as large an area as possible while maintaining sufficient concentration to be toxic. Adding inert materials to increase the viscosity and, thereby, encourage formation of larger droplets is desirable for most agents and most airborne dispensing mechanisms. Typically, mean droplet sizes of 100 to 2000 microns are optimum. A rough rule-of-thumb in the CW world that has important implications to the present problem is that droplets of 50 microns or less tend not to fall in a concentrated cloud or in a predictable fashion. Instead, under most atmospheric conditions, they bound around in low-level turbulence until they evaporate or until the cloud becomes so dilute that it is useless. Some recent research showing droplet size as a function of release altitude is shown in figure C4. Theoretical models predict the difference in behavior between 50-micron and 100-micron particles of the agent GF (figure C5).

TABLE C4.—Chemical And Biological Warfare Agents (U)

| CHEMICAL | BIOLOGICAL |
|---|---|
| NERVE | BACTERIAL |
| GA (Tabun) | Anthrax |
| GB (Sarin) | |
| | Botulinum |
| GD (Soman) | Tularemia |
| GF | Plague |
| VX | Cholera |
| BLISTER | VIRAL |
| HD (Mustard) | Yellow Fever |
| H | Rift Valley Fever |
| HL | Junin Fever |
| L | Venezuelan Equine Encephalomyelitis |
| CX | |
| BLOOD | RICKETTSIAE |
| AC (Cyanogen Chloride) | Q Fever |

Source: Holland and Pine, "SAIC Efforts in Chemical/Biological Defense for SDI-SEI." Unclassified internal SAIC briefing, July 1991.

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TABLE C5.—Some Fundamental CW Facts (U)

- A fair bit of agent is required: Typically, amount must exceed 10 $mg/m^2$
- Common figure of merit is: dosage = concentration x time
- Rule-of-thumb
  - ICT(50) = 1/2 LCT(50)
  - ICT(5) = 1/2 or 2/3 ICT(50)
  - Sure Safe = 1/100 ICT(5)

  Where:
  L = lethal
  I = incapacitating
- Example (for GB)

  LCT(50) = 75 mg•min/$m^3$
  ICT(50) = 35
  ICT(50) = 25

  *Considerations must include mode of exposure: skin v. respiratory ingestion.*

Source: R. McNally, "TMD Lethality Summary." SAIC unclassified internal briefing, 17 June 1991.

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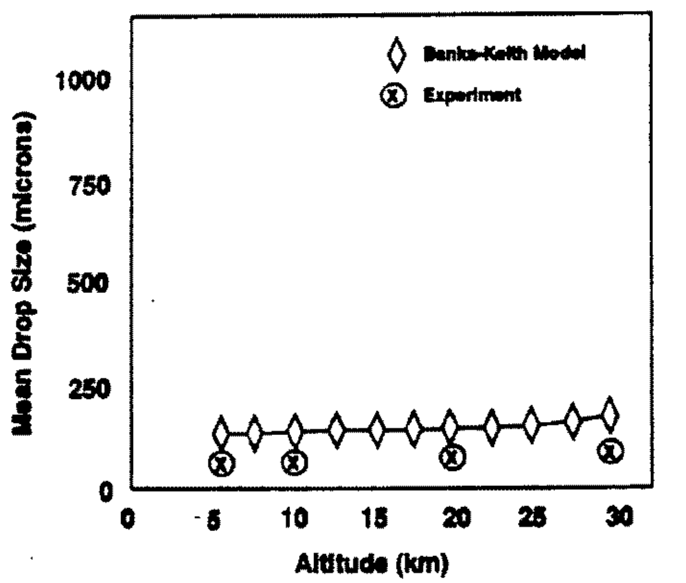
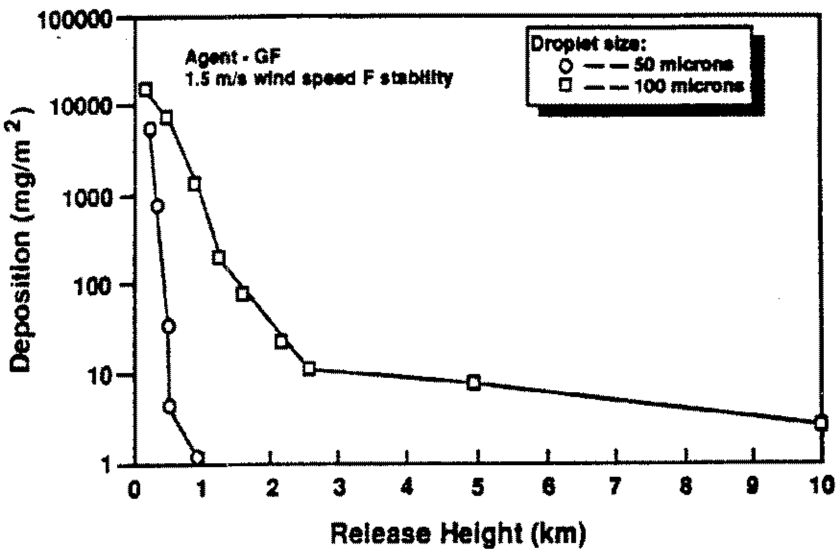



FIGURE C4.—Relationship of Reverse Ballistic Test Results to the Aerodynamic Breakup Models (U)




Source: R. McNally, "Tactical Ballistic Missile Intercept Issues for Chemical Warheads." Internal unclassified SAIC briefing, 25 March 1991

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FIGURE C5.—Peak Disposition Versus Release Height and Drop Size (U)

(U) A few words need to be said about biological agents. The problems of intercepting BW warheads are similar to, but not the same as, intercepting CW warheads. For example, many experts believe the BW weapon of choice for an Nth country would be anthrax spores. They are easy to make, have a long shelf-life, are resistant to temperature extremes and the exposure to oxygen and UV that might follow an intercept, and induce a usually fatal disease in 1 to 4 days. They require more agent than some other pathogens, but kilogram-for-kilogram, they are 100,000 times as effective as the common CW agents Sarin (GB).

(U) The anthrax spores, like most BW agents, would be dispensed as a powder rather than as a liquid. A significant problem for the offense is distributing the powder widely enough for it to be of optimum use. It seems clear that even an intermediate altitude intercept would help the aggressor achieve this goal. Intercept of a BW weapon—if one know that is what it is—should probably be carried out at as high an altitude as possible. Even with intercepts at some kilometers, however it is possible that spores could be carried along with the mixing interface and rained out on friendly or neutral territory many kilometers from the battlespace. Significant dilution will occur, however, negating much of the effectiveness of the spores.

(U) Modeling the dispersion of chemical or biological agents for various dispensing altitudes and wind conditions has been underway for some time. Some of the models are shown in table C6. One model is shown in more detail in table C7. Improvements in the phenomenology of the modeling are being made in the DNA lethality program where numerical techniques similar to those used in fallout prediction are being used.

TABLE C6.—Tactical Ballistic Missile Intercept Modeling for Chemical Warheads (U)

- Modeling Tools
  - chemical
    - NUSSE 3 ATM (no vapor damage effects)
    - NUSSE 4 (unvarying wind speed and direction above 200 m)
  - biological
    - VAMTECAP
    - PLUME (below the mixing layer only)
- Current models are completely missing key phenomenology
  - Vertical wind shears
  - boundary layer effects

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(U) The results of one of these modeling exercises is shown in figure C6, where the ground deposition of agent is predicted for various release altitudes. The persistence has also been estimated showing that in these cases, the agent is below acceptable levels in 15 minutes.

TABLE C7.—ATM NUSSE3 (U)

- CRDEC Code
- Describes the fraction of liquid reaching the ground and vapor concentration from a chemical agent cloud of droplets released at a given altitude
- Requires initial cloud and droplet size distribution and meteorological profile
- Computes droplet motion and evaporation as a function of time
- Output includes
  - droplet impaction start and stop times
  - percent of liquid agent reaching the ground and percent vapor concentration
  - deposition size and location
  - discrete X-Y grid points of agent concentration on ground

Source: K. Bradley, "Theater Missile Defense Lethality Program." Classified SDC and DNA briefing, 1991.

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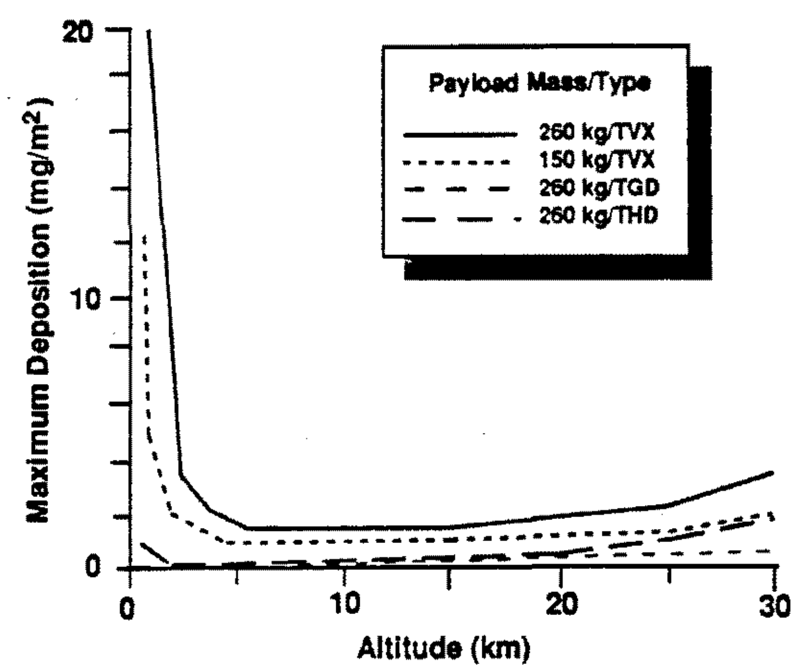
(U) Following are some observations and issues:

(U) • *For chemical munitions, what particle sizes are produced at higher altitudes and higher velocities?* This is a critical question, which SDC is addressing in a substantial experimental and theoretical program. The results to date are encouraging: Droplets appear to be "small" if formed above 2 km. If these results hold up, one would not expect much droplet penetration to the ground in the target area. An unresolved issue is whether the CW agent can be modified to form large droplets at high altitudes and still be efficiently dispersed at low altitudes.

(U) • *Where do the particles go?* The Army chemical laboratories have a set of codes, which are used for operational predictions but which do not cover the range of parameters needed in the TMD problem. The codes do not consider vertical motions of the atmosphere. In addition,they do not explicitly treat the "mixing interface"—the interface between the turbulent planetary boundary level and the more laminar flow above (typically 1000 to 2000 meters on a calm, sunny day; 200 meters at night; nonexistent in rain). There is a rule-of-thumb that small particles formed above the mixing interface do not readily fall through it, but the phenomena are not well-understood quantitatively. Thus, particle transport needs to be modeled.




Source: C. Martin, "Lethality Program Overview: A Hit Is Not Necessarily a Kill (U)." Classified DNA/SDC briefing to the Defense Science Board, August 1991.

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FIGURE C6.—Maximum Ground Disposition Predictions From a Catastrophic Release of a Modified Scud (Al Hussein) Chemical Payload (U)

**2. Intercept Angles and Velocities (U)**

(U) The $P_k$ of an incoming missile is dependent on the orientation of intercept, the resulting impact angle, and the resulting relative velocity, among other parameters. For fragment warheads, the orientation affects both the probability of hitting the target and the $P_k$ given a hit. The nature of the kill mechanism, such as the hit-to-kill (HTK) versus fragment kill, affects the choice of the most desirable intercept orientation. For fragment warheads, the fragment strike angles form the key parameter and depend upon the fragment velocity and distribution as well as the interceptor and target orientations and velocities. In a fragment kill, a relatively large fragment strike angle is needed to achieve fragment penetration. Velocities of 2 km/s or greater are needed to achieve a reasonable $P_k$. This $P_k$ dependence for 200-gram fragments is shown in figure C7. For the current Patriot fragment warhead, $P_k$ is very sensitive to the fragment strike angle.

(b)(1)

the interceptor to maneuver in or out of the atmosphere also is a factor limiting terminal maneuvers and the resulting intercept angles.

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[redacted]

(b)(1) [redacted]

## II. TARGET KILL (U)

(U) Once an intercept is made, the issue of whether or not a kill occurred remains. there are two ways to look at this: 1) hard kill and 2) mission kill. Hard kill means that no damage has been done to allied assets, and mission kill means that no damage is done to the intended targets. Mission kill means that the incoming TBM has been diverted to miss the intended target. This is usually better than a miss, but there is probably no way to count on this kill mechanism in the TMD of population centers. Killing the incoming missile warhead is not the only problem because missile debris, including the incoming missile body in the case of a Scud, can impact a target area and cause a great deal of disruption—although less than if the warhead had detonated on target. Unfortunately, aerodynamic heating and burn-up cannot be counted on to damage the incoming TBM as much as it can be counted to damage intercontinental ballistic missiles. (However, the atmosphere does significantly slow the missile and debris so that its impact velocity is reduced.) Part of the solution to this problem is engaging the TBM at as high an altitude and as far from the defended area as possible. The two main kill mechanisms being assessed for TMD warheads are: 1) fragment warheads as on Patriot and 2) HTK warheads as in the case of ERINT and THAAD. In addition, numerous ideas for enhancing warhead lethality against biological and chemical weapons—including reactive agents—are being examined.

There is room and need for innovative warheads that might include shaped charges, focused fragments, or segmented rods.

## A. HARD KILL (U)

(U) Table C8 reflect the state of our knowledge of interceptor hard kill lethality mechanisms for various types of threat warheads. In this table, directional warheads are included under CONVENTIONAL incoming warheads, and hard submunitions are the very robust runway cratering munitions. Many types of enhancers have been designed and tested. The last column in the table summarizes the enhancements that appear to be possible to add, in one form or another, to the kill mechanism. In sections 1 through 3, we discuss the status of our knowledge of these kill mechanisms.

TABLE C8.—Status of Lethality Knowledge for Hard Kill (U)

### 1. Fragment Kill (U)

(U) The effectiveness of fragment kill is determined by a variety of factors: the number of fragments hitting the incoming missile/warhead body, the energy and size of the fragments, where the fragments hit, fragment strike angle, fragment material fragment mass, and the shape and on the nature of the target warhead. Representative incoming warhead types and fragment kill lethality effectiveness are shown in table C8. The difficulty of accomplishing fragment kill varies drastically among threat warhead types. In the case of unitary HE or chemical warheads, the fragments can hit with enough mass and velocity (momentum) to achieve a hard kill. Kill methodologies for these warheads have been developed to estimate kill and are reasonably well understood. The most stressing conditions, again, arise with both HE and biological/chemical submunition warheads; it is believed that HTK warheads are required to kill a large percentage of the submunitions.

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(U) Ground tests can be developed to address part of the second and third categories but cannot include long-term effects. Flight tests also can address the third category but have difficulty in assessing the actual miss/encounter conditions and the submunition effects unless the test vehicles are recovered.

(U) Considering these problems, it may be desirable to obtain an early assessment using sled testing where the target will be at velocity and incorporate actual submunitions containing simulants. This would address many of the significant areas such as disabling or activation of the fuzing/dispensing mechanisms, rupturing and dispersal rate (including the aerophysical interaction), and enhancing interactions of the agent itself. Careful planning of diagnostics will be necessary to avoid picking up droplets before they have subdivided into their final size. It may be possible to obtain useful data on dispersal and droplet behavior by proper chemical doping of the simulated agent combined with laser stimulation and observation of the resulting cloud. This doping, illumination, and spectral observation approach could be taken further to provide indications of the temperatures, mixing, etc., experienced by the agents.

(U) As noted above, the high fragment velocity, small fragment approach used in the Patriot system is only effective against HE warheads under engagement conditions in which high fragment strike angles can be enforced. Analyses and simulations indicate that the multimode Patriot can enforce significantly smaller miss distances and, therefore, has the potential of achieving much larger numbers of fragment hits. Research by the Navy supports a defensive warhead design using a large number of small fragments as being effective against HE threat warheads. The efficacy of a large number of fragment hits at low strike angles against the relevant warhead types should be determined. There will be significant implications on Patriot growth options, achievable footprint, and the maximum range at which targets are engageable (enforceable strike angle does down with higher closing velocity) if high concentrations of small fragment impacts are effective at low strike angles. [redacted] (b)(1)

(U) Even after optimization, it is doubtful that all chemical submunitions in an incoming warhead could be killed with fragments. (Agent leakage from perforated submunitions at intercept altitudes is another matter that requires investigation.) Thus, intercept as far from a target area as possible is important.

**2. Hit-to-Kill Systems (U)**

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sets of chemicals may be thousands of feet per second, it would be necessary to mix bulk quantities of fluids in a very short time to prevent unreacted amounts of agent from continuing on their way.

(U) Tests were performed in 1988 and 1989 that indicated that at impact of about 700 m/s, approximately 70% of the chemical simulant could be destroyed with projectiles filled with 18% EKE while only about 10 to 20% could be destroyed with inert projectiles. The projectile used in these tests was designed with a cavity that was filled with either EKE or an inert substance so that the mass was kept constant. The projectiles were then mounted in a sabot and fired from a light gas gun into a stationary container of the simulant. Testing at higher velocities was not done until late 1990 because the EKE-filled projectile was breaking up during launch. After considerable effort, a new projectile that could withstand the higher launch forces was developed, and further testing, up to 3 km/s, indicates that in static tests, both the EKE and inert projectiles destroy approximately the same amount of agent for impact velocities above 2 km/s. However, in these static tests, the mixing of the EKE oxidizer and chemical simulant was processing better than expected from a real engagement; these results, therefore, are optimistic. In addition, producing a projectile that can penetrate and deposit the oxidizer effectively in both soft bulk chemical targets and very hard submunition targets is very difficult. The presence of the chemical in the center of the projectile lowers the areal density of the projectile so much that penetration into a mass of submunitions is greatly reduced.

(U) Another approach in which a reactive agent is incorporated inside an explosive submuniton is under study and test. The agent is intended to mix with the high explosive of the incoming warhead and produce significantly more energy. Thus far, there are no conclusive results.

(U) Given these problems and the fact that most TBM engagements will exceed 2 km/s, the efficacy of using EKE warheads against TBMs is questionable. However, this type of warhead may have utility in attacking low, slow-flying cruise missiles and aircraft threats. Further testing and development for that application should be considered.

## B. MISSION KILL (U)

(U) Mission kill has been defined to mean that the defense has caused the TBM to miss the intended military or population center target even though the TBM warhead may not have been destroyed. The debris for the interceptor-TBM encounter does, however, hit somewhere. Table C10 shows the status of our lethality knowledge. Hard information on bulk HE was obtained from Patriot's performance during Desert Storm.

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(U) The validation experiments and supporting calculations on the HTK approach should move rapidly, especially for chemical submunition targets. The lethality test program for HTK validation needs to be time-phased with the development programs for new systems such as THAAD. An early test of the probability of agent leakage from impacted submunitions would be valuable. Maneuvering targets and extended targets with especially vulnerable areas need consideration.

(U) An enhanced level-of-effort is needed on problems of lethality against biological weapons. While the BW work, to a large extent, can piggyback the chemical lethality program, BW involves some special considerations, particularly because small amounts of BW agents can be harmful. An area of emphasis should be atmospheric transport of agents for intercepts above 2 km.

(U) Lethality for EM gun interceptors and airplane-based boost-phase laser approaches need to be considered even though the current HTK technology programs address these issues in part.

(U) Is there hope for EKE interceptors? These are interceptor warheads carrying chemicals that will, it is hoped, burn up biological or chemical agents *in situ*.

(U) The SDIO should consider the impact if interceptors are not able to destroy entirely an incoming biological or chemical warhead. Kill—whether hard kill or mission kill—has been considered binary. This simplification may not be adequate; the problem needs to be thought through.

(U) Because it is often necessary to use multiple interceptors to increase $P_k$, emphasis needs to be placed on effective kill assessment as well as on effective mechanisms for target destruction and the interplay between the two.

(U) A variety of kill approaches are being studied; the studies are at varying degrees of maturity. Probably, our understanding of fragment kill is the most advanced, but it is not definite that this is the best approach. Thus, a mixed force of kill vehicles could be the safest approach, especially in light of the fact that TMD systems may have to defend against air-breathing threats as well.

(U) The SDIO/DNA should assist the JCS/CINCS in assessing expected collateral damage in TMD scenarios. This should be done through exercises when possible. Effective passive defense measures need to be refined based on experiences such as Desert Storm.

## III. LETHALITY SUMMARY (U)

(U) Interceptor lethality against incoming warheads is a first-order issue for the Theater Missile Defense Program. Until quite recently, the SDIO interceptor lethality programs concentrated almost exclusively on lethality against long-range missiles carrying nuclear warheads. While these programs provide important background in both the science and the development of rational approaches to the lethality question, TMD lethality poses difficult new challenges. As a consequence, the Task Force concludes that a substantial lethality program focused on TMD is required and should be supported.

(U) One of the major problems posed in TMD is the need to develop, if possible, a single interceptor that will be lethal against HE, NBC, and incendiary warheads. The BW and CW agents could be contained in either bulk delivery tanks or submunitions. Some lethality mechanisms may be very effective against one type of warhead but not against another. HTK technology looks promising against a number of these warhead types. However, a weight and volume hedge is warranted for HTK to assure lethality. This would allow for future improvements, such as lethality enhancers, that may be needed.

(U) The general observations and conclusions of this study are provided in table C11. (Detailed recommendations are included at the end of each section.)

TABLE C11.—Lethality Summary (U)

**OBSERVATIONS**

- Lethality is a parameter the system developer can trade-off with other parameters.
- Lethality is a major technology uncertainty.
- A substantial, focused TMD lethality program is required.
- Analysis and confirming tests against some possible threat variations indicate that hit-to-kill or enhancers may be marginal for a hard kill.
- Hard kill, if achieved against all threats, is still accompanied by collateral debris and fallout.

**RECOMMENDATIONS**

- TMD Patriot and Standard Missile warhead upgrades should be undertaken.
- A comprehensive TMD lethality program should be supported.
- Early emphasis should be placed on chemical and biological submunition kills.
- A weight and volume hedge is warranted to achieve sure kill for HTK: This would allow for improvements to or combinations of HTK and enhancers
- Proliferated precision warning and civil defense measures should be supported to offset collateral environments.

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# Appendix D (U)

# COUNTERMEASURES–PENETRATION AIDS (U)

*Seymour Zeiberg*
Martin Marietta Company

## COUNTERMEASURES—PENETRATION AIDS (U)

### A. INTRODUCTION (U)

(U) It is important to recognize that while Third World aggressors will be constrained in their ability to employ penetration aids (PENAIDS) against a theater missile defense (TMD), we will have uncertainty because of the unpredictability of their actions. This is in stark contrast the Soviet threat, which we have observed as it evolved over a long period of time. Third World capabilities can change quickly because they derive from technology and system transfers and direct sale of systems.

### B. CONSTRAINTS ON THE AGGRESSORS (U)

(U) A number of factors constrain the aggressor's ability to employ countermeasures.

(b)(1) [redacted]

(b)(1) [redacted]

## C. POSSIBLE PENETRATION AIDS (U)

(U) Uncertainty about what PENAIDS US TMD systems are likely to encounter are engendered by the same factors we believe limit potential aggressors. We do not know what level of technology the aggressor has access to; we do not necessarily know where the system was acquired; and we do not have the opportunity to observe system tests. This leads us to the situation of having to put ourselves in the potential aggressor's mind and to define approaches to ensure that our TMD system can cope with the potentially diverse, though not necessarily sophisticated, PENAID alternatives available to a technically clever but resource-limited aggressor.

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[redacted]

(b)(5)

[redacted]

(U) The items in the **Major Mods** category require separation of the warhead from the tank and moving the tank away so that it does not act as a beacon or acquisition aid to the defense. This category required extensive full-scale testing to prove-out various aspects of functionality.

(U) As mentioned in the text, the tactic of dispensing a multiplicity of submunitions early in the trajectory needs further study to ascertain whether it would fall into the **Minor Mods** or **Major Mods** category.

## D. US ABILITY TO COUNTER PENETRATION AIDS (U)

(U) The US missile defense community has substantial experience and a high level of sophistication in both the design of PENAIDS and the design of corresponding defense counter-countermeasures. No other nation—including the Soviet Union—comes close to matching our experience in this area. Importantly, Third World countries are markedly inferior in theory, design, testing, and refinement of penetration devices and the techniques for countering them. Accordingly, the Task Force is confident that a TMD system can be designed to cope with the PENAIDS that an unsophisticated—but clever—aggressor could mount and, in effect, drive the aggressor to need levels of technology that are beyond its reach. To be able to cope with surprises, however, the TMD designs must retain flexibility in their operation (e.g., algorithms, modes) to accommodate new knowledge obtained by observation of potential threats in operation or via intelligence.

(U) The US TMD Program would benefit greatly from incorporation of a PENAID design and test program using approaches in the context of "Third World Resource-Limited Engineering." The results of such a program should be used in the defense counter- countermeasure efforts.

(U) Finally, our TMD Program would benefit from a "Red Team" styled along the lines of the SSBN Security Program. The SSBN Security Program sought technical and operations methods to undermine SSBN security and used the insights gained to counter those methods. The Program has been productive. An analog for the TMD efforts, coupled with the PENAIDS design and testing program recommended above, would be a viable approach to dealing with the threat of PENAIDS and the uncertainties that surround the threat.

# Appendix E (U)

## RELATED ISSUES (U)

## RELATED ISSUES (U)

### A. RELATION TO COUNTERFORCE (U)

(U) In its work, the Task Force frequently noted linkages between offensive action against ballistic missile threats and active defense against them. The very large effort expended to attack Scud missiles and missile launchers during Desert Storm suggests that one benefit from increasing the capability of ballistic missile defenses would be to free offensive air resources for other high-priority missions, especially during the early phase of operations, to establish air superiority. The other side of the coin, however, is the possibility that offensive air operations may be able to suppress ballistic missile rates-of-fire, easing the requirements on defenses to meet saturation attacks. A comparison of experience in Desert Storm with the earlier War of the Cities between Iran and Iraq is suggestive but far from conclusive in this regard. An understanding of the relationship would be helpful in planning theater missile defense (TMD). Finally, it is likely that space-based sensors for TMD would also prove to be of considerable value in targeting offensive action against mobile ballistic missile launchers, especially in a counter-battery mode. The Task Force supports the effort by the Brilliant Eyes Program to consider this interaction in its R&D efforts.

### B. ALLIED ROLE IN TMD DEVELOPMENT AND DEPLOYMENT (U)

(U) To realize the interests in TMD it shares with its allies, the United States must consider how TMD deployment affects their strategic interests, their policies on arms control, and their role in the development of TMD systems. How the costs of TMD programs will be shared must also be a consideration. The Task Force notes that the Department of Defense has actively discussed the reorientation of the Strategic Defense Initiative Program to the Global Protection Against Limited Strikes concept with our principal allies; the Task Force believes equally strenuous efforts should be focused on informing them of our plans to meet the TMD objectives established by the Secretary of Defense and the Congress. Such discussions should embrace our R&D plans and the possible roles allies might play in implementing those plans. The initial exploration of arrangements for deploying such systems by US forces and for sales to allies also should be addressed in those discussions.

### C. RELATIONSHIP OF TMD AND AIR DEFENSE (U)

(U) The Task Force did not address the relationship of TMD to theater air defense. This would be, however, an appropriate topic for a follow-on study.

(U) One can easily point to elements of synergism wherein a TMD system could contribute substantially to air defense. Patriot and Aegis can perform both roles, albeit with limitations in the case of advanced tactical ballistic missiles. An important question for follow-on work is whether an advanced TMD system, such as the THAAD/GBR, should be designed to handle both advanced air-breathing *and* advanced missile threats. There are substantial differences in what one wants in a THAAD interceptor to make hit-to-kill intercepts at 30-km altitude and in an air defense interceptor to engage a low observable cruise missile at 200-ft altitude.

(U) Of course, the THAAD/GBR combination could be very useful for intercepts of very fast (e.g., Mach 4) cruise missiles at high altitudes (in the 25-km regime). There is no clear or obvious answer to how much of the air-breathing threat should be assigned to an advanced TMD system or what synergy results from the deployment of air defense units in the area defended by a TMD system. Study is required.

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# REPORT OF THE DEFENSE SCIENCE BOARD

On

# STRATEGIC DEFENSE INITIATIVE

# COUNTERMEASURES

DECEMBER 1992

Office of Director, Defense Research and Engineering
Defense Science Board
Washington, D.C. 20301-3140

Classified By: SDICM SCG
Declassify: OADR

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE BOARD

MEMORANDUM FOR DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

THROUGH: CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Report of the Defense Science Board on "SDI Countermeasures"

I am pleased to forward the final report of the DSB on "Strategic Defense Initiative Countermeasures." The Task Force examined in considerable detail the SDI architecture, design, and threats to the system. The DSB recommends significant changes with regard to the SDI system design process; Red/Blue Design Team authority and interfaces; and threat identification.

We are available to discuss the matter in further detail should you desire.

Robert R. Everett
Chairman, DSB Task Force on
SDI Countermeasures

Attachment (~~S~~)

Classified by: SDIO CM Program SCG,
Directive 5233, Nov. 1990
Declassify by: OADR

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## (U) Introduction

(U) A DSB Task Force was requested by the Deputy Secretary of Defense to examine the countermeasures to the Strategic Defense Initiative (SDI) Countermeasures Program and make recommendations to improve the system response to plausible threats. The Task Force examined in considerable detail the SDI architecture, design, and the threats to the system. The SDIO management structure and approach to the countermeasure problem was also examined.

(U) The Task Force effort was focused on tactical missile defense (TMD) because it has advanced to a point where the major subsystems are sufficiently defined to permit an assessment of vulnerabilities. Furthermore, we were more concerned with the effectiveness of the process than with the specifics of a given system. The tactical area met all of our objectives quite well and our limited examination of the strategic areas did not suggest that they differed in any significant way.

(U) The Task Force enjoyed the full cooperation of the SDIO and we were impressed with their competence and dedication to their mission. We were also impressed with the supporting contractors and the depth of their presentations.

(U) We believe we have a good understanding of the countermeasure problem as it impacts the SDI and can offer some constructive suggestions for improvement.

## (U) **General Countermeasures Considerations**

(U) All military systems are subject to degradation from countermeasures. All wars are fought with such systems and usually with acceptable results. This is true because systems can be designed with sufficient resistance to make countermeasures difficult, expensive and subject to excessive doubt about their success. It is also true that we sometimes face an adversary lacking the desire, knowledge and/or the capability to effectively counter our systems. On the other hand history is replete with examples of the use of countermeasures with devastating effect. Thus experience strongly indicates two important facts.

> (U) All military systems should be designed with careful attention to countermeasures to assure their susceptibility does not exceed acceptable limits.

> (U) The threat of countermeasures alone does not constitute a basis for rejecting a system provided the system can offer reasonable resistance and is not simply and/or obviously defeated by countermeasures.

(U) With respect to the first point it should be recognized that countermeasures are innately responsive. By and large they are conceived only after the victim system is designed and has evident vulnerabilities. We should not expect to find countermeasures in place prior to the completion of the system, nor should we expect the intelligence community to identify a threat to a new system based on their knowledge of countermeasures already in existence. Only the system designers have the requisite knowledge to recognize vulnerabilities and predict such threats. When the threats have been identified they should be presented to the intelligence community for validation. The validation process should examine the plausibility of the threat in light of knowledge already possessed, and if the threat is not yet in place the intelligence community should be tasked to set into motion the necessary collection efforts to observe it, if and when it emerges. If a new threat does materialize its impact will depend on whether the designers had anticipated it and how well they had designed the system to resist it. If the threat was unanticipated, the system must be sufficiently robust to cope with the new demands.

(U) Unfortunately many systems are designed without proper attention to countermeasures. There are many reasons for this omission. Perhaps the primary reason is that the system program managers and other advocates regard countermeasures as more of a threat to funding than to the system's utility in the field. They believe the most deadly counter to a system is its cancellation resulting from unfounded concerns that may never materialize. Most programs have their opponents who would like to stop the system development so that the money can be spent on something they prefer. The opponents frequently claim that the system is too easily countered. Consequently proponents of a system prefer (perhaps subconsciously) to ignore countermeasures fearing that a serious weakness might be exposed that would not otherwise occur to the opponents who have limited knowledge of the system in question. Other reasons for neglect include the cost implications of doing something about countermeasures. Money is almost always short for the development of a system and additional cost can have consequences which are hard to face. Of course, a blatant neglect of countermeasures also invites criticism. Consequently the prudent program manager creates a countermeasure effort in his own organization thus impeding criticism while still maintaining sufficient control to assure that the results are not destructive. One approach is to create a "Red Team" charged with defining the countermeasure threat and interacting with the design team to assure that the system design incorporates adequate protection for the threats.

(U) A Red Team can be very valuable but it has certain problems and limitations. A Red Team that is integral to a program has a fate which is irrevocably tied to the fate of that program. The members of the team report to the program management and their career prospects depend on pleasing that management. They are motivated to contribute to the success and well being of the program as perceived by the program management. Too often this perception does not include an overly zealous exposure of system vulnerabilities. Now this does not mean that they will not do a good job. Their professionalism and integrity will usually prevail, but the force with which they present their views can be influenced by their circumstances. Furthermore, the group is selected by the program management. Out of a sense of conservative decorum the management would probably avoid a professional approach which exhibits a high degree of "bloody minded" intractability. The result can be that serious threats are easily dismissed by bureaucratic constraints or specious rationalizations, such as: "It's not in the official threat", "The intelligence community has never seen one"; "It's too hard to do"; "The Third World doesn't have the technical capability"; "The Third World can't buy it"; etc.

(U) In spite of these problems, the job of the Red Team should be done with the intent of producing systems as robust as we can afford to make them, not with the intent of stopping the development of a military system which meets a well defined need. The object should be to fulfill the need to an acceptable level, recognizing it might not be perfectly fulfilled because of countermeasures.

(U) To do this well might require a Red Team located in an independent organization, <u>but not necessarily so</u>. An external group would have the advantage of being free from concerns about the impact of negative finding on their career. On the other hand, they would suffer from the loss of direct involvement in the details of the system design, achieved by day-to-day close contact with the designers. They would be outsiders, and as such, could experience serious difficulties in influencing the program. Moreover, it is not always true an internal Red Team lacks the independence of mind and action to do the job well, but a team integral to the program requires a strong team leader to be effective. There are leaders for such efforts who without concern for anything but the truth, would aggressively find the truth and state it. Red Teams should be led by such people and it is obvious when they are.

(U) In what follows we will attempt to evaluate the SDIO effort to include proper attention to countermeasures in their program and provide a set of conclusions and recommendations directed to that end.

## (U) SDI Countermeasures Activities Assessment

(U) The SDIO has established a <u>Red Team</u> to address the countermeasure threat. They also have a <u>Blue Team</u> that interfaces with the Red Team for the purpose of establishing the vulnerability or lack of vulnerability of the system concepts to identified threats. There is also a <u>Design Team</u> (which is not the Blue Team) busily designing the system and apparently doing so without much concern for the ongoing Red/Blue debate. Each team taken by itself appears to be quite competent. The Red Team has defined a comprehensive set of countermeasures and this DSB Task Force was unable to contribute significant additions to that set. The Blue Team is staffed with clever personnel quite capable of mounting a defense of the system's ability to cope with any threat no matter how severe. The Design Team is designing a very advanced system that offers considerable strength to resist a large class of countermeasures and they understand that there are significant weaknesses not yet addressed. However, it is clear that the Red Team/Blue Team combination is having very little impact on the system design. Also, the Red Team does not appear to be properly connected and/or empowered to aggressively force proper consideration of the threats they define.

(U) The formal Red/Blue Team interactions are a good technique for adversarial gaming of offense/defense scenarios and determining the outcomes of specific engagements. But, they are not very useful for exploring the detailed considerations of countermeasures. This becomes very clear when it is realized that the system designers are not participants in Red/Blue games. We are concerned that without participation of the designer's important details will not surface and the outcome of the interaction will have little influence on the system design. The system designers must participate in the Red/Blue interactions if the interactions are to have any significant bearing on the design. The DSB Task Force took yet a stronger position with regard to the three teams. The DSB believes the Design Team should also be the Blue Team, perhaps augmented by a few people drawn from the present Blue Team to address certain higher level questions.

~~(S)~~ An example receiving considerable attention by the DSB Task Force was the (b)(1) [redacted] In the Red Team's contractor's briefings the [redacted] was included in a comprehensive assemblage of possible countermeasures. The impact of the (b)(1) [redacted] (b)(1) [redacted] was described and later confirmed by the Task Force. (b)(1) [redacted]

~~(S)~~ The system designers, [redacted] (b)(1)

Nevertheless, the techniques described offer some hope and should certainly be pursued vigorously by the Design Team.

~~(S)~~ It would appear that the [redacted] (b)(1) [redacted] To the credit of the Red Team, they funded a design study to determine the extent of the difficulty but the study conclusions were badly colored by seemingly arbitrary constraints. [redacted]

(b)(1)

(U) When the difficulty of implementation of a given countermeasure is questioned, the issue is best resolved by assigning the job of building or otherwise acquiring it to a team equipped with the necessary experience and skills. If that team can produce the countermeasure, they must assume that others can as well. If they can not produce it then there is a very good basis for placing less emphasis on the threat, but it is dangerous to reject a threat on the opinion of personnel not experienced in the design or acquisition of such equipment. For this reason the DSB favored the creation of a "skunk works-like team" to objectively evaluate the difficulty of achieving certain countermeasures that are in doubt. The evaluation should be based on "hands on experience" in building or buying, and not on opinion alone. This team should consist of a small (perhaps 6 to 12), but highly experienced staff skilled in the engineering design and acquisition of equipment found in the worldwide market. They should have a modest budget (order of a few million dollars per year) to buy commercially available hardware to support the development of suitable countermeasures. The team should be free to operate unconstrained by the usual government regulations and controls with respect to the acquisition of equipment and materials. Their efforts should attempt to establish the feasibility of countermeasures designs achieved without resort to the high technology only available to major world powers. This "skunk works" would clearly be a Red Team function, but in order to have the requisite flexibility it is probably best achieved by use of a supporting contractor.

~~(S)~~ The Task Force was also concerned that the [redacted]

(b)(1)

(b)(1) [redacted]

~~(S)~~ A previous DSB study recommended that [redacted] (b)(1) This DSB Task Force supports those previous findings which are reinforced by the demands placed on the system by countermeasures.

~~(S)~~ We were also concerned with [redacted] (b)(1)

(b)(1)

[redacted]

~~(S)~~ Experience in the Gulf War suggests two ways in which defense system response to enemy countermeasures can be improved. There was time during the Gulf War to design, test, and install software modifications to Patriot to remedy deficiencies found in combat. Counter-countermeasures during a campaign would be eased if key elements such as radars and interceptors were outfitted with recorders to permit the system to learn from its mistakes. During the Gulf War, the Iraqi's used modified Scuds which certainly were not tested according to U.S. practice. The modified Scuds were unstable during reentry and broke up differently flight to flight. Third world flight testing is likely to be limited at best. Whether accidental or deliberate, unstable or jinking reentry flight with possible breakup during reentry should be expected. Adequate design margin in end-game tracking, divert velocity, and acceleration should allow response to threats that could not be foreseen in detail even by the people who designed the ballistic missiles in the first place.

(U) Perhaps the most important concern that resulted from our examination of the SDIO process was the apparent lack of a System Engineer with the responsibility for the entire system design, including adequate response to countermeasures. A well balanced and effective design of a complicated system such as GBR/THAAD must be managed by a central responsible authority. If there is a system designer with the responsibility for all aspects of the design, the results can be impressive. A splendid example of what can be achieved is found in the Patriot system. The DSB Task Force was very impressed with the Patriot design, and most especially with the attention paid to countermeasures. The Patriot system gives excellent testimony to the fact that if proper attention is given to the countermeasure problem, a system with very considerable strength can result.

(U) We were told the system engineering task for TMD has been assigned to an SDIO integration contractor. We do not believe that such an arrangement meets the need for a System Engineer, irrespective of the quality of the contractor. A System Engineer is an individual within the organization who is responsible for all aspects of system design including counter-countermeasures. He is responsible for the overall success of the system and has the duty and authority to make tradeoffs, define specifications, direct subcontractors, and modify the design to solve unforeseen problems. He has direct access to users, decision makers, and organizations responsible for subsystems and components. He needs various kinds of direct support, including technical support, some of which may be provided by an integration contractor, but his responsibility and role can not be delegated to a support contractor.

(U) The System Engineer can be provided by a prime contractor or can be a government employee if the government retains the system design role. We understand the TMD task is the responsibility of the SDIO, which subcontracts the system components to the services. This arrangement implies that the System Engineer should be in the SDIO, but we do not find an individual who has the system engineering role as it has been described above.

(U) It is very difficult for the Red Team to be effective, no matter how capable and aggressive it might be, until a proper System Engineer has been appointed. When there is a functioning System Engineer, the Red Team must couple very closely. For example, the Red Team should participate in the Design Board meetings and review RFPs, which we have been told they do not currently do.

(U) We made no attempt to seriously evaluate the size and funding of the Red Team, but believe in the absence of a System Engineer and a proper relationship with the system designers, the size makes little difference. On the other hand, if the Red Team is properly connected, there will probably be general agreement that its activities and resources should be substantially increased.

## (U) Conclusions and Recommendations

(U) **Conclusion 1**

(U) A system with the complexity of TMD absolutely requires a System Engineer who is in charge of all aspects of the system design including countermeasures. We could find no clear indication that SDIO has a proper System Engineer and concluded that this was a serious shortcoming that is the root cause of most, if not all, of the problems we encountered.

(U) **Recommendation 1**

(U) We recommend that SDIO establish a position of System Engineer and fill it with a well qualified person to assume responsibility for all aspects of the system design including proper consideration of countermeasures; and that the System Engineer be provided a staff of appropriate size and qualifications to support the design function.

(U) **Conclusion 2**

~~(S)~~ The SDIO has appointed a Red Team that, as far as we can tell, has delineated a comprehensive set of countermeasures for consideration by the Blue Team. [redacted]

(b)(1)

(U) We examined the question of where the Red Team should belong organizationally; and concluded it should continue as part of the SDIO. If they it were placed in an independent organization, it would lose the close contact and working relationships essential for its effectiveness. The problem we encountered is not due to a lack of independence but rather to a lack of management actions needed to make reasonable influence of the system design possible. Further separation would only make matters worse.

(U) We discovered the Blue Team is not one and the same as the

Design Team and concluded this is a serious mistake. Also, the design team does not significantly participate in the Red/Blue Team interactions. We concluded the Blue Team should be the Design Team and should actively interface with the Red Team.

(U) **Recommendation 2**

(U) We recommend the SDIO have a highly qualified Red Team leader who will, with proper support, aggressively define the entire countermeasure threat and be empowered to bring about adequate consideration of that threat by the system designers.

(U) We recommend the present Blue Team be dismantled and be reconstituted under the leadership of system designers and there be frequent and active Red/Blue interchange to decide how identified countermeasures should impact the system design.

(U) We recommend the Red Team leader report to the top level of SDIO and provide frequent reports to that level on serious threats to the system and how the reconstituted Blue Team (Design Team) has responded to those threats.

(U) We recommend the reconstituted Blue Team (design team) be required to formally report on their responses to all Red Team concerns and proposals.

(U) We recommend that the Red/Blue Teams interactions be for the purpose of improving the design and be kept separate from advocacy.

(U) **Conclusion 3**

(U) We observed considerable disagreement with respect to the difficulty of designing, building, or otherwise acquiring certain countermeasures. The positions taken are by and large based on opinion, and not hard facts, but nevertheless serve as a basis for rejecting some threats. It was concluded that a "skunk works" like activity, staffed and funded to determine whether or not a given threat could be built or acquired by simple means and thus supplying real information on the difficulty, would be very valuable.

(U) **Recommendation 3**

(U) We recommend the SDIO establish a small activity as part of the Red Team that is unencumbered by the usual government acquisition constraints to determine the difficulty of building, buying, or by some means acquiring simple and practical countermeasures that constitute a serious threat, but do not require high technology, not readily available.

(U) **Conclusion 4**

(U) The practice of going to the "intelligence community" to establish the threat is not useful and should not be relied upon as the ultimate definition of the threat. This is not intended as a criticism of the intelligence community, per se, but a recognition of what they can reasonably be expected to do. For the most part, countermeasure threats to a system which does not yet exist are not in a form that can be observed by the intelligence community. The threat must be assumed to grow out of innate vulnerabilities in the system design which are best identified by the system designers. Once the threat has been identified, the intelligence community should validate it and be tasked to set up a collection program to observe its possible emergence.

(U) **Recommendation 4**

(U) We recommend the Red/Blue Team be responsible for the identification of the countermeasure threats to the system they are designing.

(U) We recommend each potential threat be validated by intelligence community and they be tasked to set up the necessary collection to observe the threat if and when it appears.

# APPENDICIES

## Terms of Reference

## Task Force Membership

## Meeting Agendas

(This Section is Unclassified)

(b)(5),(b)(6)

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