OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

8 February 1967

TO: THE SECRETARY OF DEFENSE

THROUGH: THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

The Defense Science Board herewith respectfully submits its report on Ballistic Missile Defense. This report is the work of a task force established by the Board in response to a request for this study from the Director of Defense Research and Engineering. The body of the report was shown to Dr. Foster last September and in turn presented, in substance, to you. We trust that within its assigned scope it is fully responsive to your needs and those of Dr. Foster.

The task force devoted its main effort to an examination of the technical possibilities for a rapid deployment of a U. S. antiballistic missile defense against Communist China and the Soviet Union. The task force concluded that rapid deployment was feasible and that through rapid upgrading of the initial deployment an effective defense could be maintained against the Chinese Communists and possibly the U.S.S.R. as well.

We wish to express our appreciation to Dr. Foster and his staff for their full cooperation in this study which it has been our privilege to conduct.

Frederick Seitz
Chairman
Defense Science Board

# BALLISTIC MISSILE DEFENSE

Report of the

Defense Science Board Task Force

15 September 1966

Office of the Director of Defense Research and Engineering
Washington, D. C. 20301

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OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

15 September 1966

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Report of the Task Force on Ballistic Missile Defense

The Task Force submits herewith its report on the question of U.S. deployment of an ABM system.

In its report, the Task Force limited itself to technical considerations. During its meetings, however, the question of need for deployment inevitably arose. It appeared to the Task Force that there was a need for deployment.

The Soviets are now deploying an ABM defense of their cities. The U.S. is concerned that this defense might prevent penetration of a substantial portion of its missile forces and limit Soviet damage to an acceptable level. As a consequence, we are speeding deployment of pen-aids in order to restore some of the original effectiveness of our forces. However, the pen-aids are relatively primitive, and Soviet defenses may be able to cope with them. Fortunately, there is a great deal more that we can do, and should do, to maintain the damage-inflicting capability of our forces.

The bombers can be maintained and, perhaps, upgraded. ICBM bases can be made more survivable. The total payload of the missile forces can be increased, and sophisticated penetration aids can be incorporated. But even with all of these recourses, we seem to be left with a basic problem. Improvement takes time, and during that time we must expect that Soviet defenses will be upgraded in an effort to offset the improvements. In this competition, we may not be sure that we are doing enough.

With the loss of assurance, we face a dangerous imbalance: while we will be unsure of our own damage-inflicting capability, we will be sure that the Soviets can destroy our undefended cities. Faced with this imbalance, the U.S. may no longer be able to deal resolutely with Soviet provocation.

The Task Force believes that we can solve this problem—and maintain deterrence—if we deploy our own ABM defense. By providing some protection of our cities, we deny the Soviets certainty in their ability to destroy our cities and strengthen our willingness—and Soviet belief in our willingness—to deal with provocation.

For maintaining deterrence through this balance of uncertainty, it is essential, of course, that our offense forces continue to be of sufficient capability that they can provide a good chance of inflicting unacceptable damage on the Soviets.

Many ABM systems suitable for this purpose have been explored in detail over the years and adequately reported elsewhere. In its report, the Task Force devoted its main efforts toward examining a new approach to achieving defense which it considers better than others—being more responsive to the growing Soviet threat.

There is a final point which was not discussed by the Task Force—namely, the balance between strategic offense and ABM defense. It is clear that even though the rapid pace of Soviet developments makes it urgent both to deploy an ABM defense and to upgrade U.S. offense forces, budget constraints may make it difficult to take both steps. If a choice is inevitable, it appears that money spent at this time for an ABM defense might buy substantially more deterrence than additional money for major upgrading of the offense force—beyond the currently programmed upgrading to incorporate penetration aids into the force.

Richard Latter

Richard Latter, Chairman
Task Force on Ballistic Missile Defense

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# INTRODUCTION

Since its initial meeting 18 March 1966, the Defense Science Board Task Force on Ballistic Missile Defense (BMD) has examined the question of U.S. deployment of an antiballistic missile (ABM) system. Primary consideration of the Task Force was given to specifying the general characteristics of an ABM defense against the Soviet Union, but defense against China was also considered. The emphasis on the Soviet Union was simply a reflection of the relative timing of the Chinese and the Soviet threats.

The Task Force limited itself to the problem of active defense against intercontinental ballistic missiles (ICBMs) and sea-launched ballistic missiles (SLBMs). The problem of coupling active and passive defense, as well as that of balancing defenses against all modes of possible attack (air defense, antisubmarine warfare (ASW)) would not be dealt with by the Task Force in the time available.

The Task Force wishes to express its indebtedness to the many agencies and companies that worked hard to provide the Task Force essential information for its consideration. The Task Force is particularly indebted to the Army and the NIKE-X Project Office, together with its contractors, the Bell Telephone Laboratories and the Western Electric Company, for their diligent cooperation.

## The Old Approach

In past considerations of deploying an ABM defense system against the Soviet Union, the U. S. has taken the approach that the initially deployed system should be able to cope with an extremely sophisticated all-out attack against cities. As a result, it was assumed that the initial system had to be as sophisticated and flexible as U. S. technology could allow.

This approach had serious difficulties:

1. Since the system had to be sophisticated and flexible, it was complicated and costly.

2. Because of the system complexity and the need for large numbers of expensive components to achieve a prescribed level of effectiveness in the event of an all-out city attack, deployment lead-times were estimated to be about

3. Because of the long lead-times, it appeared likely that by the time the system became operational the Soviets could react with the necessary penetration aids to degrade seriously the ability of the system to deal with an all-out attack.

## A Conclusion of the Task Force

In sharp contrast to the possible future Soviet threat which could seriously degrade a long lead-time system, we know with high confidence that the Soviet threat is today not sophisticated—but consists of isolated warheads with large radar cross-sections, unaccompanied by penetration aids and individually delivered by separate boosters.

Against this threat, without trying to be quantitative for a moment, the Task Force concluded that even a relatively simple ABM system could be effective in limiting the damage to the U. S. which might result from a first-strike, all-out ICBM and SLBM attack by the Soviet Union, provided it were in the field today.

The problem—deployment of even a simple system may require substantial lead-time, and even if that lead-time is short, a simple system cannot be expected to retain effectiveness very long.

## A New Approach

Two considerations suggest that this problem is soluble:

1. Evidence indicates that the Soviets have not done the required research and development (R&D) toward equipping their missile force with penetration aids. As a result, if they find it necessary to respond to a U.S. deployment of an ABM system, it is anticipated that they will be faced with substantial lead-times. They will be faced not only with the intelligence lead-time needed for design of suitable penetration aids but also with the technological lead-time to build the penetration aids, make them compatible with their missiles and deploy. While U.S. experience indicates that building simple penetration aids can be fairly rapid, perhaps as short as additional time is necessary to obtain accurate knowledge of the defense and conduct careful testing both of the pen-aids and of the warhead.

   However, in view of a possibly shorter Soviet intelligence lead-time, the Soviet Union may be able to react somewhat more rapidly. To minimize this possibility, there is a strong need to improve U.S. security with respect to the nature, characteristics and growth potential of its defense.

2. For the past ten years the U.S. has been carrying out a vast R&D program in ballistic missile defense. The result of this program is that today the U.S. possesses a substantial body of defense technology. Depending upon the type of system, deployment could entail minimal additional developments —the deployment lead-time being set mainly by the time to fabricate a system. In addition, new techniques and new hardware are constantly under study and may be available soon for operational employment.

There is an additional key advantage to a quick-reacting, responsive ABM system—it is likely to be cheaper than one which attempts initially to cope with a wide range of offense technology. This results from the relatively limited extrapolation of the threat, the growing diversity of defense technology, and the consequent better choice for upgrading the system to maintain system effectiveness. Despite the apparent open-endedness of the system implied by continual upgrading, these considerations suggest that the system can be maintained into the foreseeable future at substantially less cost and scope than deployments such as DEPEX IV.

The Task Force examined the two key items:

1. U.S. ABM systems which can be rapidly deployed; system costs and effectiveness.

2. U.S. capability to maintain an effective system.

<u>Defense Options</u>

The NIKE-X Project Office with the assistance of Corps of Engineers, the Bell Telephone Laboratories and the Western Electric Company has attempted to determine the minimum time for U.S. deployment of an ABM system.

Four sample system deployments were examined. The composition, cost and deployment lead-times of each of these four systems are shown in Table 1. Three of the options could be deployed in

These relatively short lead-times are based on maximum use of existing R&D facilities for production of components. However, some of these facilities are programmed to be dismantled in early 1967. Thus the short lead-times imply a deployment decision prior to 1967 or availability of additional funds to maintain the facilities for future use.

In addition, these lead-times presuppose:

1. System to be operated initially by contractor personnel with a gradual phasing in of military operators.

2. Limited system-design feedback during production.

3. Limited cost-reduction program.

4. No system-design feedback from full-scale operational system tests.

Items 1, 2 and 3 are likely to have only a small effect on system cost or system reliability. Item 4 appears potentially important for system reliability.

However, despite the absence of feedback from operational tests, at the completion of deployment, the interceptor component of the systems would have been completely tested in a normal test program and would have high reliability. The radar component of the systems would not have undergone complete systems test. However, the radar component involves only U. S. state-of-the-art technology and would be expected rapidly to attain high reliability. Even initially, however, with the preparation time likely to be available from strategic warning high reliability could be achieved over extended periods of time. The most difficult aspect of the system to design and check out will probably be the software, such as computer programs which specify the system operating logic. This problem can probably be solved by adequate simulation testing— detection and tracking of satellites and high-altitude aircraft, together with non-nuclear operational intercepts of satellites.

Within about the same time scale as the four sample systems, other options are also available. The number of interceptors could be

## Table 1. SAMPLE DEPLOYMENTS

| | Options | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Equipment | | | | |
| Long-range, Low-frequency Radar and Data Processing | 4 | | | |
| Long-range, Low-frequency Radar, DP includes Defense Coordination Center | | 4 | 4 | 4 |
| Firing Batteries | 12 | 10 | 10 | 11 |
| MTR (NIKE ZEUS) | | | 30 | |
| RMTR (Redesigned for S-Band) | | 30 | | 21 |
| ZEUS Data Processor | | 10 | 10 | 7 |
| MSR and Data Processing | 8 | | | 4 |
| MSR and Data Processing including Defense Coordination Center | 4 | | | |
| ZEUS X-2 Interceptor | 240 | 200 | | 220 |
| ZEUS 15C Interceptor | | | 200 | |
| Investment Cost (in millions)[a] | 3,220 | 1,715 | 1,575 | 2,230 |
| Annual Operating Cost (in millions)[a, b] | 353 | 225 | 215 | 267 |
| Time from Decision to Completion (in years) | | | | |

[a]These costs include an increase of about 40% on some items to achieve the short deployment times. This increase amounts to about $0.5 billion. The Task Force does not believe the 40% but considers that the increase will be substantially less.

[b]These costs are for the first year. Lower costs are expected for later years.

increased to about 1000. The investment-plus-5-year-operating cost of adding interceptors beyond the numbers indicated in Table 1 is $1.8 million per interceptor with warhead. Besides the NIKE ZEUS X-2 or 15C interceptor, about 1000 SPRINT interceptors for use in a terminal defense with the Missile Site Radar (MSR) or the long-range, low-frequency radars could also be incorporated into the system at a cost of $1.2 million per SPRINT with warhead.

System capability could be upgraded rapidly. At completion of initial deployment the production capacity for the NIKE ZEUS X-2 or 15C interceptor could be about

Production capacity for the long-range, low-frequency radars (with 2 faces) could be

at a cost of about $70 million per radar; for MSR radars (with 4 faces), about at a cost of about $125 million per radar; and by 1970 the TACMAR radar could be available for deployment at a rate as high as at a cost of $270 million for the 2-face version.

## A Responsive Defense

The Task Force attempted to select from the wide range of defense options available to the U.S. a representative one which could be deployed as rapidly as possible and could provide adequate effectiveness for minimal cost.

To this end, the deployment selection was based on two criteria. First, the initial system was to be effective against the early non-reactive Soviet threat—that is, against isolated warheads. For this purpose, the initial system had to contain radars of sufficient capability to detect and track large numbers of isolated objects with the precision needed for accurate intercept, and, moreover, the system had to contain sufficient interceptors with suitable warheads to provide substantial protection against the entire Soviet missile force. Second, the initial system was to provide the base for early build-up required to maintain effectiveness against the initial Soviet penetration reaction and so was not to deny future options for technical upgrading. This criterion implied that in so far as foreseeable, the components used in the initial system would always contribute to system effectiveness.

The nature of the initial system selected was as follows. It would be a high-altitude area defense providing complete coverage for CONUS. Such an area defense is expected to be part of any future more sophisticated defense. It seems therefore to provide an optimal initial base for future upgrading.

It would consist of a few long-range radars suitably deployed around the periphery of the U.S. These radars would detect and track any warheads delivered against the U.S. by Soviet SLBMs and ICBMs. They would be internetted to provide the maximum mutual support. Depending upon the level of defense desired, a number of interceptors would be deployed throughout the country, with the greatest number being deployed to protect the areas of greatest population. In order not to exclude the use of these interceptors as part of a possible future terminal-defense upgrading of the system, the interceptor farms would be deployed in the neighborhood of the largest population densities, to the extent consistent with initial complete area coverage.

Interceptors would be launched against incoming warheads based on the information from the long-range radars, and incoming warheads would be attacked exoatmospherically with high-yield weapons using
The radars would be protected by interceptors co-located with them. To provide the maximum protection of the radars, these interceptors (SPRINT or NIKE ZEUS X-2 equipped with a low-yield warhead) would attack incoming objects at as low an altitude as possible (that is, they would be used for terminal defense of the radars).

More specifically, 4 to 6 long-range, low-frequency radars would be needed across the northern border of the U.S. and possibily an additional 2 along the southern border (used in conjunction with the FPS-85) for detection and tracking of the ICBM threat. Along the east and west coasts, a total of 6 to 8 radars would be required for detection and tracking of SLBMs. While low-frequency radars could be used for this purpose, they do not have the growth potential needed for these important population centers. Therefore, the MSR radar should be used. The MSR radars can furthermore provide coverage of these important areas for attacks from any direction and they also permit some autonomous area defense to an extent set mainly by the capability of the interceptor and by the number and siting of the interceptor farms. The NIKE ZEUS X-2 was preferred to the 15C because of its greater capability and its growth potential. The number of NIKE ZEUS X-2 interceptors depends upon offense force levels and the desired degree of protection.

Any estimates of the degree of protection provided by the system involve considerable uncertainty. Nonetheless, it is useful to determine the potential of the system under ideal circumstances. Table 2 shows estimated U.S. fatalities as a function of the number of interceptors for various offense force levels assuming that the system operates ideally in the event of an attack, that fallout protection is provided by

Table 2. ESTIMATED U.S. FATALITIES* (in millions)

| Reliable Interceptors | Offense Force Levels (Reliable Missiles) 250 | 500 | 750 | 1000 |
|---|---|---|---|---|
| 0 | 55-60 | 75-125 | 90-140 | 100-145 |
| 1000 | 15-20 | 25-40 | 40-65 | 50-85 |
| 2000 | 10-15 | 20-25 | 25-40 | --35-50 |

*Assumptions:

1. Defense system operates ideally.
2. One reliable interceptor can destroy one offense missile.
3. The present fallout shelter program has the effectiveness estimated by OCD.

the present U.S. fallout-shelter program and that the offense missiles deliver single isolated warheads. Projected Soviet ICBM and SLBM force levels for 1970 indicate These missiles are estimated to have an average reliability of —for a total missiles deliverable against the U.S. If this total force reliable missiles were directed entirely at populations, then a defense system with interceptors would decrease fatalities to million and a system with interceptors would decrease fatalities to However, it seems exceedingly unlikely in the event of a Soviet first-strike that all missiles would be directed at population centers. A substantial portion of the offense force would most likely be directed at counterforce targets to minimize retaliation, which would thereby tend to reduce U.S. fatalities even more and increase confidence in system effectiveness.

Additional interceptors are required for protection of the long-range, low-frequency radars. The MSR radars being in areas protected by the main interceptor force will not require further protection. The number of interceptors which can be used for defense of the long-range, low-frequency radars is of necessity limited. The offense can therefore exhaust the radars' defense and then penetrate, destroying the radars. With the long-range, low-frequency radars destroyed, those portions of the country not protected by MSR radars will be without defense. The only recourse which the defense has against this possibility is to make the offense pay as high a price as reasonable for destroying the radars. Perhaps a reasonable price to extract from the offense would be a number of offense missiles sufficiently great that the residual offense force could inflict no more fatalities after destroying the defense than would result if the entire force went against defended populations. The Task Force could only estimate the approximate number of interceptors required to extract this price. This number was a total of a few hundred SPRINT or NIKE ZEUS X-2 interceptors equipped with low-yield warheads to permit terminal intercept.

On this basis, it appeared to the Task Force that the option initially to deploy 1000 NIKE ZEUS X-2 and 1000 SPRINT interceptors together with a capability to deploy an additional 80 of each kind per month was consistent with substantial protection against the non-reactive Soviet threat. The cost of the system (see Table 3) based on 1500 interceptors would be about $6 billion for investment and 5 years of operation and could be deployed in With 2500 interceptors which would provide added protection of populations, the cost would be about $8 billion.

Table 3. REPRESENTATIVE DEPLOYMENT*

| | |
|---|---|
| Equipment | |
| Long-range, Low-frequency Radar and Data Processing | 6-8 |
| MSR and Data Processing | 6-8 |
| ZEUS X-2 Interceptor | 1000 |
| SPRINT Interceptor | 500 |
| Investment-plus-5-year-operating Cost** | $6 billion |
| Time from Decision to Completion | |

*All numbers are approximate.

**This cost assumes about 30 interceptor farms. The system can be deployed into a greater number of farms at a cost of $10-12 million per additional farm.

## Some Technical Problems

1. The Blackout Problem.

Since a significant fraction of the total population is outside areas protected by the MSR radars, the possible severity of the precursor blackout is sufficiently great as to justify some countermeasures. The best countermeasure is the use of very high-frequency radars to assist the long-range, low-frequency radars in the event of blackout. At this time it is not clear what radar should be used. A microwave-dish radar might provide some early, limited capability against blackout. The radar capability could be enhanced by using tracking data on threatening objects from the 266 satellite system. Eventually to cope with high target rates in a precursor environment, deployment of high-frequency, phased array radars, such as MSRs, may be necessary.

Although precursor blackout could be an early reaction to a defense, the Task Force notes that there is doubt that the offense can rely on it to assure the success of a first-strike attack.

It would appear that the offense might require more confident penetration techniques for a first-strike attack and use precursor blackout only for added assurance. For the defense to counter these other penetration techniques, he will have to upgrade his system. Any upgrading of the system will result in less reliance on the long-range, low-frequency radars and, therefore, less concern about precursor blackout.

2. The Long-range, Low-frequency Radar Problem.

The Task Force did not attempt to specify the detailed characteristics of the long-range, low-frequency radar. However, it is clear that it must have certain general characteristics.

It must be capable of long-range acquisition and accurate tracking.

It must be capable of operating in conjunction with co-located interceptors in a terminal self-defense mode.

It should have as much discrimination capability as feasible.

It should have low-frequency to make costs low and penetration techniques more difficult. However, a precise choice of low frequency involves weighing technical capability against cost. In the UHF region, the blackout problem is less severe, tracking accuracy is improved and one can in general obtain narrower beam widths to permit radar operation nearer the horizon. Cost favors the VHF region. In this competition, the Task Force believes that the improved capability may outweigh the additional cost for UHF.

3. The Warhead Problem

The present weapon being considered for the NIKE ZEUS X-2 missile is a high-yield warhead

As a result, its development requires more time than a more conventional design, which does not have both the property of being clean and of radiating high-energy x-rays.

In the long run, the more nearly optimal warhead is desired and therefore its development should be continued.

## Maintaining the Defense

At this time, we can foresee a relatively straightforward and inexpensive upgrading which will probably maintain effectiveness

However, since the Task Force did not have an opportunity to explore this upgrading in the same detail as the initial system, this system upgrading must be considered only tentative. Specifically, this upgrading involves the

The technology for this type of system appears to be at hand, though not yet tested. It is believed, however, that the NIKE ZEUS X-2 missile in its present configuration will have this capability and that by a modification of the missile, it might be given even capability in time for initial deployment and without significant added cost. The optimal radar and optimal system deployment have not yet been determined. It is likely, however, that the MSR could be used, provided the interceptors are deployed into a large number of properly sited farms. If so, about ten or more MSR radars in addition to the 6 to 8 in the initial deployment would appear adequate.

The total cost of the upgrading would appear to be about $1-1/2 billion for the additional MSR radars and could probably be deployed within about a year after initial deployment. Since the cost and the deployment schedule are apparently not affected by a delay in decision to upgrade the system in this way, it would appear best to delay the decision for about 1-1/2 years to permit optimization of the radar and system design. However, the loiter capability of the interceptor should be a part of the initial deployment.

In the longer run, the system can include an extensive terminal defense capability by addition of SPRINT interceptors and TACMAR radars. Also some radars might be deployed outside the U.S. to improve the area-defense capability. Moreover, one can foresee a number of subsystems currently in the R&D phase, which could provide the system with a rapidly increasing effectiveness. Such subsystems include the use of the 266 satellite

While one cannot be sure which subsystem developments will prove feasible and effective, one can be sure that feasible and effective subsystems will evolve from a continued vigorous R&D program.

However, besides the technological aspects of maintaining system effectiveness, it is clear that an organizational mechanism is necessary to assure review of Soviet progress and rapid and responsive upgrading of the system if required.

While the Task Force could not define in detail the proper organizational mechanism, it could foresee the need for three critical elements. First, continuing and complete review of Soviet progress on penetration developments should be undertaken. On the basis of this continuing review, determination should be made of the most suitable technology, if any, which should be added to the system to meet the growing threat. At each budget cycle a decision can then be made whether or not it is feasible to continue the competition with the Soviet Union.

Second, there should be an organizational mechanism for translating the most useful results of advanced research on defense technology into a form which can be rapidly and effectively deployed into the system to meet advances in offense technology.

Finally, based upon the magnitude of the system, its complexity, and its critical dependence on responsiveness, a system-manager type of organization for the system would probably be necessary. By this means, with suitable authority and vertical organization, direct communication with other DoD agencies will be possible together with efficient and responsive planning, direction, and control of the system.

## A Critical Decision

The Task Force recognized that the effectiveness of the ABM defense against an evolving Soviet offense may not be maintainable indefinitely with confidence except at great cost. Such a possibility does not appear to be a strong argument against proceeding now with the system.

If such a time should come when the U. S. defense can no longer compete effectively with the Soviet offense, the system will still have a limited deterrent, and possible virtual attrition, value against the Soviets—but more critically it will be effective against the Chinese or any other threatening nuclear power.

## The China Problem

If protection against a Chinese threat is the only consideration, some changes in the above discussed ABM system would appear desirable. The same type of system would appear suitable since it is clear that the initial defense against the first Chinese ICBM or SLBM capability need not be sophisticated in order to be highly effective for damage denial. However, since Chinese force levels will be considerably less than Soviet force levels for some time to come, fewer interceptors will be required to cope with the Chinese threat.

The four specific options of Table 1 are reasonable system choices. However, they differ somewhat in effectiveness. Options 2 and 3 do not include MSR radars for defense against the SLBM. Option 4 includes sufficient MSR radars only for the protection of the U.S. west coast. The Task Force concluded that with slight modification, Option 1 in Table 1 was the best choice for an initial defense against the Chinese. The modification is to reduce the number of MSR radars from 12 to 6 or 8 and to add 3 firing batteries with a total of 60 NIKE ZEUS X-2 interceptors and to add about 100 to 150 interceptors for radar defense. The system cost decreases slightly and the time for deployment becomes comparable to the other options. The additional batteries are needed for complete coverage of the U.S. The reduction in the number of MSR radars results from restricting their use to the SLBM threat. While the west coast alone could be protected with 3 to 4 MSRs, the Task Force felt that the threat to the east coast was sufficiently great so as to justify its protection as well.

The proposed system can probably cope with about 20 offense missiles aimed at a single point before penetration is possible. The system can be upgraded to cope with greater numbers of offense missiles simply by augmenting with more interceptors at an exchange rate of about 15 interceptors, one additional interceptor at each of the 15 interceptor farms ($27 million), to one offense missile. If penetration aids are developed with the initial offense force, fewer offense missiles can be dealt with. Even in this case the system can maintain its effectiveness at reasonable cost simply by increasing the number of interceptors and barraging, with several interceptors, a threatening cloud made up of warhead and penetration aids. Eventually, however, as Chinese force levels and sophistication increase, the type of defense evolution discussed above to cope with the Soviet Union would have to be applied to the Chinese threat.

While speed of deployment is less important against the Chinese threat than against the Soviet threat, nonetheless there are advantages to be gained by speed. Rapid deployment will permit maximum time for U.S. experience and training before a serious threat develops. Perhaps even more importantly, rapid deployment of the smaller system will provide the U.S. with a system capable of deterring small

Soviet attacks for a period of time before the Soviets react with suitable penetration techniques.

Recommendations

1. If a decision to deploy an ABM defense against the Soviet Union is made, the Task Force recommends that the deployment be as rapid as possible in order to minimize the time available for Soviet reaction.

2. The recommended defense is primarily a high-altitude area system which can be deployed in at an investment plus-5-year-operating cost of about $6 billion. The system should contain:

(a) 4 to 6 long-range, low-frequency radars deployed along the northern border of the U.S. and possibly an additional 2 along the southern border (used in conjunction with the FPS-85) for detection and tracking the ICBM threat. These radars should be suitably designed to assure that they can be used in a terminal self-defense role. If the NIKE ZEUS X-2 is used as the self-defense interceptor instead of SPRINT, the low-yield option for its warhead must be optimized for the terminal defense role.

(b) 6 to 8 MSR radars deployed along the east and west coasts for detection and tracking of the SLBM threat as well as for some limited area and terminal defense capability.

(c) Initially about 1000 NIKE ZEUS X-2 interceptors with a loiter capability—perhaps including the modification for increased capability—together with an additional few hundred interceptors for radar defense. The number of interceptors should be increased to about 2500 at the rate of about 80 interceptors per month.

The interceptors should be deployed into as large a number of properly sited farms as feasible in order to maximize the flexibility of the system to deal with self-blackout, to make use of its initial limited-area-loiter and terminal-defense capability, and to provide for future upgrading. As a means for minimizing the impact of precursor blackout, consideration should be given to co-locating high-frequency radars with the long-range, low-frequency radars and operating these radars in an acquisition-and-track mode—possibly with the assistance of the 266 satellite. Since deployment of the currently proposed NIKE ZEUS warhead on a

3. Because system optimization depends upon rapid response, a system-manager type organization is probably required to manage the system. In addition, there should be an organizational mechanism to insure a continuing review of the Soviet threat to determine required system upgrading, if any.

4. The Task Force recommends that detailed design of an area-loiter defense system be initiated immediately. The system design should include a determination of the optimal radar for the area-loiter capability to be used with the NIKE ZEUS X-2 interceptor.

5. If the initial ABM system is to be deployed only against the Chinese threat, the Task Force recommends deployment of a less extensive area defense system than in Recommendation 2. The long-range radars along the southern border of the U.S. are probably not necessary and about 400 interceptors are probably sufficient initially. While such a system designed specifically against the Chinese is somewhat cheaper than one for defense against the Soviets (about $4 billion compared with about $6 billion) and can be deployed on a less urgent time scale, it appeared to the Task Force that the additional $2 billion is justified to achieve the greatly increased system capability to cope also with the Soviets.

6. In order to minimize the likelihood of an early offense penetration reaction to a U.S. ABM deployment, the Task Force urges that the nature, characteristics and growth potential of the system be kept as secure as possible.