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Soviet Strategic Defenses

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Abstaining:

The Assistant to the Director, Federal Bureau of Investigation, the subject being outside of his jurisdiction.

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Soviet Strategic Defenses

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SOVIET STRATEGIC DEFENSES

SUMMARY CONCLUSIONS

I. THE PRESENT STATUS OF SOVIET STRATEGIC DEFENSES

A. Confronted for many years with a strategic threat from the US much greater in size and complexity than that which the US faced from the USSR, the Soviets have regularly expended greater resources on strategic defense than the US. Consequently, they have deployed the most extensive and, in some respects, most modern strategic defenses in the world. This Estimate treats mainly those Soviet forces designed to defend the USSR against manned bombers and their air-to-surface missiles (ASM), against ballistic missiles, and against ballistic missile submarines in the open ocean. Briefer treatment is given to Soviet capabilities to render inoperable or destroy satellites in orbit, and to civil defense.

B. As total Soviet outlays for military and space programs grew during the 1960s by some 50 percent, the proportion devoted to strategic defense remained constant at about 15 percent. (This compares to about 15 percent for intercontinental and peripheral strategic attack, 25 percent for general purpose forces, and 45 percent for command and general support, research and development (R&D), and space programs for the decade of the 1960s as a whole.) Of the share for strategic defense, about 75 percent went to air defense, 5 percent to ballistic missile defense, and the remainder to antisubmarine warfare (ASW).[1] Expenditures for these defenses in 1970 approximated 3 billion rubles (the equivalent of about $9 billion).[2] These figures, however, represent only the cost of producing, deploying, and operating already developed weapons systems. They do not include amounts allocated to R&D, which we cannot quantify, but which are very substantial, and are especially significant in the fields of ballistic missile defense and ASW.

Air Defense

C. As a result of this effort, we estimate that the Soviets had on 1 January 1971 a strategic air defense establishment with some 3,300 ground-based radars, 3,300 interceptor aircraft, and over 10,000 surface-to-air missile (SAM) launchers at 1,200 sites. During the past few years they have introduced new automated techniques in order to control these forces more rapidly and effectively. The airborne warning and control (AWAC) aircraft, Moss, is now believed to be operational and capable of limited overwater patrols for early warning, and probably airborne intercept control. Their integrated systems provide excellent defense against bomber attacks at medium and high altitudes. Defense against current air-to-surface cruise missiles (ASMs) at these altitudes is almost as good.

D. The Soviets still have not solved fully the problem of intercepting aircraft coming in at low altitudes. Soviet capabilities against aircraft flying below about 1,000 feet remain limited, although gradual improvements have continued over the past several years. For example, in the Leningrad area ground-based radars on masts probably can now provide continuous tracking of an aircraft flying as low as about 200 to 300 feet. The SA-3 has been modified to permit intercepts down to about 300 feet, and deployed more widely. Some models of the SA-2 may also now be able to intercept at altitudes as low as 300 feet in favorable locations, although 500 to 1,000 feet is a more general low-altitude limit. The Firebar interceptor aircraft can attack targets down to about 600 feet, and perhaps somewhat lower over

[1] The forces costed under ASW are multi-missioned naval forces. For the purposes of this Estimate we have included the entire cost of these naval forces under ASW although the specific portion of their cost which is dedicated to countering the US fleet ballistic missile force cannot be distinguished from those costs incurred in acquiring their other mission capabilities.

[2] The dollar figures (appearing in parentheses after the rubles) are approximations of what it would cost to purchase and operate the estimated programs in the US.

water and flat terrain. To engage penetrating aircraft at such low altitudes with a variety of weapons, however, puts a very heavy burden on the command and control network.

Ballistic Missile Defense

E. During the past eight years the Soviets have installed a ballistic missile early warning system on the periphery of the USSR and an antiballistic missile (ABM) system around Moscow. Additional early warning radars are still under construction, and an improved ABM system is under development at Sary Shagan. The Moscow ABM system is not yet maintained at a high state of readiness. Tests of the Galosh interceptor missile show that it can attack an incoming missile either outside the earth's atmosphere at long ranges, or within the atmosphere at much shorter ranges; the use of both modes against a single target allows a two-layer defense with an improved probability of success. But the system cannot discriminate between re-entry vehicles (RVs) and decoys and chaff outside the atmosphere. Moreover, since the interceptor missile does not have very high acceleration (unlike the US Sprint), it cannot wait for the sorting of RVs and penetration aids by the atmosphere before being launched.

F. Assuming optimum conditions, our theoretical calculations indicate that the Moscow ABM system, using a two-layer defense, could at best successfully engage about 45 ICBM targets before running out of interceptor missiles. Decoys and chaff puffs would appear as valid and separate targets, and their use could rapidly exhaust the missiles on launcher. The system could handle an equal number of submarine-launched ballistic missile targets if they arrived from sectors covered by large acquisition and tracking radars. In an attack from other directions, however, such as from the western Mediterranean, the defenses would have to rely on engagement radars at the missile sites for acquisition of targets and could be saturated by a relatively light attack.[3]

G. Because of its long range, the Moscow system has an inherent capability to defend regions outside the Moscow area, but it can pro-

[3] Vice Adm. Noel Gayler, the Director, National Security Agency, believes that with respect to command and control, the performance of the Moscow ABM system on its first full-scale test—when actually under ballistic missile attack—is almost certain to be well below design level. The cumulative effect of its various weaknesses suggests that the Moscow system has little capability to defend Moscow, except against a small and unsophisticated attack.

tect such regions with only a single layer, and therefore quite thin, defense. This area defense would be more effective against attacks by a small third country or an accidental or unauthorized launch, as the number of targets would be small, and several interceptor missiles could be sent against one target. The ability of the Moscow system to protect Moscow and its environs from a moderate, unsophisticated attack, and its ability to defend a much larger area against a light attack, make it well suited to the National Command Authority (NCA) type of defense which has been proposed at the strategic arms limitation talks (SALT).

H. There is ample evidence that currently deployed Soviet SAMs have not been modified to provide them with a ballistic missile defense capability. It is technically feasible, however, for the Soviets to augment their ballistic missile defense by upgrading their SA-2 and SA-5 systems for such a purpose. The marginal effectiveness of additional ballistic missile defense which would result, along with the degradation in bomber defenses that almost certainly would result, make it a very unlikely Soviet course of action. It is agreed within the Intelligence Community that even in an arms control environment, in which Soviet opportunities to deploy ABM defenses would be limited, the shortcomings of upgrading SAMs for an ABM role would be recognized by the Soviets and would discourage them from following such a course.

Defense Against Ballistic Missile Submarines

I. During the past three years the Soviets have deployed new surface ships, submarines, and aircraft with improved sensors and weapons which represent a concerted effort to deal with the problem of detecting, identifying, locating, and destroying nuclear-powered ballistic missile submarines in the open ocean. There is general agreement that the sonars on new surface ships and submarines represent an improved capability to detect and maintain contact on target submarines, although the degree of improvement remains debatable. (See alternative views in Section IV.) The Soviets are employing two new ASW Moskva-class helicopter ships, which operate as the leaders of a task force and greatly improve their capability for surface search for submarines. New nuclear-powered attack submarines have more powerful sonars, greater speeds, and operate more quietly. Two new ASW aircraft have much greater range and load carrying capability. The Soviets are also experimenting with fixed hydroacoustic arrays and with new types of moored and air-dropped buoys.

J. Despite these improvements, the Soviets are still a long way from developing an effective defense against ballistic missile submarines operating in the open ocean. For one thing, although two Moskva-type task forces may be able to place some constraints on Polaris operations in the Mediterranean, they do not constitute a significant threat to the survivability of Polaris submarines operating there. Because of the larger areas to be searched, the capability of these task forces against Polaris submarines in the relatively unrestricted waters of the Atlantic and Pacific Oceans, and the Norwegian and Barents Seas would be even more limited.[4]

K. Lacking an open-ocean search capability, the Soviets might employ their new submarines to detect ballistic missile submarines at vulnerable points in their mission, while they are leaving port or passing through narrow straits, for example, and trail them to their open-ocean operating areas. Such trailing tactics might be either covert or overt. But present Soviet submarines still are unable to detect and trail covertly a Polaris submarine while it is on, or en route to, station. Their noise levels are still higher than Polaris. This not only degrades the performance of their sonars but also makes it virtually impossible for them to approach close enough to a Polaris submarine to trail it with passive sonar without being detected themselves. Elimination of the problem probably would require redesign of the submarines.

L. Overt detection and trail of patrolling or transiting Polaris submarines is a more likely possibility. The speed advantage and sonar performance of the new V-class submarine are such that they may have reduced the effectiveness of present US countermeasures in breaking trail. The theoretical Soviet capability of maintaining an overt trail does not now constitute a significant threat to the survivability of the Polaris deterrent, however, since there are not enough V-class submarines to conduct such trails on a sufficient number of Polaris submarines simultaneously, and since construction of the V-class is currently at a rate of only two a year. Moreover, the problem of initial detection remains.

[4] Maj. Gen. Rockly Triantafellu, the Assistant Chief of Staff, Intelligence, USAF, does not agree with judgments expressed in this paragraph. For his views, see his footnote to Section IV, page 50.

Antisatellite Defense

M. The deployment of an extensive space tracking network and the development of an ABM system have provided the Soviets with an antisatellite capability as a by-product. We believe that a non-nuclear intercept capability has been demonstrated and could be used at any time against selected US satellites. The Moscow ABM system as located at Moscow and at the Sary Shagan test center has the accuracy and guidance to kill satellites with non-nuclear weapons at altitudes up to about 300 nautical miles (n.m.), at slant ranges of a few hundred n.m. The system could also be used in a ballistic intercept mode against satellites up to about 450 n.m. altitude, although this might require use of a nuclear warhead. The Soviets have also demonstrated a capability to perform orbital intercepts using maneuverable satellites. In tests, wherein the target and interceptor were launched so as to be in the same plane, the interceptor maneuvered in-plane to overtake and close on the target. A fully operational system would require greater flexibility than was displayed in these tests.

II. FUTURE PROGRAMS AND CAPABILITIES

N. The Soviets have traditionally been preoccupied with defense and willing to expend the necessary resources for nation-wide defense in depth. The momentum of existing programs will continue for at least several years and keep the commitment to strategic defenses high. Moreover, the forces capable of mounting a nuclear attack on the USSR will continue to grow in extent and complexity, as the US brings in new systems, its NATO Allies continue to develop their nuclear armaments, and the nuclear capability of Communist China grows. The resources devoted to strategic defense will reflect such considerations as the status of technological development, bureaucratic competition for scarce resources, and general policy aims. Of these, technological development will probably have the most influence on future capabilities.

Technological Development

O. Since World War II, strategic offensive innovations have usually exceeded the capacity of defensive technology to counter them. The resulting defense lag is most acute in two areas: that of providing sensors—radars and sonars—to detect, identify, and keep track of targets, and that of providing the computers and associated equipment needed to process the information on which defensive systems operate. For without sensors and processing equipment to pinpoint the target accurately, the task of destroying it becomes very difficult, if not impossible. The principal defensive problems being encountered by the Soviets stem from the inability of current technology to provide sufficiently effective equipment at costs which permit widespread deployment.

P. *Air Defense.* The principle continuing problem in Soviet air defense is development of an effective capability to intercept low-altitude intruders. The major problem of low-altitude air defense lies in the fact that in most of the current radars, the echoes from attacking aircraft are lost in reflections from terrain features. An airborne radar system which can look down over land, as well as over water, and see targets against the background return from the terrain, would offer significant advantages over a vast proliferation of ground radars, however improved. The Soviets are undoubtedly working on the technology for an airborne warning and control system (AWACS) with an overland look-down radar, though apparently at a slower pace than estimated several years ago. As the required capabilities have not yet been demonstrated by the Soviets, its introduction before 1976 now seems unlikely.

Q. An interceptor that would work with the AWACS, utilizing a look-down air intercept radar and missiles with radar guidance that would enable them to engage aircraft penetrating at lower altitudes, is a Soviet requirement which will probably be met in the mid- or late-1970s. Such a system could be put on a further development of the new Mach 3 Foxbat interceptor just deployed, on a new interceptor specifically developed for this role or, more likely, on both.

R. Another defense problem for the future will be that of intercepting ASMs now under development to be carried by US bombers. These nuclear-armed ASMs will not only present extremely difficult targets to Soviet air defenses, but they will also pose a saturation problem to Soviet air defense command and control systems. In order to intercept these ASMs with SAMs—there will be too many to attempt to do so with interceptor aircraft—the Soviets would have to upgrade considerably their current SAMs or deploy widely a new SAM system, or both. The modifications required to the SA-2 (if such were to be made) would include substantial changes in—or even replacement of—

the radar, shortened reaction times, and faster interceptor missiles. These modifications, incidentally, might pose a serious intelligence problem because they might be confused with those for the upgrading of SAM systems for ABM use.

S. *Antiballistic Missile.* Soviet ABM development has been limited by the capabilities of radar systems to acquire a target, to tell whether the launch unit should shoot at it, and to do this in time if there is a large number of potential incoming targets. The development of new phased-array radars should provide significant increases in target handling capabilities for a follow-on ABM system in the mid-1970s or later. We believe that the Galosh missile of the Moscow system has sufficient propulsion flexibility for use in a loiter mode, i.e., a mode in which the interceptor is launched toward the general vicinity of the incoming objects, flies at reduced thrust until the target can be identified as it enters the atmosphere, and is then directed to the target at accelerated thrust. The loiter thus utilizes atmospheric sorting of RVs, but does not require a very high acceleration interceptor missile.

T. We believe a new defensive missile system is being developed in what may be a new complex at Sary Shagan. Galosh-type interceptor missiles are being tested at one launch site within the complex. The possibility of an air defense role cannot now be ruled out. The weight of our limited evidence indicates, however, that these components will probably have a significant ABM capability and that the system is probably intended to fulfill an ABM role. The Soviets may be developing a system utilizing a two-layer defense consisting of a modified Galosh in association with a new smaller missile and new radar. It might be used to increase the effectiveness of defenses around Moscow and may lend itself to rapid deployment.

U. *Antisubmarine Warfare.* The fundamental limitation of Soviet ASW remains the difficulty of detecting a submarine in the open ocean. We expect that Soviet sonars will continue to be improved during the 1970s, and that their submarines will be made more quiet. Even with the improvements projected for the end of the decade, however, a new submarine could not gain an advantage over Polaris sufficient to give any significant probability of maintaining covert trail for an extended period. The Soviet use of long-range acoustic detection systems is now limited by geographic and hydrogeographic conditions around the periphery of the USSR. Development of remotely emplaced acoustic detection systems may enable the Soviets to overcome this limitation in the next 10 years. To do this, however, would require significant improvements in their sensors and undersea cable technology. In any event, an open-ocean search or trailing capability, utilizing acoustic means of detection, and sufficient to neutralize the on-station force of Polaris submarines, appears beyond the reach of the Soviets during the 1970s.[5]

V. But we are not so confident in our judgments with regard to non-acoustic sensor developments. Non-acoustic methods seek to exploit thermal or electromagnetic radiation from the submarine, disturbances of the earth's magnetic field caused by the submarine, or characteristic wakes created as it passes through the ocean. There is evidence that the Soviets are seriously investigating various techniques of non-acoustic detection. But we have almost no technical information about their programs. [redacted] If significant Soviet progress should occur, the result might be a decidedly improved Soviet system for search of the open ocean. Though we might become aware that the Soviets were detecting US submarines with unexpected success [redacted] the development might come as a technological surprise.[6] There would, of

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[5] Maj. Gen. Rockly Triantafellu, the Assistant Chief of Staff, Intelligence, USAF, does not agree with judgments expressed in this paragraph. For his views, see his footnote to Section IV, page 50.

[6] Mr. Leonard Weiss, for the Director of Intelligence and Research, Department of State; Vice Adm. Noel Gayler, the Director, National Security Agency; and Rear Adm. Frederick J. Harlfinger, II, the Assistant Chief of Naval Operations (Intelligence), Department of the Navy; believe [redacted] the likelihood of technological surprise very small. Mr. Leonard Weiss, further believes that the translation of such a development into an ASW weapon system capable of neutralizing the US missile-launching submarine force would still be a major undertaking extending over a period of several years, and doubts that such a capability would come as a surprise to the US.

course, still remain the problem for the Soviets of incorporating these techniques into an effective counter to the US fleet ballistic missile force.

W. *Antisatellite Defense.* Efforts made thus far indicate the Soviets will have in the coming decade a tested non-nuclear antisatellite capability based upon their maneuverable satellite and ABM programs. As these two programs grow in sophistication and to the extent that additional ABMs are deployed, antisatellite capabilities will grow. A reliable capability for non-nuclear disabling of satellites up to and including synchronous altitudes (19,800 n.m.) can be expected in the late 1970s, and any widespread deployment of ABM defenses will increase the opportunities for attacking satellites in low-earth orbit. In addition, a laser system capable of producing physical damage to the film, the optical system, and other components of a satellite, could be available for use by the mid-1970s.

Strategic Alternatives

X. Developments in Soviet strategic defense forces over the next two or three years are reasonably clear, as they result from construction programs now discernible. Thereafter the alternatives open to the Soviets in the planning of their future strategic defenses become increasingly varied. A major indeterminate factor at present is the possibility of a strategic arms limitation agreement. If one is agreed upon, explicitly or tacitly, it may be limited to an agreement on ABM deployment, or it may be more comprehensive, including means for intercontinental attack as well. In these cases the Soviets might at a minimum accept mutual deterrence as a basis for strategic defense and do little more than complete current deployment programs. Without an agreement, they might continue to develop their forces at rates consistent with past trends, or they might attempt to achieve a maximum defense posture through greatly expanded deployment of improved and new air defense, ABM, and ASW systems. As between the various defensive forces concerned, they might continue to emphasize air defenses, while concentrating mainly on R&D programs in the ABM and ASW fields in a search for better solutions before deploying new systems. Or they could deploy ABM and ASW systems widely, with less emphasis on air defense. Within each of these general courses of action a large number of strategic force developments could take place.

Y. The various uncertainties summarized above make it evident that no exact estimate of the future Soviet force structure, at least after about the end of 1972, could be defended. We have therefore constructed in Section VII of this Estimate, several illustrative force models to depict selected possibilities. The first, called Force Model I, represents little more than a completion of programs presently under way; it seems unlikely the Soviets would stop at this. Another model, Force Model IV, is representative of what we believe would be a rough upper limit, short of converting to a wartime basis, especially if it were to accompany extensive deployment of intercontinental attack forces; this also appears unlikely.

Z. Between these models we have set forth two others which we consider to be more likely, but under differing conditions. Force Model II illustrates the level of effort and technical progress that might obtain if there were to be a comprehensive arms control agreement. Force Model III illustrates an approximate level of effort and of technical progress we think likely in the absence both of an arms control agreement and of a significant step-up in the arms race. But we wish to emphasize that all of these models are strictly illustrative, and not to be regarded as confident estimates or as projections for planning. As one moves beyond the next two years or so, all projections become increasingly uncertain; beyond five years they are highly speculative.

DISCUSSION

I. THE SOVIET APPROACH TO STRATEGIC DEFENSE

A. The Threat to the USSR and the Soviet Response

This section reviews successive stages in the Soviet response to the developing strategic threats to the USSR, and tells briefly how Soviet expenditures for strategic defense have reflected this development. Finally, the section indicates three continuing problem areas of Soviet strategic defense—against low-flying aircraft, against ballistic missiles, and against ballistic missile submarines—which are technically very difficult and for which the USSR has not yet developed a satisfactory answer.

1. Twenty-five years of intensive development have provided the Soviets with the most extensive and in some respects, most modern strategic defenses in the world. Soviet strategic defense forces have gone through several stages of development since World War II in response to changes which the Soviets have perceived in the threat facing them. The last two decades have seen both Soviet defenses and US offensive forces interacting in such a manner as to produce the substantial capabilities that today exist on each side.

2. Confronted through the mid-1950s with large US strategic bomber forces, the Soviets built large numbers of interceptor aircraft, reinforced at Moscow with numerous surface-to-air missiles (SAMs). As the US improved its bombers, the Soviets in turn developed faster interceptors. By the late 1950s, the US responded to expanding Soviet defenses by introducing low-altitude penetration tactics and air-to-surface missiles (ASMs) for standoff attack; and the Soviets countered by developing interceptors and SAMs with improved capabilities against low-altitude targets as well as longer range interceptors and SAMs to counter the ASMs.

3. In the early 1960s, intercontinental ballistic missiles (ICBMs) and submarine-

launched ballistic missiles (SLBMs) were added to the threat originally posed by bombers and by nuclear-capable tactical aircraft based around the periphery of the USSR. The increase in the size and diversity of US strategic attack forces had a tremendous impact on Soviet strategic defenses. It caused the Soviets to expand and modernize their air defense forces, to develop and deploy a ballistic missile defense system, and to expend considerable resources in efforts to improve their antisubmarine warfare (ASW) capability.

4. Soviet leaders are deeply concerned about the threat from NATO, particularly US tactical air and missile forces in the forward area. The Soviets consider nuclear-capable US forces based in Europe and Asia and on aircraft carriers to be strategic weapons since those forces could be used to attack strategic targets in the USSR. In addition, the Soviets now are faced with two potentially hostile nuclear-armed NATO nations—Great Britain and France—both with small but growing strategic attack capabilities.

5. Finally, China's emerging nuclear attack capability has become a factor of growing concern to Soviet military planners. We believe that the Soviets have been steadily improving their air defense installations near the border with China and there probably has been some increase in SAM, aircraft, and antiaircraft artillery (AAA) deployment there. Soviet concern for the Chinese ballistic missile program is reflected in the construction of large early warning (EW) radars, some of which probably are oriented toward China.

6. Soviet decisions about how to respond to these threats have been affected not only by the way in which the Soviets view them, but also by the pace of technological developments and the extent to which the leadership has been willing to commit manpower and economic resources. The present Soviet leadership has shown a general disposition to accommodate military programs, and military expenditures have continued to rise. Moreover, within the military establishment, strategic defense has long enjoyed a favored position. Both in absolute terms and as a share of the total military budget, the Soviets strategic defense effort is larger than that of the US.

B. The Cost of the Program

7. From 1950 through 1970, the Soviets spent an estimated 45 billion rubles—the equivalent of $130 billion—on strategic air and missile defense forces and on forces for ASW. As total Soviet outlays for military and space programs grew during the 1960s by some 50 percent, the proportion devoted to strategic defense remained constant at about 15 percent. (This compares to about 15 percent for intercontinental and peripheral strategic attack, 25 percent for general purpose forces, and 45 percent for command and general support, research and development (R&D), and space programs for the decade of the 1960s as a whole.) During the 1960s, of the share for strategic defense, about 75 percent went to air defense, 5 percent to ballistic missile defense, and the remainder to ASW.[7] Expenditures for these purposes in 1970 approximated 3 billion rubles (the equivalent of about $9 billion).[8]

[7] The forces costed under ASW are multi-missioned naval forces. For the purposes of this Estimate we have included the entire cost of these naval forces under ASW although the specific portion of their cost which is dedicated to countering the US fleet ballistic missile force cannot be distinguished from those costs incurred in acquiring their other mission capabilities.

[8] The dollar figures (appearing in parentheses after the rubles) are approximations of what it would cost to purchase and operate the estimated programs in the US.

These figures, however, represent only the cost of producing, deploying, and operating already developed weapons systems. They do not include amounts allocated to R&D, which we cannot quantify but which are very substantial and are especially significant in the fields of ballistic missile defense and ASW. (See Figure 1.)

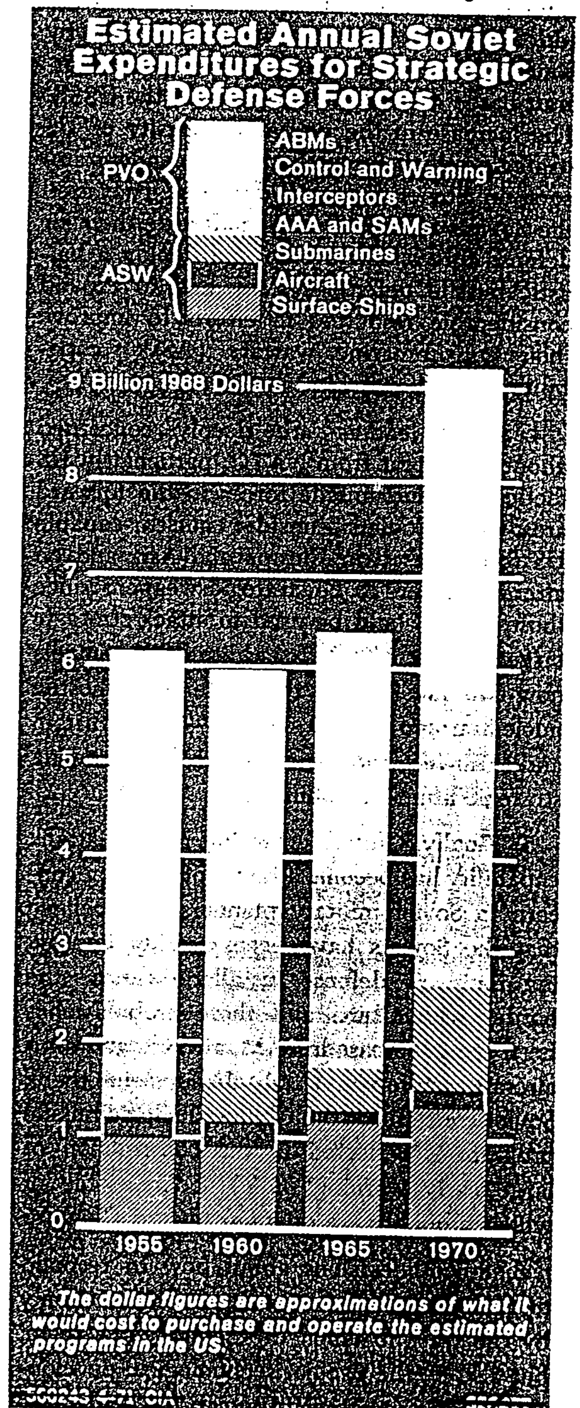
C. Major Continuing Defense Problems

8. As the Soviets view the future, they face the fact that the US has begun planning or is already deploying systems which could significantly degrade their ability to defend themselves against a strategic attack from the West. These include the B-1 strategic bomber, advanced ASM, improved SLBMs, and multiple independently targetable re-entry vehicles (MIRVs) for ICBMs and SLBMs. Moreover, by the late 1970s, China probably will have a limited but nonetheless significant capability for delivering nuclear weapons to virtually any part of the USSR. Thus, the size and diversity of the threat continues to grow, creating new problems for Soviet defense planners before they have fully solved the old ones.

9. Three special problems continue to face Soviet strategic defense planners: defense against aircraft attacking at low altitudes; defense against ICBMs equipped with sophisticated penetration aids; and defense against ballistic missiles launched from submarines. The failure to solve any one of these problems can undermine progress made with respect to the others.

10. *The Low-Altitude Problem.* Soviet capabilities against aircraft penetrating at altitudes below about 1,000 feet remain limited. Steps are being taken to improve these capabilities, such as more widespread deployment of the improved version of the SA-3 low-altitude SAM

Figure 1



system. But even as the Soviets begin to take steps to counter this shortcoming, new standoff attack weapons threaten the effectiveness of Soviet air defenses at higher altitudes.

11. *The Antiballistic Missile (ABM) Problem.* The Soviets have the world's only operational ABM system and are believed to be developing a follow-on system at the Sary Shagan test range. There is still no evidence of ABM deployment outside the Moscow area, however, and our analysis indicates that the Moscow system, as presently configured, has significant weaknesses. Among these are the limited number of launchers and its inability to discriminate between re-entry vehicles (RVs) and the penetration aids which have become a part of the US ballistic missile threat. In its current form, the Moscow ABM system provides long-range radar coverage of the US ICBM threat corridor, but covers only a part of the multidirectional threat from Polaris submarines.

12. *The ASW Problem.* In the absence of an effective nation-wide ABM system, the Soviets for the foreseeable future, must rely primarily on their antisubmarine forces to counter the Polaris threat. Recognizing this, the Soviets have built and continue to build new ASW ships, submarines, and aircraft and are equipping them with improved ASW sonars and weapons. They are vigorously investigating non-acoustic detection techniques which may have an application to the ASW problem. They are also developing new tactics for the use of submarines, ships, and aircraft in integrated antisubmarine operations. Despite these efforts, we believe the Soviets have not developed a reliable capability to detect, identify, and locate Polaris submarines operating in the open ocean.[9]

[9] Maj. Gen. Rockly Triantafellu, the Assistant Chief of Staff, Intelligence, USAF, does not agree with judgments expressed in this paragraph. For his views, see his footnote to Section IV, page 50.

13. The estimate which follows considers in some detail the efforts which the Soviets have made to cope with the problems of strategic defense. It treats both the forces which they have deployed for this purpose—air defense, ABM, and ASW—and the special defensive problems which are likely to dominate the development of those forces over the next decade. Consideration also is given to Soviet efforts to develop an antisatellite capability and an improved civil defense program. Finally, the estimate provides four force models to illustrate the possible course and scope of Soviet strategic defenses in the coming decade.

II. STRATEGIC AIR DEFENSE

A. Introduction

14. The strategic aircraft threat perceived by the Soviet Union consists of a variety of aircraft ranging from intercontinental bombers to forward-based tactical aircraft capable of delivering nuclear weapons to targets within the Soviet Union. Attack may come from virtually any direction and could take many forms, such as supersonic attack at medium or high altitudes, low-altitude penetration aimed at defeating the radars upon which Soviet air defenses rely, or the launch of small, fast ASMs from aircraft flying well beyond the borders of the USSR.

15. The variety of options available to an attacking force calls for variety in defensive measures and weapons. Long-range interceptors able to operate hundreds of miles beyond the border are necessary to attack aircraft before they launch ASMs. Long-range SAMs deployed in peripheral barriers are needed to intensify this defense before actual penetration of the defended territory occurs. Aircraft, SAMs, and AAA are required to provide both area and point defense within the

country itself. To use such defenses effectively requires that they be directed in a coordinated fashion and be provided with rapid collection, processing, and transmission of information about both attacking and defending forces.

16. The USSR has made a concerted effort to insure the coordinated use of radar facilities, interceptor aircraft, and SAMs by creating an elaborate command and control system. Air defense systems have been deployed in great numbers. Older equipment has been modified and improved, and new equipment has been introduced to meet new threats. The result is a diversity of equipment, redundancy, an impressive "force-in-being", and great momentum in the development and production of air defense systems.

17. An integrated defense system has enabled the Soviets to achieve an excellent capability against bomber attacks at medium and high altitudes. To be sure, careful sequential attack on defensive systems with ASMs, ICBMs, and SLBMs together with electronic countermeasures (ECM) and selected approach routes would significantly degrade medium- and high-altitude defense systems. Defense against *current* standoff ASMs at these altitudes is almost as good. Defense against low-altitude attack by bomber or standoff weapons and against new generation ASMs pose special problems, which the Soviets have not yet fully solved. The search for their solution will likely dominate Soviet efforts in the air defense field over the next 10 years.

B. Organization, Command and Control

Organization of the PVO

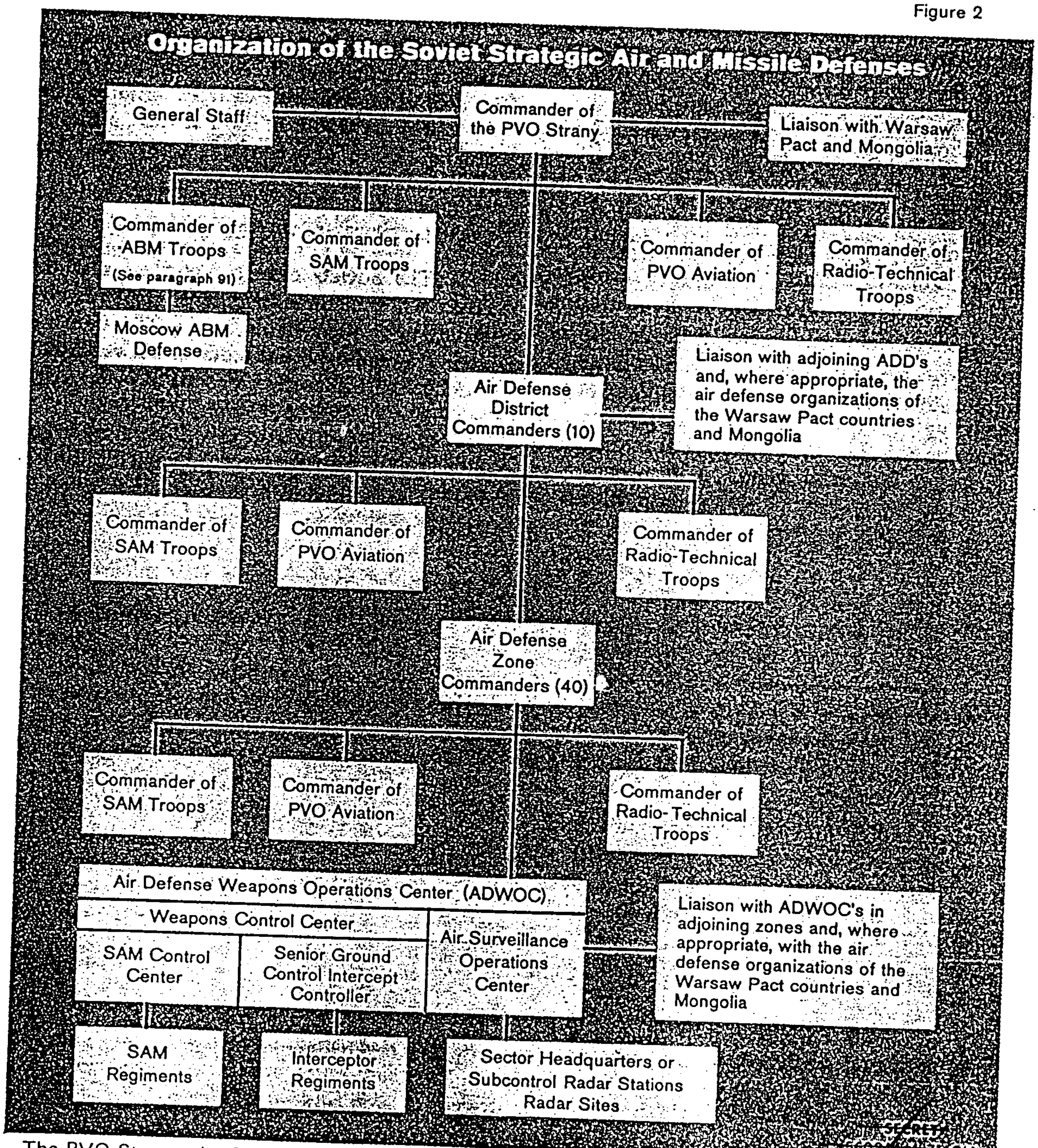
This section describes the organization, command, control, and communications of Soviet defenses against air attack on strategic targets in the USSR. It also illustrates how these elements work together in combined SAM and interceptor operations.

18. The PVO Strany (anti-air defense of the country) in its various organizational forms dates back to World War II. The PVO Strany as it is organized today dates from the creation of the Soviet Ministry of Defense in 1954. At that time, the PVO Strany became a branch of service equal in status to the Ground Forces, the Air Forces, and the Navy. (In 1960 the Strategic Rocket Forces became the fifth branch of service.) It is commanded by a Deputy Minister of Defense, currently Marshal of the Soviet Union, P. F. Batitskiy. (See Figure 2.) The PVO includes three arms of service. The Radio-Technical Troops operate the radars and other electronic systems; the Anti-aircraft Missile Troops man the SAM units; and the APVO (PVO Aviation) [10] is responsible for interceptor aircraft.

19. The PVO exercises control of all its forces through a hierarchical structure of command echelons. Area control of the PVO forces for use against aircraft is the responsibility of 10 air defense districts (ADDs) which are themselves divided into a total of 40 air defense zones (ADZs). The latter constitute the key command echelons in the PVO. Each zone is believed to be responsible for conducting its own defense through its air defense weapons operations center (ADWOC), where operational tasks such as target and weapons assignment and decision to launch are performed. The ADZs are further divided for the purpose of air surveillance reporting. A representative of each of the arms of service is assigned to each ADD and ADZ and,

[10] Previously referred to as IAPVO; since the early 1960s, the Soviets have designated these organizations as APVO. A possible fourth arm, the Antimissile Defense Troops, is discussed in the ABM section of the Estimate.

Figure 2



The PVO Strany--the Soviet strategic defense organization--is one of five independent branches of service under the Soviet Ministry of Defense. Its national headquarters in Moscow exercises operational direction and administrative control through a hierarchical structure of command echelons responsible either for geographic areas or the operation of individual weapons or radars.

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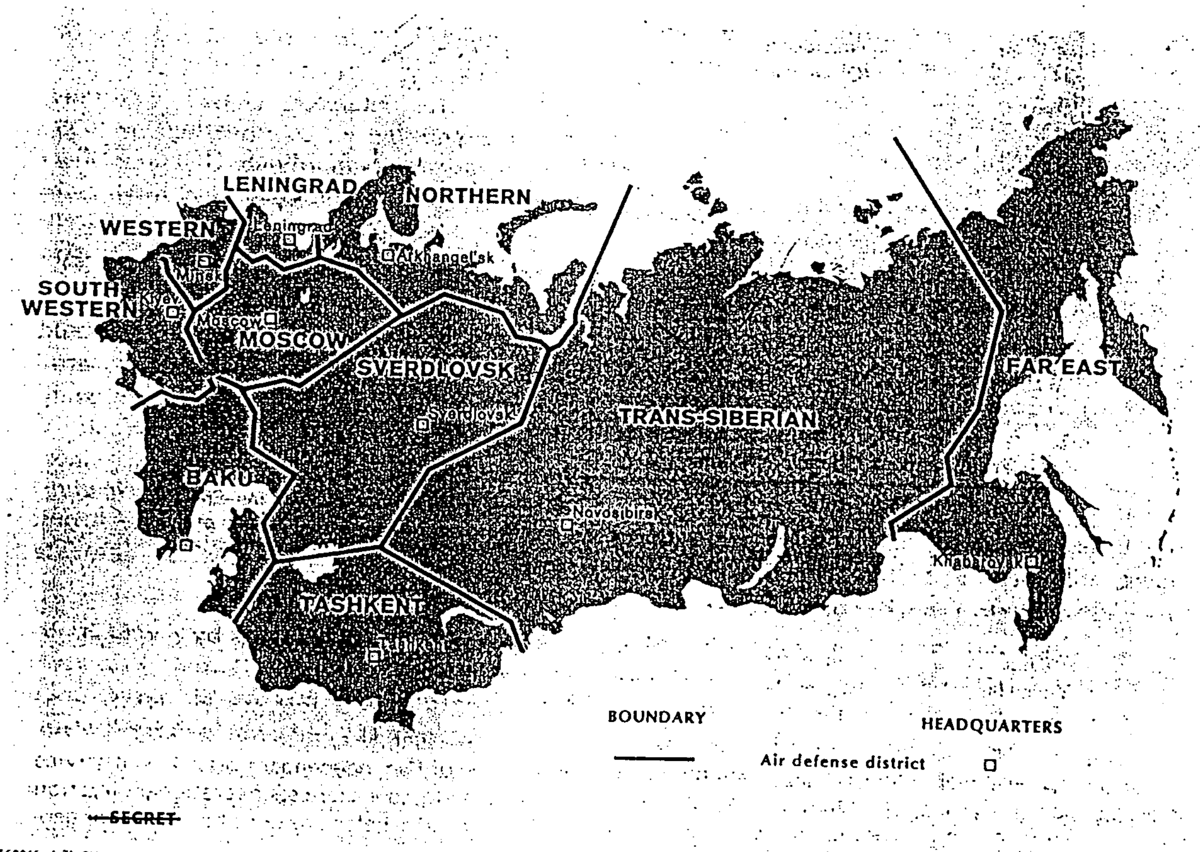
with the commander, they form the battle staffs at the district and zone command centers. (See Figure 3.)

20. The PVO Strany also exercises operational control over air defense elements of the tactical air forces and ground forces at such times as those elements are required for defense of the USSR. Defense of the Groups of Soviet Forces in East Germany, Czechoslovakia, Hungary, and Poland rests with the local Soviet commander, while air defense of each Warsaw Pact country remains a national responsibility. This close coordination of the functions of the PVO Strany, PVO of the field forces, and the Soviet trained and equipped national air defense forces of the Pact countries constitutes a westward extension of air defense of the USSR. In the Far East, a similar situation exists between the USSR and the Peoples Republic of Mongolia.

The Command and Control Network

21. The Soviets clearly recognize that the effectiveness of their air defense depends ultimately upon the reliable and effective operation of a command and control network. The function of this network is to provide data

Figure 3



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collected by the radar network to the weapons elements of the system and to direct and coordinate their responses. The continued introduction of higher performance interceptors and SAMs, together with the need for rapid data transmission systems, have imposed increased requirements on this command and control system. The Soviets continue to place high emphasis on integrating and automating their air defense system.

22. Recent changes have modified the strictly hierarchical structure of the command and control network. As a result, the vulnerability of the system has been reduced but not eliminated. We believe new communications systems have been introduced so as to improve the efficiency, security, and reliability of the network, and that sophisticated operational procedures for coordinating the combined use of SAMs and interceptor aircraft have been established. These procedures probably would be hard to maintain in the confusion of an actual attack.

23. The effective use of radar data determines in large measure the effectiveness of PVO forces. The Soviets have deployed a variety of air defense radars at a number of sites throughout the Soviet Union. (These are discussed in some detail in the section which follows.) In order to increase the reporting speed and reduce the vulnerability of the air surveillance system, the organization of radar elements within the ADZ is being modified. We believe that the old organizational arrangement, still followed in most zones, has each zone divided into a number of air surveillance sectors which evaluate and pass radar information received from subordinate echelons up to zone headquarters. Under the new arrangement, the sector probably will be dropped, and instead, several subcontrol radar stations—each of which controls several radar sites—report air situation data directly to the zone. To provide for the required internetting of ground stations, a system was deployed in the late 1950s and early 1960s. This system is now a key PVO communications system for point-to-point transmission of tracking data.

24. Control of SA-2 and SA-3 SAM sites is generally exercised through SAM regimental headquarters, each of which has command authority for about four sites (battalions). A new data transmission system probably has been put into operation to link SAM control authorities to as many as 8 to 12 subordinate battalions. This system would provide target designations and tracking data more rapidly, accurately, and efficiently than was previously possible. It would also provide for automated responses of weapons status and engagement results.

25. Control of interceptor aircraft at the ADZ level is the responsibility of the senior ground-control intercept (GCI) controller, who is responsible for coordinating the intercept operations of subordinate GCI controllers at radar sites. The controllers use radar data to direct interceptors either by a semi-automatic ground-to-air data transmission system or by voice communications.

26. The most disruptive loss which could occur within the PVO command and control system would be that of the destruction of ADZ headquarters. To offset the effects of such a loss, the Soviets in some areas most certainly have established communications links among operational units at lower levels, some of which might be used as alternate zonal command posts.

27. We believe that flights by AWACS aircraft over the Baltic and Barents Sea areas have been used not only for air surveillance (see paragraph 41) but also to carry out airborne-controlled intercept (ACI) operations. (See Figure 4.) Operational testing of AWACS has been in progress for the past several years.

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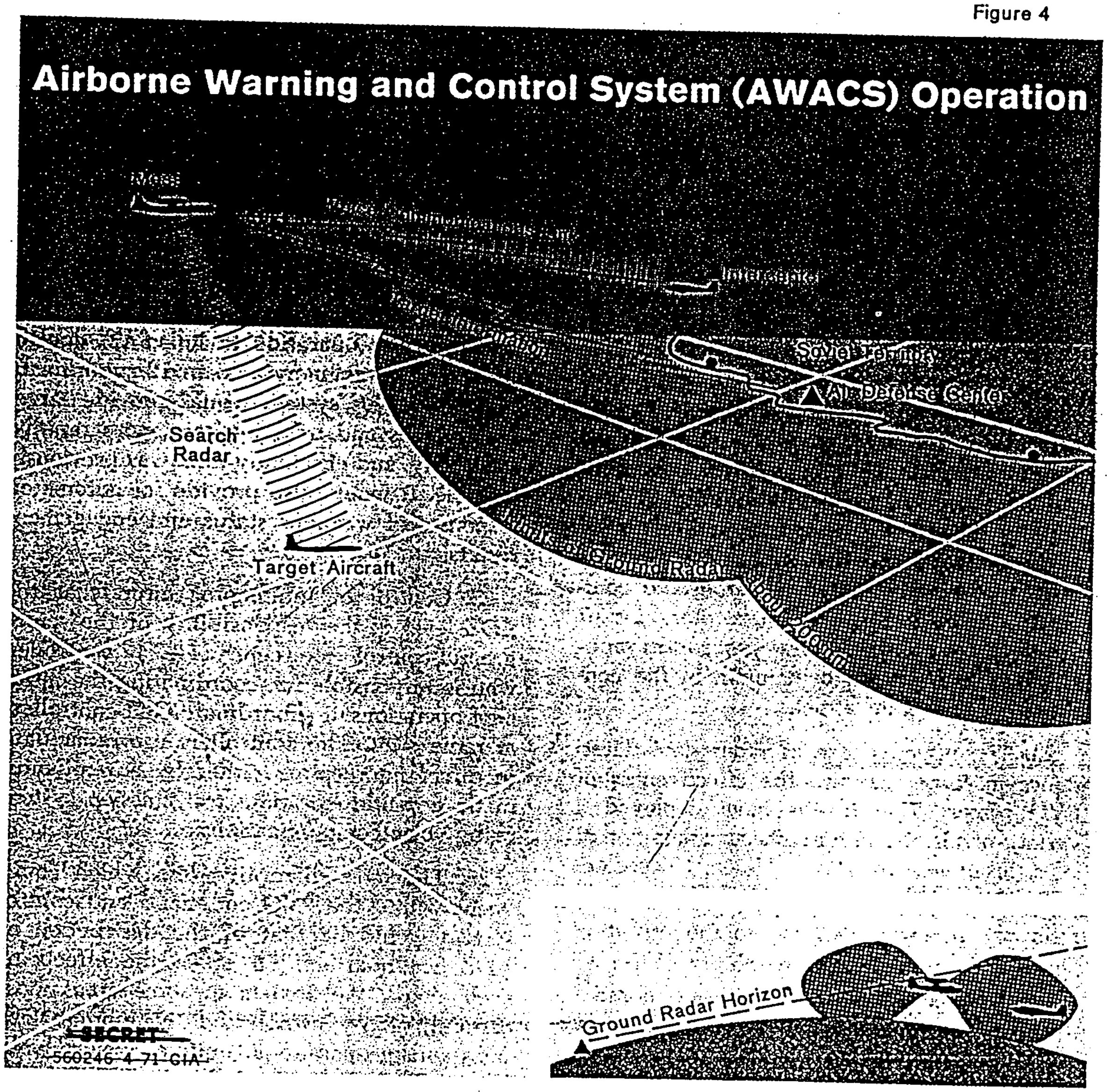
Figure 4



28. In addition to the introduction of more advanced data transmission systems, the Soviets probably have taken steps to incorporate diversity and redundancy in PVO communication equipment. Provisions probably also exist for the PVO to utilize the communications facilities of the other armed forces of the USSR. Additionally, we believe that specific channels of Ministry of Communications facilities are leased to the PVO.

29. New-generation communication satellites—*Molniya* 2 and the geostationary *Statsionar*—should be in operation within the next year or so and will provide an efficient

way to pass data over long distances, further increasing PVO communications diversity and redundancy.

Joint Surface-to-Air Missile and Interceptor Aircraft Operations

30. An air battle with any aggressor would include use of coordinated PVO fighter and SAM elements. Control and coordination would be exercised by the ADWOC in each ADZ, which in turn would select tactics to ensure that the SAM units were provided with sufficient data to avoid destroying friendly aircraft. Interceptors under target assignment and coordination by the ADWOC normally would engage their targets beyond the SAM zone, but stay close enough to maintain constant contact with their GCI controllers. Upon nearing the SAM zone, the fighters would separate from the hostile aircraft. This concept reduces the need for close coordination by ground controllers.

31. An exception to this defensive scenario is the "mixed-zone" operation. In this concept of defense, fighters operate at varying altitudes against targets within the SAM zone. In addition to the inputs from their own radar, SAM forces receive a more complete picture of the air situation by monitoring air surveillance broadcasts or by receiving data directly from the ADWOC. The Soviets may be developing a capability to use mixed-zone tactics when the ADWOC is inoperative.

C. Air Surveillance and Control Radars

This section describes the deployment concepts and the capabilities of Soviet ground-based air surveillance and control radars. It also describes the Soviet efforts to extend air surveillance out over the sea approaches to the USSR by means of sea-based radars of the Soviet Navy and by an AWACS.

32. The deployment of radars able to detect attacking aerodynamic targets at long ranges and to maintain continuous track on them at all altitudes is necessary for fully effective air defense. The extent and diversity of Soviet air defense radars is unmatched by any other country.

33. The present Soviet air surveillance and control network consists of more than 3,000 radars at about 1,000 sites. Coverage is particularly dense west of the Urals. These radars are supplemented by over 400 sites containing about 1,800 radars in the Warsaw Pact countries of Eastern Europe. Though we are confident that our count of the number of sites is approximately correct, no such assurance can be given on the number of individual radars deployed. Uncertainty continues to exist as to the actual number of deployed radars. (The basic characteristics of Soviet air surveillance and control radars are given in Table I, Annex.)

Ground-Based Radars

34. Soviet EW/GCI radar sites are characterized by a multiplicity of radar sets of several types which can operate in several frequency bands. In addition to their radar complements, the sites are equipped with Identification Friend-or-Foe (IFF) interrogators, many of them integrated into the radar surveillance system. Also present is the equipment needed to introduce the radar data collected into the command and control network in several different forms.

35. A number of advantages result from this approach to radar deployment. The redundancy of radar sets ensures that each site can maintain surveillance with high reliability despite the loss of individual radars. In addition, these radars operate in different frequency ranges which allows the site to overcome many of the frequency sensitive factors

which degrade radar performance. These include weather conditions which affect radars operating at higher frequencies or nuclear environmental effects which limit the performance of lower frequency sets. Because radars of different types are available at each site, a whole range of varying functions can be performed. In general, Soviet radar deployment practices have created a widespread, flexible, highly reliable air defense radar network.

36. Frequency diversity across a wide region of the radar band also poses serious difficulties for the use of ECM by an attacker because so wide a band of frequencies must be countered. The deep concern of the Soviets about ECM is also revealed in the design of the circuitry and antennas of their radars and in the frequent training of radar crews to operate in the presence of countermeasures. All of these steps serve to reduce greatly the vulnerability of Soviet air defense radars to deliberate electronic interference.[11]

37. Soviet surveillance and control radars have a formidable capability against aircraft attempting to penetrate at medium and high altitudes toward principal target areas. These radars are fully capable of supporting associated air defense weapon systems by providing them with EW and acquisition information as well as data for interceptor aircraft control. Under optimum conditions, where detection and tracking is limited only by the radar horizon, Soviet land-based air warning capabilities extend 200 n.m. to 250 n.m. beyond the borders of the USSR. Under normal operating conditions, detection and tracking at medium and high altitudes is virtually assured out to about 135 miles.

38. In recent years, the Soviets have introduced developmental versions of systems intended to speed the transmission of radar data. The Soviets apparently are testing a new radar system with integral data reporting (Part Time). Six sets of radars and receiving antennas and a portion of a seventh have been identified to date. Little is as yet known about the characteristics of this radar system and its intended role. The system links two widely separated radars to a receiving terminal 70 to 100 miles away. Processed target data apparently are transmitted automatically to the receiving terminals. The nature of the data and the form in which they are transmitted has not yet been determined, however. The potential advantages of the data transmission system, if used for automatic radar detection and air situation reporting, would be speed and accuracy which in turn would facilitate rapid track prediction. The tracking capabilities of the radars used in the present system, however, do not appear to be good enough to capitalize on all of the apparent advantages of the data transmission system.

Sea and Airborne Radars

39. In addition to new land-based radars, radar surveillance ships subordinate to the Soviet Navy have been identified in each of the four fleet areas. These ships could provide tracking data to PVO Strany facilities, and they could be used to guide land-based interceptors to airborne targets. Ships of the Moskva and Kresta II classes seem particularly well equipped for such a role.

40. The radars employed by these surveillance ships all have good medium- and high-altitude tracking capabilities, and some are

[11] Maj. Gen. Rockly Triantafellu, the Assistant Chief of Staff, Intelligence, USAF, notes that the USAF has had extensive experience in employing ECM across most bands used by Soviet radars with the notable exception of the J-band, and actions are underway to cover that band. He believes it important to appreciate the vulnerability of Soviet electronic systems to ECM and other countermeasures (such as roll back tactics and radar suppression weapons) to balance the image of invulnerability suggested by the apparent diversity and quantity of Soviet radars.

capable of tracking targets at low altitude as well. If deployed in sufficient numbers, they could significantly extend Soviet air warning and surveillance capabilities. As yet, however, their deployment remains very limited and in any case deployment in the northern approaches might be restricted in the winter months by ice.

41. The Soviets have (as indicated above in paragraph 27) an AWACS in limited operation which has operated offshore, thereby extending their radar coverage seaward in portions of the Barents, Baltic, and Norwegian Seas. The radar set used is believed to have some capability to distinguish moving targets from the stationary background, thereby improving its performance against low-altitude targets in the presence of sea clutter. The limited moving target indicator (MTI) capability of the Flat Jack radar on the Moss can be enhanced by operation of the Moss aircraft at medium to low altitudes where it can look either up or horizontally to see approaching aircraft so as to avoid looking down into sea clutter. The radar is estimated to have a detection range of about 200 n.m. against a B-52 target. When the Moss operates at 10,000 feet, its coverage is limited by the horizon in the case of targets flying below about 5,000 feet. AWACS will extend Soviet EW range against air targets flying at medium to high altitudes by about 200 miles beyond that provided by land-based radar. It probably also has a limited ACI capability. A greater extension of coverage will be possible if additional AWACS aircraft are deployed. But the number of AWACS aircraft now available (about 7) limits present possible coverage. The present Soviet AWACS is believed not to have a look-down capability over land.

D. Interceptor Aircraft

This section describes the composition of the interceptor forces deployed for strategic air defense of the USSR, the capabilities of new interceptors deployed over the past several years, and test programs for new fighter designs.

During 1970 the initial unit of a Mach 3 interceptor (Foxbat) became operational near Moscow. Deployment of two other new interceptors continues—Fiddler and Flagon A. We have been unable to identify any new aircraft which are clearly destined for the strategic defense forces.

42. Soviet interceptor aircraft assigned to APVO remain a primary element in countering the air threat and can be expected to play a key role for the foreseeable future. They provide the only means for intercepting bombers well beyond the borders of the USSR, prior to the launch of ASMs. They also hold promise as a future solution to the low-altitude problem if given a look-down/shoot-down capability [12] in coordination with an AWACS operating over ground terrain.

Current Interceptor Forces

43. APVO aircraft are deployed on the periphery of the USSR and on the approaches to prime targets. (See Figure 5.) The force is most heavily concentrated in the area west of the Urals and in the southern maritime area of the Soviet Far East. We estimate that this force comprises about 3,300 fighter aircraft in 94 fighter regiments, each normally divided into three squadrons. Soviet Tactical Aviation has about 3,000 fighters based in the Soviet Union and Eastern Europe. Most of these were designed as interceptors and are assigned to tactical air defense fighter regiments. Although the primary mission of these aircraft is the support and protection of thea-

[12] The ability of the fire-control system in the aircraft to look down with its radar and distinguish its targets below it from ground clutter, plus an ability of the missile while shooting downward to home on the target.

ter forces, about a third of these are assigned to regiments based in the Soviet Union that have a primary mission of air defense and could be used to supplement the forces of APVO in an emergency.[13]

44. The interceptor force of APVO operates in coordination with SAMs and ground force AAA. About one-half of the interceptor force is composed of fighters introduced in 1957 or earlier—the Fresco, Farmer, and Flashlight. (The inventory breakdown of the interceptor aircraft force is provided in Table I. Detailed weapon system characteristics and capabilities are provided in Tables II, III, and IV, at Annex.) These subsonic or low supersonic models are largely gun-armed, limited to tail attacks at ranges of a half mile or less, and have little capability above 50,000 feet. About one-half of them have an all-weather attack capability. These older fighters are gradually being withdrawn from the force.

45. Another 25 percent of the force is made up of the Mach 2 Fishpot. The Fishpot B is armed with a first generation air-to-air missile (AAM) which has a range of only two to four n.m. and limits this aircraft to tail attacks. The Fishpot C, of which there are about 100, is armed with the AA-3 (Anab), which

[13] There are in addition, some 1,800 interceptor aircraft in East European Warsaw Pact countries which might provide limited support to Soviet air defenses.

Figure 5

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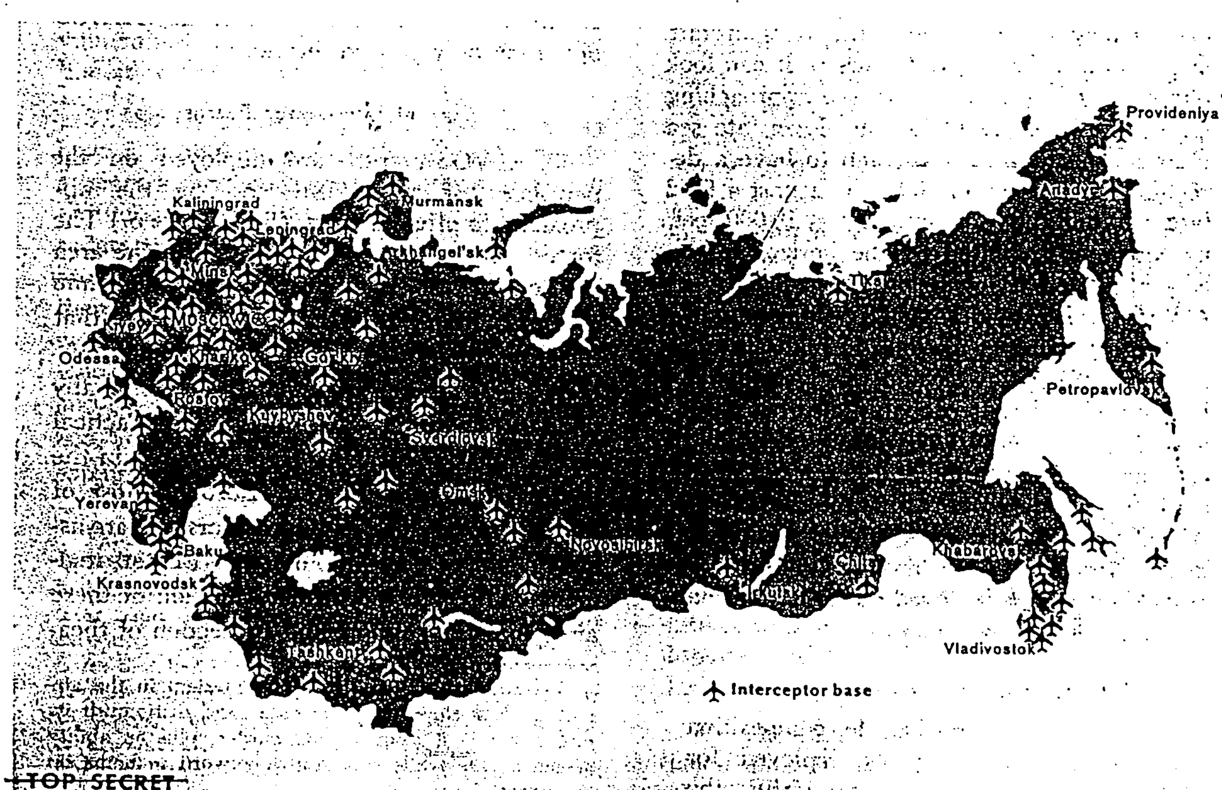

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TABLE I

ESTIMATED
SOVIET AIR DEFENSE INTERCEPTOR
AIRCRAFT AS OF 1 JANUARY 1971

Older Models	
Fresco	1,030
Farmer	350
Flashlight	190
Fishpot	770
Newer Models	
Firebar	360
Flagon A	400
Fiddler	135
Foxbat	15
TOTAL	3,250

has a range of 10 to 14 n.m. and is capable of head-on attacks. The remainder of the force is composed of four new interceptors introduced since 1964. The weapon systems carried by these new interceptors have longer ranges and can be used in two or more attack modes, thus significantly increasing the Soviets' air defense capabilities.

46. The first of the newer aircraft to be deployed was the all-weather, low- and medium-altitude Firebar interceptor. The Firebar carries two AA-3 missiles, one with radar and the other with infrared homing guidance. With this armament the Firebar can conduct both head-on and tail attacks. The aircraft can achieve speeds near Mach 2 at higher altitudes, but is limited to subsonic speeds at low altitude. In low-altitude defense, the Firebar is used most effectively over water or relatively flat terrain.

47. Another of the new interceptors is the long-range, medium- and high-altitude Fiddler all-weather interceptor. The Fiddler is armed with four AA-5 (Ash) missiles which apparently use either radar or infrared homing or a mix of the two. The Fiddler is capable of attacking targets from any direction.

48. The third of these modern aircraft, the medium- and high-altitude Flagon A, is an all-weather point-defense interceptor and is armed with the AA-3 (Anab) missile. It can attack both head-on and from the rear.

49. The fourth and newest of the aircraft in the interceptor force is the Mach 3, high-altitude Foxbat all-weather fighter first deployed with a PVO regiment in 1970. It is expected that the Foxbat will be deployed further to bases both on the periphery and in the interior of the USSR to improve Soviet capabilities against high performance aircraft and ASMs. A new AAM, similar in size to the AA-5 carried by the Fiddler, has been identified at the factory where the Foxbat is being produced. This missile probably is intended for the Foxbat. There has been no indication that the Foxbat has a look-down/shoot-down capability, although the aircraft is believed to be equipped with a new air intercept (AI) radar. An advanced look-down radar system could be developed later on. There are still no indications of the development of such a radar, however.

50. In contrast to their inability to handle low-altitude penetrators effectively, Soviet air defense interceptors have a good capability against existing bombers and standoff weapons at medium and high altitudes. Fiddler's combat ceiling of about 53,000 feet would be satisfactory against most free world bomber aircraft. Fiddler could attack targets up to about 90,000 feet using the AA-5 missile in a snap-up mode, a tactic in which the missile is launched at targets above the interceptor. The point-defense interceptors—Fishpot and Flagon A—have combat ceilings of about 60,000 feet. All of the newer interceptors can attack targets above their combat ceiling using either zoom climb or by firing their

AAMs in a snap-up mode. These are very difficult tactics.

51. Recent Soviet efforts to extend the air warning network are of particular importance because, if successful, they would better enable interceptor aircraft to cope with standoff weapons. The use of long-range interceptors—in particular the Fiddler—in conjunction with AWACS will enable the Soviets to attack ASM carriers before these carriers reach the weapon-release line. At a minimum, the Fiddler-AWACS combination may be able to degrade the penetration and attack capabilities of the ASM carriers by forcing them to adopt evasive tactics before releasing their weapons against the USSR. Those interceptor aircraft armed with AAMs and having both head-on and tail attack capabilities against aircraft are also estimated to have the ability to carry out head-on attacks against current ASMs themselves.

Aircraft Under Development

52. Virtually nothing is known about a program of aerial refueling of Soviet fighter aircraft. If inflight refueling of fighter aircraft is developed, however, it would extend their range or endurance.

53. We have been unable to identify any new aircraft which are destined for the strategic defense forces, although the Soviets introduce a new fighter aircraft every five years or so.

54. The Flogger, Mikoyan's variable-geometry wing fighter, has recently become operational with the tactical air forces. Flogger's weapon system has not been identified, but it probably carries two AAMs—probably Anabs. The Flogger design is believed to provide a Mach 1 speed capability at sea level, which is an improvement over the low-altitude capabilities of currently operational APVO fighters. Its low-altitude capabilities may be used to augment those of APVO.

E. Surface-to-Air Missile Systems[14]

This section describes the deployment, unit makeup, and capabilities of SAM systems deployed for the strategic air defense of the USSR.

During the past 15 months, deployment of the low-altitude SA-3 system and of the long-range SA-5 system continued. Since NIE 11-3-69, "Soviet Strategic Defenses", dated 2 October 1969, TOP SECRET, RESTRICTED DATA, we have re-evaluated downward our count of operational SA-2 battalions.

55. In order to cope with the improved bombers which emerged at the end of World War II, the Soviet Union turned to SAMs to augment its AAA and interceptor aircraft forces. By the end of the war, aircraft had been developed which could fly at altitudes beyond the reach of AAA and could be employed in numbers too large for interceptor aircraft to handle. SAMs provided a means for massing large amounts of firepower with a high probability of kill in defense of key areas.

56. We estimate that some 10,000 SAM interceptor launchers are deployed in operational battalions throughout the USSR around key targets and astride the major air-penetration routes. (See Figure 6.) These SAM defenses are most effective against aircraft attacking at medium and high altitudes. They are as yet unable to cope effectively with aircraft flying at very low altitude. Small, fast standoff weapons would also challenge the capability of these defenses. Efforts to meet these two challenges probably will dominate further Soviet SAM development.

57. Our knowledge about individual SAM systems varies greatly. The location and extent of deployment of strategic SAM systems are generally well known, though the

[14] See Table V, at Annex for SAM characteristics.

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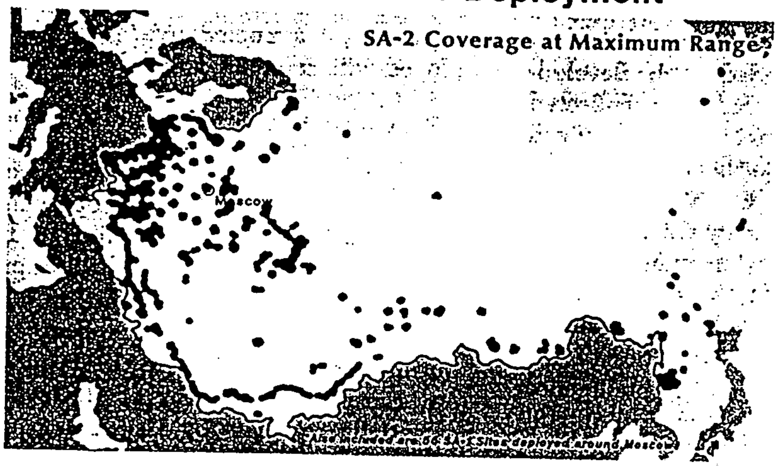
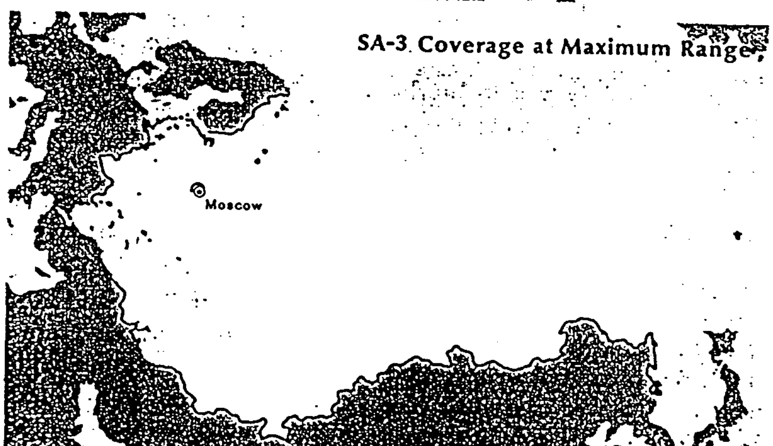
Figure 6

Soviet Surface-to-Air Missile Deployment





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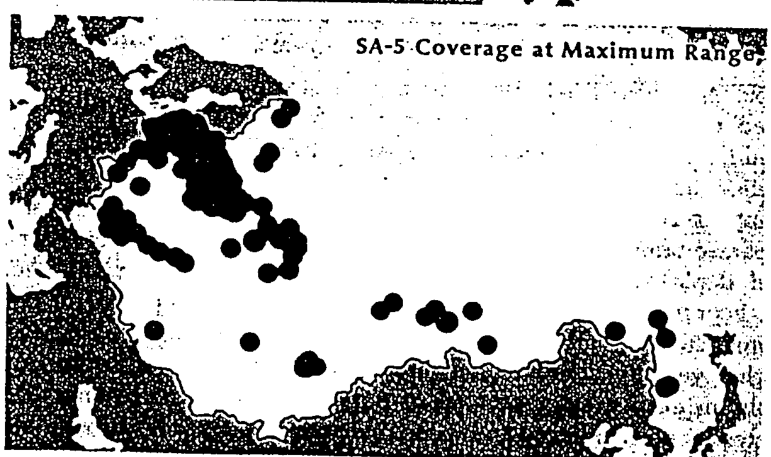

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recent deployment of two mobile tactical SAM systems has introduced some uncertainty. With respect to characteristics, rather precise information such as that needed for the development of countermeasures has been collected on systems such as the SA-2 and SA-3, which have been exposed outside the USSR. [redacted] This is not generally true, however, and even in the examples mentioned, additional technical information is needed on the equipment deployed in the Soviet Union. A precise assessment of the capabilities of the SA-5 and SA-6 remains a major intelligence problem due to continuing technical intelligence gaps.

SA-1

58. The first Soviet SAM system to be deployed, the SA-1, was installed at 56 sites in two concentric rings around Moscow during the mid-1950s. This system was never deployed elsewhere. The 56 sites remain operational though only about 25 percent of the some 3,300 launchers in these sites are occupied with ready missiles. The full SA-1 force probably could be activated in times of crisis, however. Although the phase-out of the SA-1 might be expected as newer systems were deployed in the Moscow area, modifications to SA-1 equipment suggest that the system may remain operational for several more years.

59. A typical SA-1 site consists of a single fixed radar installation and launchers for 60 Guild missiles. The guidance radar, a track-while-scan system, reportedly can guide as many as 20 Guild missiles to as many as 20 separate targets simultaneously. Since its original deployment, the intercept range of the SA-1 probably has been increased, the performance of the missile upgraded to cope with higher velocity aerodynamic threats and possibly an even greater number of targets. The system is now believed to be capable of intercepting aircraft with speeds up to Mach 2 at ranges between 5 and 26 n.m. at altitudes of 3,500 to 60,000 feet. There is some evidence to suggest that a nuclear warhead may be deployed with some SA-1 missiles.

SA-2

60. The SA-2 system was the successor to the SA-1. It was designed to cope with supersonic aerodynamic threats and to be more mobile and more suitable for widespread deployment. Deployment began in 1958. Although additional SA-2 sites were identified during the past year in the USSR and in Eastern Europe, deployment of the system was essentially complete by 1965.

61. The SA-2 is the most widely deployed SAM system in the USSR. It provides point air defense of virtually every important strategic target in the country. The system also is deployed as an air defense barrier on the western and southern borders of the European heartland of the country and along the central Asian borders of the USSR. We estimate that there are about 760 sites occupied by operational battalions and about 400 unoccupied sites, which probably are intended to serve as alternate or supplementary firing positions during periods of high tension. The number of operational SA-2 battalions has declined slightly over the past several years. Continuing modification of SA-2 launch sites and missile and guidance components indicate that the SA-2 probably will not be phased out of service before 1975.

62. A full SA-2 firing unit consists of one Fan Song guidance radar, six single missile launchers for Guideline missiles arranged around the radar position, and related support equipment. Permanent SA-2 launch sites normally are revetted, although missiles can be fired from non-revetted field positions. The system has been constantly improved, evolving through at least five fundamentally different variants, four of which remain in wide-

spread use in the Soviet Union, Eastern Europe, and in other countries such as North Vietnam and the UAR.[15]

63. Two Fan Song models are now in use in the Soviet Union: Fan Song C and E. Fan Song C probably employs MTI for better performance against low-altitude targets. A Guideline missile, designated Mod 2, is used with the Fan Song C radar. Little is known about this missile, but there is evidence that the Fan Song C/Guideline Mod 2 combination can achieve intercepts to a maximum range of about 24 n.m., about a 20 percent greater range than that of earlier SA-2 variants. We estimate that about one-half of the sites in the USSR contain this SA-2 variant.

64. Fan Song E has two additional large dish antennas. While the function of these antennas is not clear, they probably improve the radar's performance at low altitudes, increase its target detection and tracking ranges, and provide the radar with an improved electronic counter-countermeasures (ECCM) capability.

65. The Mod 3 Guideline missile, used with Fan Song E, represents a major redesign. Its longer intercept range, better maneuverability, and modified warhead and fuzing system have resulted in greatly improved performance against high speed, maneuvering targets. The Fan Song E/Mod 3 Guideline combination can intercept small targets at speeds up to Mach 3.0.

[15] These four variants consist of the Fan Songs C and E discussed below, and the Fan Songs B and F which are the principal export models of the radar. The B is an old S-band set formerly deployed in the USSR. The Fan Song F is a new export model which includes an optical tracking device which improves its performance against targets in the presence of ECM. This version has been deployed to North Vietnam and the UAR. We have no evidence that it has been deployed in the USSR or East Europe.

The maximum range of the system is about 27 n.m. Its high-altitude ceiling is about 90,000 feet.

66. The Mod 4 Guideline missile seen in recent parades has a larger warhead section,

SA-3

67. Deployment of the low-altitude SA-3 system has occurred in two phases—1961 to 1964, and 1967 to present. It is estimated that about 200 operational SA-3 battalions are now deployed in the USSR, more than 60 of them having been installed in the past year. In addition, alternate SA-3 sites have been identified. The most recent developments have augmented the barrier defenses originally set up in the Baltic Sea, Black Sea, and Polish border approach routes. The new deployments have also extended SA-3 defense beyond Moscow and Leningrad to a few other key industrial and military areas.

68. The typical SA-3 site includes a single Low Blow radar with 4 dual launchers for Goa missiles. The hiatus in SA-3 deployment between 1964 and 1967 may have been the result of modifications made to improve the low-altitude performance of the SA-3. We have not been able to identify any changes in the Low Blow radar, but 2 versions of the SA-3 missile are known to exist. The modifications were intended to improve its propulsion and aerodynamic characteristics for use at low altitude. In its modified form, the SA-3 system is estimated to be capable of intercepting targets at altitudes as low as

[redacted] The system has a maximum altitude capability of 60,000 feet and can reach targets at maximum slant ranges of about 12 n.m.

SA-5

69. Deployment of the long-range SA-5 system began in 1963. We estimate that there are now 80 SA-5 complexes, about 60 of which appear to be operational. Only four new complexes have been detected in the past year, indicating that deployment is probably coming to an end. Nearly all of the identified complexes will be in service by late 1971. The SA-5 system is deployed as a barrier defense to protect key military and industrial targets in the European USSR and as a point defense to protect important but more isolated targets.

70. A typical SA-5 complex comprises a launch area of 3 sites, each with 6 launchers, an electronics area containing a Square Pair engagement radar for each launch site, and a central control area for the complex. An acquisition radar site is located a few miles away. Most launch positions contain two missile dollies to facilitate the rapid reload of a single launcher.

71. The intended role of the SA-5 system within Soviet strategic defenses and the capabilities of the system to cope with various types of targets have in the past constituted major uncertainties and sources of disagreement within the Intelligence Community. But the following has been learned about this system in the past several years:

a. The components of the system have been identified.

b. Ground photography has revealed details on the configuration of the fire-control radar. Power vans associated with the radar have been analyzed and a rough limit of the power supplied to the radar has been established.

c. [redacted]

d. The configuration and dimensions of the SA-5 Gammon missile have been obtained [redacted]

e. The SA-5 missile employs a radar homing guidance system.

f. The flight profiles of the SA-5 probably extend to altitudes of 90,000 feet and ranges beyond 100 n.m.

72. A number of critical gaps in our information remain, however:

[redacted]

73. Despite these and other gaps in our information, there now is agreement within the Intelligence Community that the SA-5 system is intended to provide long-range defense against aerodynamic targets including advanced, high performance aircraft and small supersonic air-to-surface standoff weapons. This judgment rests primarily on the following considerations:

a. The SA-5 is deployed in a pattern which is typical of other Soviet anti-aircraft barrier defenses with reinforced defenses around key target areas. The SA-5 defense pattern could provide limited coverage to only a few targets if the system were capable of being used in an autonomous ABM mode.

b. The sites themselves are similar in appearance to those associated with earlier Soviet SAM systems and use ground support equipment that are known to be associated with other Soviet air defense systems.

c. The size and estimated power output of the system's fire-control radar indicate that it would be only marginally effective against Minuteman RVs.

d. the acquisition radars for the SA-5 system (the Back Net surveillance, and Side Net height finder) are well known Soviet air defense radars which operate in their normal modes when deployed at SA-5 sites.

e. We believe the SA-5 missile is configured for aerodynamic control and maneuverability at high altitudes—up to about 30 kilometers (100,000 feet). This suggests that an ABM role is not intended.

f. The SA-5 missile almost certainly employs a radar homing guidance system, indicating that it is intended for use against aerodynamic vehicles rather than missile RVs.

g.

Another source has reported that the system is intended for air defense; he also described a test in which the SA-5 successfully intercepted a drone target aircraft.

h.

74. Although the information needed to characterize the performance of the SA-5 system in a detailed fashion still is not available, sufficient information has been obtained to resolve most of the disagreements within the Intelligence Community as to the role and basic characteristics of the system. The SA-5 system is estimated to be capable of engaging high performance aerodynamic targets at ranges of about 50 to 100 n.m. The configuration of the SA-5 missile indicates that it would be able to maneuver against targets at altitudes as high at 100,000 feet. The minimum altitude of the system cannot be established. With a homing guidance system and a conventional warhead, the missile would have a high probability of kill against an aerodynamic target.

75. It also is agreed within the Community that the SA-5 system is not now used to provide ABM defense and is not well suited for such use. Nevertheless, the present state of knowledge prevents us from conclusively ruling out all possibilities for its use in an ABM role.

Other Surface-to-Air Missile Systems

76. In addition to SAM systems which are employed specifically for the purpose of strategic air defense of the USSR, tactical SAM systems have been deployed which might be utilized to bolster strategic air defenses. These systems include the SA-4 and SA-6. Both systems are now being deployed to the Soviet Ground Forces. The more important of these is the SA-6 because of its apparent low-altitude capabilities. Based on its apparent role and design intent, rather than technical data, it is estimated to be capable of engagements at altitudes down to about 500 feet, and perhaps below, and up to about 50,000 feet. The maximum range is estimated to be about 10 to 20 n.m. Uncertainties about the missile's propulsion system preclude more precise calculations.

F. The Continuing Problem of Low-Altitude Defense

This section investigates the complicated problem of defense against low-flying aircraft and ASMs. It explains why the problem is difficult, describes Soviet efforts to overcome the problem, and estimates the present Soviet capabilities against low-altitude intruders.

During the past year the Soviets have continued their deployment of the SA-3 along the western sea approaches to the USSR and of air surveillance systems which can better handle the low altitude problem. Since NIE 11-3-69 we have also obtained information on the fuzing of the SA-2, which indicates it has been improved so as to enable it to make intercepts at lower altitudes.

77. A significant weakness of Soviet air defenses against the existing threat is their limited capability to prevent penetration at low altitudes. A major problem in this respect is the inability of the ground-based radar network to detect and track targets at very low altitudes. The radar detection range for such targets is limited by the radar horizon. This horizon range varies with the height of the target and the height of the radar antenna. Over the past five years, the Soviets have attempted to improve low-altitude coverage by employing a new antenna for their chief low-altitude radar atop a 100 foot mast. This modification, designated Squat Eye, has been deployed in considerable numbers throughout the USSR and Eastern Europe.

78. Within the USSR, Squat Eye is estimated to have been deployed to at least 130 sites, though it probably has been much more widely emplaced. The extent of deployment is uncertain. In the area around Leningrad, where deployment of Squat Eye is believed to have been extensive, continuous radar coverage extends down to 200 to 300 feet over an area of some 50,000 to 60,000 square miles. Spotty coverage exists down to 100 feet in some areas. Elsewhere in the western USSR and the Warsaw Pact, it is estimated that Pact air defense forces can detect, identify, and track aerodynamic targets below 1,000 feet. Nevertheless, it is possible to penetrate these areas in such a way as to deny the necessary tracking information required for command and control of the air defense weapons elements.

79. Soviet efforts to overcome this weakness in low-altitude surveillance almost certainly will continue. A principal part of this effort probably will be the development of an AWACS radar capable of detecting and tracking low-altitude targets over land. The development of such a system would greatly augment the Soviet ability to maintain surveillance and continuous tracking on low-altitude targets and to provide a means for the control of intercept attempts.

80. At low altitudes, command and control requirements for systems employing ground-based radars become more stringent since targets are in view of a radar for a very short period of time. Reporting of plots on low-altitude targets from the radar sites to a filter center calls for automated aids because manual reporting and plotting would be too slow. Soviet command and control communication systems have the capacity to transmit dozens of plots per minute together with such data as target height and identity. With such capabilities, the Soviet command and control system would be able to maintain track on a limited number of low-altitude targets in the area of radar coverage.

81. Weapon system limitations of the interceptor force at low altitudes and the lack of tracking continuity provided by present Soviet EW/GCI radars make Soviet interceptors least effective against low-altitude penetrators. The primary low-altitude interceptor in the PVO is the Firebar, but even this aircraft apparently cannot adequately perform intercepts of targets flying beneath it at low altitudes. The tactics used by the Firebar indicate that the radar which it carries has limited ground clutter suppression capabilities. Against low-altitude targets, the launch range for the AA-3 missiles carried by Firebar falls to between 2 and 4 n.m. Intercept capability of the AA-3 extends down to about 600 feet but may be somewhat lower over water or flat terrain. Consistent with this, Firebar has been deployed to defend approach routes to the USSR from the sea and over relatively flat terrain. Although the Flagon A was designed for medium- and high-altitude missions, it is equipped with an AI radar similar to that of the Firebar; it can intercept targets down to about 2,000 feet. At such altitudes, however, Flagon A is limited to subsonic speeds, a reduced combat radius, and a limited AAM range.

82. The older gun-armed interceptors in the PVO also would have some capability against low-altitude targets under good visual conditions. Lacking the AI radar of the newer interceptors, however, they would require close GCI vectoring or would have to be employed in patrol patterns. In either case, they are available in sufficient numbers to harass an attacking force along both entry and exit routes.

83. Soviet efforts to improve the low-altitude capability of interceptor aircraft probably will be focused upon the development of a downward looking AI radar and on a complementary shoot-down missile. The development of a look-down system capable of detecting and tracking aircraft at low altitudes against ground clutter is critical if the Soviets are to make real progress toward solving the low-altitude defense problem.

84. Present Soviet SAM systems also are limited in their ability to cope with low-altitude attackers. The low-altitude performance of any SAM system is dependent upon many factors and is difficult to assess even when all of the factors are well defined. This assertion is supported by recent reports from a defector who was trained in the Soviet Union on the SA-3 system. He stated that his Soviet instructors could not agree on the lower altitude limit of the SA-3 system when using MTI and, further, that different textbooks specified different limits. A limit of 200 meters was specified by some while 300 meters was specified by others. We have no reports such as these regarding the newer variants of the SA-2 system, and we must base our estimates of the performance of these systems upon their observable technical features and the known performance of comparable systems.

85. For the most part, low-altitude capabilities depend upon the ability of the guidance radar to detect and track low-altitude aircraft

at sufficient range to allow a missile to be launched in time to engage the target, and upon use of a proximity fuse system that can operate at low altitude without triggering on reflections from the ground. Guidance radar performance is in turn highly dependent upon siting the radar in such a way that it can point its beam at very low angles without seeing returns from the surrounding terrain (ground clutter), or upon the radar's having circuitry that enables it to distinguish a moving target from any ground returns which it may see. The placement of individual radars in relation to surrounding terrain (causing the ground clutter situation to vary from location to location) is almost impossible to generalize. Very little is known about the MTI circuitry of newer models of Soviet SAM radars. In these circumstances, no generally valid minimum-altitude capability for the radars can be derived.

86. Recently obtained information about the newest export model of the SA-2 system (Fan Song F) indicates that it can intercept targets at altitudes as low as 300 feet. It appears that this ability is derived in part from the use of an optical tracking device, so this adds little to what we know about radar performance. The information also indicates, however, that the proximity fuse used by the missile has been improved so as to make intercepts at 300 feet possible. Though this is a different variant of the system than those employed in the USSR, it must be assumed that the fuses on those missiles have been similarly improved. Under these circumstances, it appears that the low-altitude capabilities of Soviet SAMs will be limited primarily by the radar down to altitudes of about 300 feet.

87. The Fan Song C—present at about half the Soviet sites—is known to have better low-altitude performance than the Fan Song B, about which we have a good deal of information. Documentary data indicate a 1,500 foot minimum altitude for the Fan Song B/Guideline Mod 1 combination which is no longer deployed in the USSR. The Fan Song E is, in turn, known to operate better in this regime than the Fan Song C, because of the addition of the two dish antennas and improved MTI circuitry. Consideration of all the information available regarding this progressive improvement leads us to conclude that SA-2 intercepts are possible down to altitudes as low as 300 feet where radar siting is good. Though many sites might have such a capability, it cannot be possessed by all, however, and a more likely minimum altitude which would generally be obtained would be in the 500 to 1,000 foot region. At these and lower altitudes, however, intercepts can probably be performed only in a small kill zone extending a few miles beyond the forward edge of the system's dead zone. At altitudes of about 1,000 feet, it is likely that the Fan Song E could rely upon the use of its MTI circuitry to distinguish the target even in the presence of substantial ground clutter. However, single shot kill probability is most likely reduced when MTI is employed.

III. DEFENSE AGAINST BALLISTIC MISSILES

A. Introduction

88. The difficulties of defense against a US strategic ballistic missile force are formidable. Such a defense must contend not only with land-based ballistic missiles whose launch points and approach corridors are known, but also with SLBMs which may come from virtually any direction. Strategic defenses might cope with this threat in a number of different ways:

a. By attacking ballistic missile submarines before they can launch their weapons;

b. By attacking missiles during the mid-course phase of flight; and

c. By attacking incoming RVs in the final portion of their flight.

89. The difficulties of finding and maintaining trail on ballistic missile submarines in the open ocean are still so great as to preclude reliance on that approach to counter the submarine portion of the threat. However, the Soviets are expending a considerable effort to build an effective ASW program. (See Section IV of this Estimate for discussion of Soviet capabilities in this area.) Mid-course systems pose difficult technological and geographical problems and have not been tried to date in either the US or the USSR. The Soviets are involved in a significant program designed to cope with ballistic missiles—both land and sea based—during the terminal portion of their flight, and have in fact installed the world's only operational ABM system.

90. The Soviets have been involved in ABM development since the mid-1950s when they began construction of a test range at Sary Shagan. They have been attempting to meet the very stringent technical requirements on ABM radars and missiles which must detect, track, and intercept ballistic missile RVs. The detection of a missile attack which might come from any direction requires the surveillance of large volumes of space. US RVs have been designed so as to appear very small to most radars. Such small targets must be detected at long ranges to allow sufficient tracking data to be obtained in order to launch and guide intercepting missiles. Further compounding the detection and tracking problem is the necessity of distinguishing individual attacking objects from each other to determine their trajectories and to see whether the offense is employing non-threatening, but confusing, penetration aids. Characteristics of a radar which might enable it to meet some of these requirements prevent it from meeting others. The Soviets in general have relied on the use of large, high power radars and big interceptor missiles capable of meeting a whole range of requirements, rather than on subsystems designed to cope with limited particular parts of the ABM defense problem. During the past eight years the Soviets have installed a ballistic missile early warning system in five areas on the periphery of the Soviet Union and an ABM system around Moscow. Additional radars are believed still under construction. An improved ABM system probably is also under development at Sary Shagan.

B. Command and Control

91. Information as to how the Soviets have organized their present ABM force is very limited. There is as yet no conclusive evidence that a separate missile defense command has been established. In the early 1960s, Soviet statements suggested that their ABM forces might constitute a separate command within the PVO called the Antimissile Defense Troops. From mid-1967 to the present, the name of Lieutenant General of Artillery, Yuriy Vsevolodovich Votintsev, has appeared regularly with the names of the commanders of the three previously identified arms of the PVO, suggesting that he heads an organization at a comparable level. There also is an indication that Votintsev has an office at the national PVO command center, as do the three commanders of the identifed PVO arms. The command center for the Moscow ABM system is probably located at the Dog House target acquisition and tracking radar, a key element of that system. Virtually nothing is known, however, about the command and control network that links together the elements of Soviet ABM defenses.

C. Ballistic Missile Detection and Early Warning

92. *Hen Houses.* The Soviets have relied on the deployment of large, high-powered, phased-array radars—called Hen Houses—to provide early warning (EW) of missile attack against the USSR. The locations and orientation of these radars afford the Soviets extensive, although incomplete, coverage of US ICBMs and SLBMs, as well as intermediate-range ballistic missiles (IRBMs) launched from other countries. Construction started in 1963-1964 on radars at Skrunda and Olenegorsk to provide radar coverage of the US ICBM threat corridor into the western USSR. The orientation of four new radars, which have been under construction at Skrunda, Sevastopol', Sary Shagan, and Mishelevka since mid-1967, indicates that they are intended to provide coverage against SLBMs launched from parts of the North Atlantic, Arctic, Pacific, and Indian Oceans and the Mediterranean, as well as against ballistic missiles launched from Europe and Communist China. At present, there is apparently no coverage which would provide warning of ICBMs launched from the US toward targets in the eastern USSR, such as Irkutsk and Khabarovsk, or of SLBMs launched from the Mediterranean or southwest Atlantic to targets in the western USSR.

93. It is estimated that the Hen House radars can detect any type of US ICBM RV

The Hen Houses use a range of frequencies which cause US ICBM RVs to appear larger than they would at any other frequency. In addition, the Hen House uses sophisticated tracking signals which enable it to detect small targets at long ranges while providing precise tracking information.

94. Despite these capabilities, the Hen Houses have limitations which degrade their missile defense potential. The radars are located along the borders of the USSR so as to provide maximum warning of a missile attack and are, as a consequence, difficult to defend. In addition, the relatively low frequency of the Hen House signal makes the radar susceptible to nuclear blackout. Moreover,

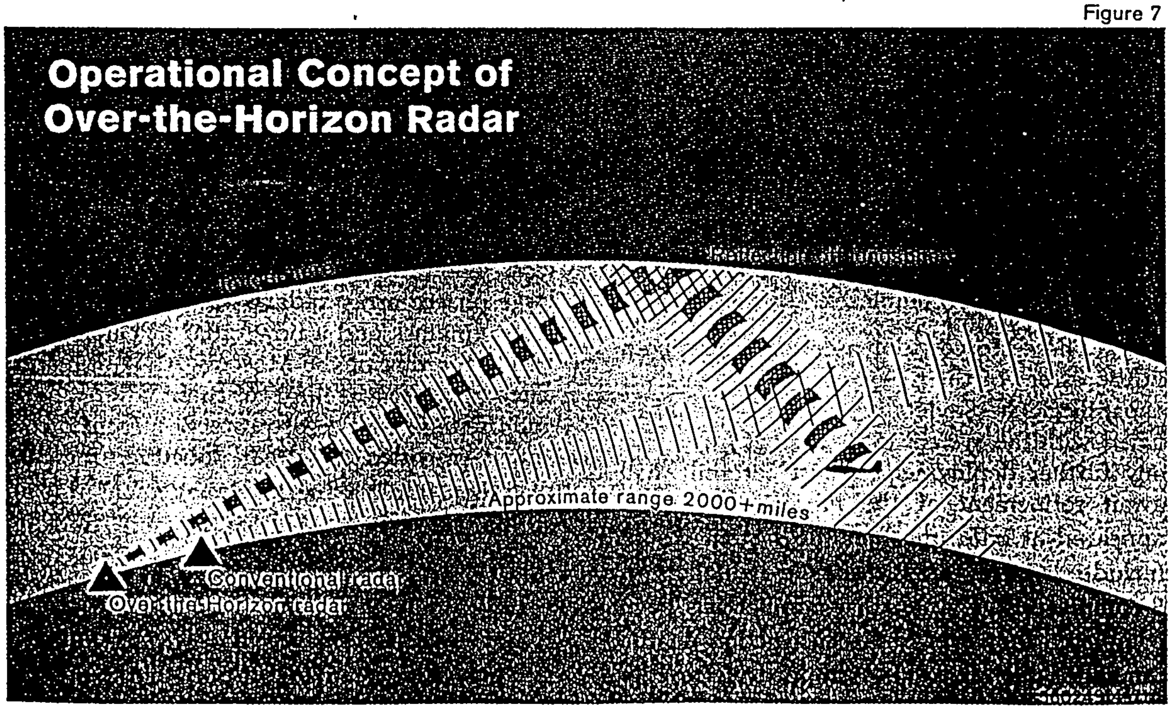
Since the Hen Houses must perform their primary function in an environment free of nuclear effects, Soviet planners probably do not consider Hen House information necessary for whatever actions need to be taken after a nuclear exchange has been initiated.

95. Hen Houses can, within their viewing sector: (a) positively identify a missile attack before it reaches the Soviet Union; (b) predict missile impact points to an accuracy of a few n.m.; (c) determine the origin of the attack; and (d) estimate the initial number of attacking objects. In addition, the EW and threat assessment information provided by these radars would be valuable inputs to decisions relating to the commitment of a retaliatory strike and the allocation of the limited number of ABM interceptor missiles of the Moscow system.

96. *Over-the-Horizon Detection (OHD).* The Soviets may in time deploy an OHD radar system [16] in order to further extend EW. (See Figure 7.) The Soviets have demonstrated an interest in OHD techniques since the mid-1950s and probably have had an active developmental OHD program in progress since the mid-1950s or early 1960s. What is assessed as being a new OHD facility has been identified under construction at Nikolayev. Because of its orientation, it appears that flight test activity on Soviet missile test ranges could be used as a source of targets for future development of this system. No operational use of the Nikolayev system against missiles launched from the US appears possible. The distortion and attenuation experienced by HF signals passing through the northern auroral regions could thwart efforts to develop an operational OHD system capable of reliable detection and tracking of ICBMs launched toward the USSR from the US. The Soviets probably could deploy a system which would

[16] An OHD radar can transmit its signal over a far greater distance than that allowed by line of sight by using the ionosphere as a reflective surface. It is not as reliable, however, as radar which operates along a direct line of sight.

Figure 7



provide them with a limited capacity to detect SLBMs and strategic aircraft attacks, however.

D. The Moscow Antiballistic Missile System

This section describes the development and components of the Moscow ABM system. It assesses the capabilities of the target acquisition and tracking radars of the system, of the terminal engagement radars, and of the interceptor missile. Finally, it describes an operational concept for the system.

During the past year, we believe that the Moscow ABM system reached its currently-planned goal of 64 launchers. Also, the initial checkout of the southeast face of the Dog House target acquisition and tracking radar commenced; when operational, this face will survey the missile approaches to Moscow from the Indian Ocean.

97. As part of their first attempt at meeting the problems of ballistic missile defense, the Soviets deployed radar and interceptor missile facilities around Moscow. Started in 1962, the construction of these defenses followed an uneven pace and was finally substantially curtailed. The system only recently became operational at all complexes.

98. These Moscow defenses are limited both in the extent of their deployment and in their capability. The Soviets apparently are not satisfied with the system in its current form, and any further deployment almost certainly will await refinement of the present system. It appeared at one time that the system would include as many as 128 missile launchers at 8 complexes. Only half that number has been completed, however, and construction on the remaining complexes has stopped. (See Figure 8.) Since the deployment began before development was complete, difficulties encountered in the test program must have affected the pace and scope of deployment. Dissatisfaction with system performance in the face of increased complexity of the threat probably caused its curtailment.

99. The Moscow system consists of a target acquisition and tracking radar which we call a Dog House; another acquisition and tracking radar near Chekhov; engagement radars—which we call Try Adds—at four complexes; and the Galosh missile and its launchers deployed at these four complexes.

100. All of the identifiable elements of the Moscow ABM system, except the Chekhov radar, now are estimated to be operational. But [redacted] the system is not yet maintained at a high state of readiness.

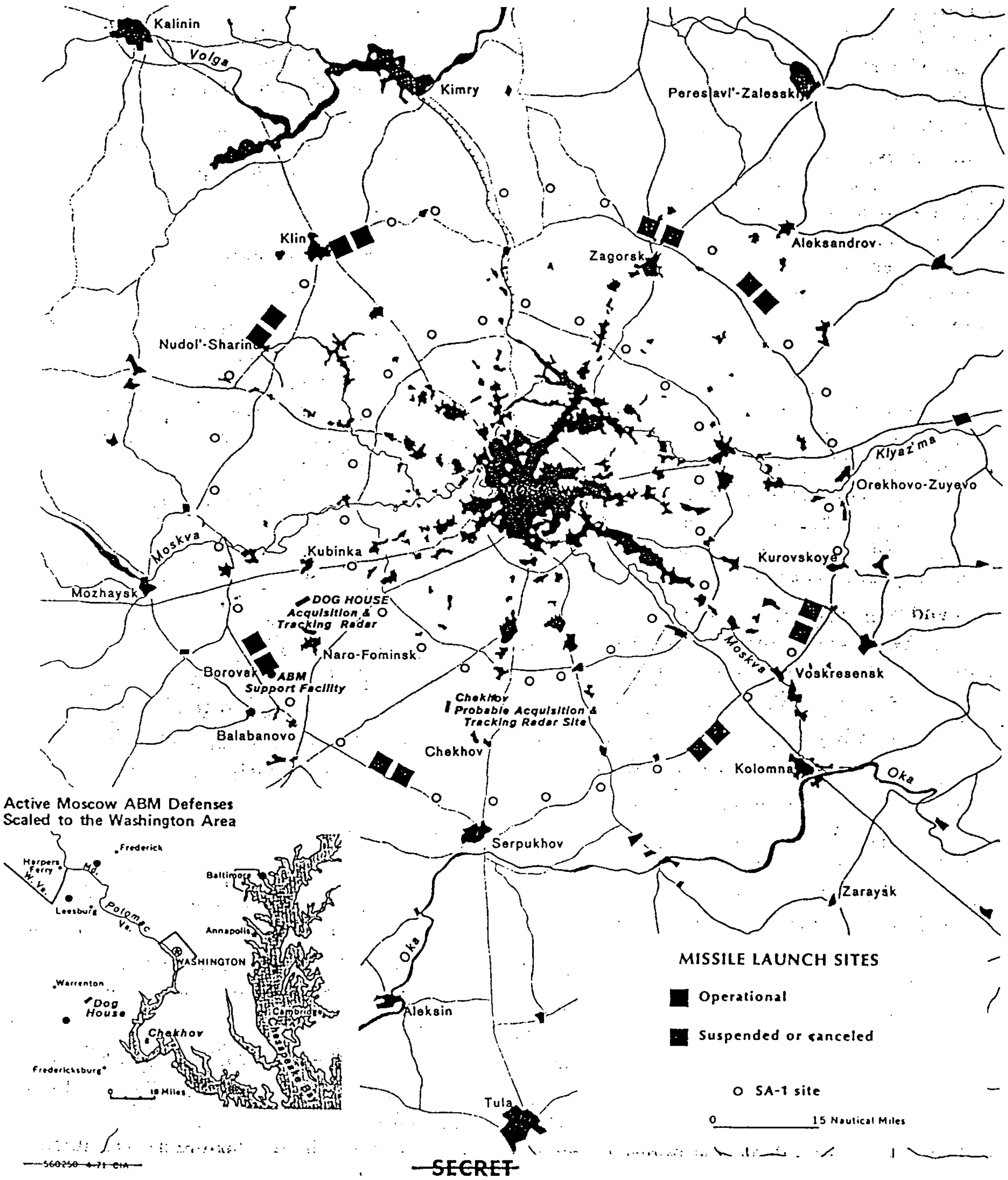
Target Acquisition and Tracking Radars

101. To be effective, an ABM system must acquire and track incoming RVs at long ranges in the presence of many penetration aids and in a nuclear environment. The Hen House EW radars alone are not adequate for this task. Thus, the Soviets have deployed very large phased-array radars—the Dog House at Naro Fominsk and a new radar at Chekhov—within the ring of the Moscow ABM defenses. The size and capabilities of these latter radars, and the high degree of protection from direct attack provided by their location, indicate that they fulfill a battle management role in addition to their acquisition and tracking functions.

102. The Dog House covers all potential ICBM trajectories from the US to Moscow but only a very small portion of the Polaris threat. The southeast face of the Dog House,

Figure 8

Moscow ABM Defenses



which only recently has come on the air, is directed toward the Indian Ocean. Although Polaris submarines currently do not operate there, the Soviets may be guarding against the possibility of a Polaris or fractional orbit bombardment system (FOBS) threat from this quarter.

103. Within its area of coverage, the Dog House can: (a) provide warning of an attack; (b) determine the extent of the attack; (c) determine the origin and intended target of the attack; and (d) predict the trajectories of threatening objects with sufficient accuracy to permit assignment of the incoming RV to a Try Add radar facility and launch of an interceptor. Since ICBMs from the US do not begin to re-enter the atmosphere until they are about 125 n.m. from impact, those targeted against Moscow normally will be outside the Dog House coverage at re-entry because the radar is offset too far from the path of the missile. Thus, the radar is intended for exoatmospheric tracking in the defense of Moscow and cannot take advantage of atmospheric sorting to discriminate an RV from accompanying penetration aids.

104. The new phased-array radar under construction at Chekhov, 35 n.m. south of Moscow, will perform the functions of the Dog House against some additional threats, such as SLBMs launched from the North Atlantic and IRBMs launched from France. Like the Dog House, the Chekhov radar will consist of antennas in two separate operations areas. The southern antenna and a portion of the northern antenna probably will work together to constitute a bistatic radar system. In addition, a large part of the northern antenna probably will serve as a separate, pulsed radar system for precision tracking. It may also be used to obtain special resolution measurements of targets of immediate interest as indicated by the bistatic radar. The Dog House has no such additional radar. If this separate radar is limited to the same sector estimated for the bistatic array, the Chekhov radar, because of its location relative to the paths of RVs targeted against Moscow would also be limited to the exoatmospheric tracking. It is estimated that the Chekhov radar will begin transmitting in 1972 and could become operational about a year later.

Terminal Engagement Radars

105. Missile guidance during the intercept phase is derived from tracking information on the target and interceptors provided by the Try Add engagement radars. For each target tracking radar there are two smaller defensive missile tracking and guidance radars. All Try Add radars use mechanically steerable dish antennas which are large enough to track at long ranges, and which have features indicating that they can also operate effectively at very short ranges. Principal among these features is the type of antenna mount. Though more expensive and cumbersome than more conventional mounts, it enables the antenna to track targets at the high elevation angles (that would characterize engagement of close-in targets) without undergoing excessively high accelerations.

106.

107.

[redacted]

108. [redacted]

109. The interceptor missile tracking and guidance radars—the small Try Adds—are located close to the missile launchers, so that the interceptor can be acquired by the Try Add as soon as possible after launch. This, and the fact that the small Try Add dome contains only a single dish antenna, indicates that the radar probably can track and guide only a single interceptor missile at a time. Since there are two small Try Add radars for every large one, it appears that one Try Add site could engage a single target with two interceptors. Tracking of the interceptor missile probably is accomplished with the aid of a beacon aboard the missile. [redacted]

Interceptor Missile

110. The Soviets designed and deployed a two-stage missile—the Galosh—as the interceptor for the Moscow system. Flight tests at Sary Shagan have confirmed the long-range intercept capability of the Galosh which earlier had been suggested by its sheer size. Certain characteristics of other components of the system, such as trainable missile launchers and special Try Add radar mounts, and the absence of any other missile which might be used with the system for short-range intercepts, suggest that the Galosh is to be used for intercepts at short ranges as well.[18]

111. [redacted]

[17] Unambiguous range is the maximum distance to a target from which the reflected signal can return to the radar before the next pulse is transmitted. It is thus inversely proportional to the pulse repetition frequency (PRF). For large targets at sufficient altitude, many radars have the power to detect at greater than unambiguous range. Should this occur, the targets will appear on the radar scope at a much nearer, but false, range.

[18] The Galosh missile in its canister was first paraded by the Soviets in November 1964. Testing was apparently underway at that time. [redacted] There is no basis for distinguishing between any variants that may exist. The term "Galosh", therefore, is used here to designate all versions of the missile.

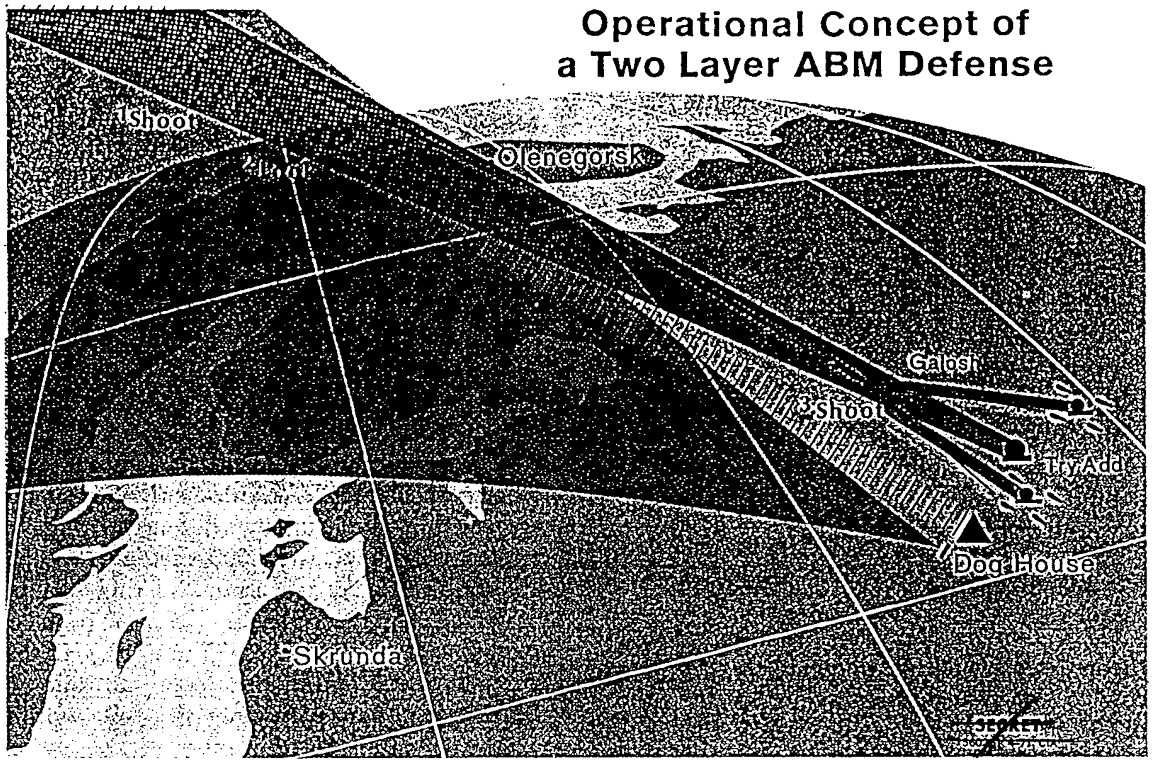
112.

Operational Concept of the System

113. The characteristics of its various elements, and the deployment pattern of the system as a whole, indicate that the operational concept of the Moscow system embodies a two-layer defense in which an initial intercept attempt at long range can be followed, if necessary, by a second attempt at short range. A two-layer, or shoot-look-shoot defense, probably is the only means by which an acceptably high probability of kill (greater than 0.99 per RV engagement) could be achieved without an excessive expenditure of interceptors on each incoming RV. A firing doctrine involving the use of a single interceptor for long-range exoatmospheric engagement, plus two interceptors for each target which gets through the first layer of defense, appears to be the best means of utilizing the limited number of interceptors available. (See Figure 9.) It is not known, however, what firing doctrine the Soviets actually will employ.

114. Using the shoot-look-shoot doctrine, the Galosh missile would be used for both the long- and short-range intercepts. In the short-range mode of operation, the Galosh is in no way the equivalent of the high acceleration US Sprint. Because of its low launch acceleration, the Galosh cannot wait for atmospheric discrimination of the target to take place before launching, as the Sprint does. The Galosh might be used in a "loiter mode", in which case it could be launched before discrimination but not be targeted specifically until the RV actually was identified. The Galosh can fly in a low thrust coast and has demonstrated significant terminal maneuver capability, both of which are required to employ the loiter mode. It has not been observed, however, using these capabilities to intercept targets after atmospheric discrimination had occurred. In this loiter mode it

Figure 9



would have only limited effectiveness against current US chaff packages. Furthermore, there is no evidence that the Moscow system has a capability for exoatmospheric discrimination against sophisticated threats by either ground-based or missile borne sensors. Thus the Soviets must pay the price of shooting at every incoming object without waiting to determine whether it is a real RV or a decoy. Galosh tests observed at Sary Shagan have confirmed both its long-range and short-range intercept capability.

115. The Moscow ABM system probably is neither wholly automatic nor centralized (i.e., the Soviets probably have not chosen to time-share all the computing and data processing tasks in a single, large centralized computer array). It is more likely that suitable processing units are dedicated to specific functional tasks, using computers especially designed for the various functional requirements of the system. This approach enables the Soviets to avoid the tremendous computer requirements of a wholly centralized system.

116. The requirements that impose the greatest demands for data processing in the system probably are those of detection and tracking of targets by the Dog House radar. Estimates of the minimum operational speeds and storage capacity requirements for these functions vary, but known Soviet computer capabilities appear adequate for exoatmospheric detection and tracking of at least 500 objects over a 500 second time interval. We have insufficient information to estimate the computer requirements for battle manage-

ment, command and control, and communication functions of the Moscow system. Despite these uncertainties, it appears that the Soviets have the necessary computing and data processing equipment to support the operations of the Moscow system when used in the two-layer mode described above.

E. Capabilities of the Moscow Antiballistic Missile System

This section assesses the capability of the Moscow ABM system to defend both the Moscow area and a large portion of the western USSR against ICBMs and SLBMs. Our judgments of these capabilities are essentially the same as those we held for several years.

Against Intercontinental Ballistic Missiles

117. Assuming optimum conditions, our theoretical calculations indicate that the Moscow ABM system, employing its inventory of 64 interceptors in a two-layer defense mode, could at best have a high probability (about 80 percent) of successfully engaging about 45 ICBM targets before exhaustion of the interceptor inventory. That is, in theory, there is a 20 percent probability that if a 45 target raid is directed against Moscow at least one target will leak through the defense. Decoys and chaff puffs would appear as valid and separate targets to the system and their use could rapidly exhaust the system's present on-launcher interceptor inventory. While the launchers could be reloaded, there is no evidence that provision has been made at the launch sites for storing reload missiles. The deployment of radars and interceptors appears to be so balanced that the system, in coping with the ICBM threat, is equally vulnerable to saturation of its target handling capability and to exhaustion of the supply of on-launcher interceptors. Completion of more complexes would not materially improve the defense against an all-out attack which made use of penetration aids.[19]

118.

Timing requirements become stringent for second-layer intercept attempts, however. Since the Galosh accelerates slowly, and since the second-layer launch probably is not intended to occur until after the results of the first attempt have been observed, any single site can provide second-layer defense for only part of the area within the Moscow defensive ring.

Against Submarine-Launched Ballistic Missiles

119. The Moscow system appears to be primarily directed toward defense against US ICBM attack, but it also has a limited capability to intercept SLBMs. (See Figure 11.) For those SLBMs on which long-range tracking data could be obtained by the Hen House or Dog House radars, the probability of successful intercept would be about the same as for ICBMs. In some of the azimuth sec-

[19] Vice Adm. Noel Gayler, the Director, National Security Agency, believes that with respect to command and control, the performance of the Moscow ABM system on its first full-scale test—when actually under ballistic missile attack—is almost certain to be well below design level. The cumulative effect of its various weaknesses suggests that the Moscow system has little capability to defend Moscow except against a small and unsophisticated attack.

Figure 10

Figure 11

tors from which SLBMs could be launched against Moscow, however, Try Add target tracking radars would have to assume the entire burden of search, detection, and tracking. A single Try Add probably could search an azimuth sector as large as the threat from the Mediterranean Sea, i.e., 53 degrees, but it could not track and search simultaneously for new targets. Since the Try Add has a very limited target handling capability, and since there are only eight Try Adds in the presently deployed system, the Moscow ABM radar defenses could be saturated by a relatively light SLBM attack.

In An Area Defense Role

120. Because of its long range, the Moscow system has an inherent capability to defend regions outside the Moscow area: but it can protect such regions with only a single-layer defense. (See Figure 10.) Despite the large area for which the Moscow system could provide some degree of defense against missile attack, the limited number of interceptors deployed and the design which allows for intercepts at short range as well as long, argue that area defense was not the intended purpose of the system. Since only a single intercept attempt would be possible, the area defense provided would be quite thin. With the expenditure of several interceptors on each long-range target—as would be possible if defense against a small third country attack or an accidental or unauthorized launch were necessary—the area defense would be much more effective.

In National Command Authority Defense

121. The ability of the Moscow ABM system to protect Moscow and its environs from a moderate, unsophisticated attack, and its ability to defend a much larger area against a light attack, make it well suited for the NCA-type of ABM defense which has been proposed at the strategic arms limitation talks (SALT). Under an NCA-type agreement, neither the US nor the Soviet ABM systems would be expected to provide defense against an all-out attack, since the number of missiles and radars permitted under the agreement would be too small. The defense would be valuable however to defend the NCA against accidental attack or third country attacks. Thus, the principal shortcomings of the present Moscow system—vulnerability to saturation and exhaustion—would diminish in significance. And in a limited attack, the likelihood of exhaustion from penetration aids would not be so great. Another weakness of the present system—its reliance on large and numerous radars which would make more widespread deployment difficult—would also decline in importance, since further deployment would not be allowed under an NCA agreement anyway. Finally, current radar developments at Sary Shagan involving the Try Add target tracking radar could result in improvements in the system which might overcome some of the weaknesses of the present system against Polaris missiles.

F. Antiballistic Missile Research and Development

This section describes the Soviet ABM test programs now underway at the Sary Shagan Missile Test Center and the new construction there in support of future test programs and new ABM system development.

122. We believe that Soviet ABM R&D is continuing at a high level and is directed primarily toward improving upon the present Moscow ABM system. Activities of principal interest include the flight testing of the Galosh missile in a variety of intercept modes, the construction of new radars and launchers at a formerly abandoned Try Add radar site,

and the construction of a new large bistatic radar which probably is the prototype for the one being built at Chekhov. Although these activities are probably related to improvement on the ABM defenses presently deployed, we cannot rule out the possibility that developments at Sary Shagan will lead to more widespread ABM deployment.

Flight Testing

123. The observed characteristics of ABM flight tests at Sary Shagan indicate that the Soviets are experimenting with both exoatmospheric and endoatmospheric intercepts of targets simulating US missiles targeted to the Moscow area and possibly beyond. ABM tests involving Galosh interceptor missiles and SS-4 target vehicles have been observed at Sary Shagan since 1968.

124. Actual ICBM velocities and re-entry angles have not been simulated nor has an attempt been made to reproduce the radar reflection characteristics of US RVs.

125. Several of the tests suggest, however, that the Soviets were testing the Galosh in a long-range exoatmospheric intercept mode, simulating the geometry that would obtain during engagements with US ICBMs. In three of the tests which involved two interceptor missiles, the second interceptor—which could not have engaged the SS-4 target—was probably used to intercept a simulated target endoatmospherically (below 50 n.m. altitude) in much the same manner as the short-range intercepts discussed above as part of the Moscow system's postulated mode of operation.

126. Recent Soviet ABM tests are of particular interest since they differ from earlier ones. The absence of target vehicles in all but the last, and the obvious departure from the previous pattern of trajectories flown, suggest that a new ABM program has begun which involves new intercept modes.

New Construction

127. We believe that work on a follow-on ABM system (ABM-X-2) is underway at Sary Shagan. This system is apparently designed to enable the defenses at Moscow to overcome the saturation problem posed by SLBM attacks outside the Dog House sector. A new launch area which will include at least two launchers, now is being built next to a previously abandoned Try Add radar site at Sary Shagan. It appears that a flat, antenna has been installed within a dome on top of the large Try Add building. It is likely that a mechanically steerable, phased-array radar is under construction with significantly better target handling capabilities than those of the large Try Add radars deployed around Moscow. If so, it would be capable of simultaneously searching for, and tracking, a number of targets within a relatively large sector—perhaps 30 to 50 degrees. The new antenna is the most significant difference noted thus far between the facilities at Sary Shagan and the deployed Try Add facilities.

128. It may be that at Sary Shagan an ABM system utilizing a two-layer defense is being developed, consisting of a modified Galosh in association with a new smaller missile and the new large radar. The smaller missile could be a high acceleration interceptor akin to the US Sprint. With such a missile, Soviet ABM defenses could use the atmosphere to discriminate between RVs and penetration aids. The system, if developed, might be used to increase the effectiveness of the defenses around Moscow without requir-

ing the addition of very large and expensive Try Add radars. It might also be used to protect other areas, and may lend itself to rapid deployment.

129. It must be noted, however, that such an approach represents a significant departure from the approach taken in past ABM projects. Our information at present is so limited that we cannot rule out the possibility that the system developed will fulfill an air defense role. The weight of our limited evidence, however, indicates that the components will probably have a significant ABM capability, and that the system is probably intended to fulfill an ABM role.

130. Beginning in 1966, the prototype for the Chekhov radar—which we call the Top Roost—was constructed at Sary Shagan. Electronic signals intercepted during the past year have revealed that the two antennas comprise a bistatic radar system similar to the Dog House radar.

G. The Use of Surface-to-Air Missiles for Antiballistic Missile Defense

This section assesses the likelihood of the Soviets upgrading SAM systems for ABM defense under conditions of an arms control agreement, and concludes that such a program is not likely.

131. There is ample evidence that currently deployed Soviet SAMs have not been modified to provide them with a ballistic missile defense capability. It is possible, on the other hand, that the Soviets could augment their ballistic missile defense by upgrading their SA-2 and SA-5 SAM systems for such a purpose.

132. The geographical extent of coverage which might be provided by suitably upgraded SAM systems would be large under certain circumstances. It appears technically feasible to upgrade a SAM system so as to give it some ABM capabilities. The quality of the missile defense which could be achieved by such measures, however, would be low:

a. The success of the defense would depend on the continued use by the US of weapons and tactics that would be peculiarly vulnerable to the upgraded SAMs;

b. SAM performance in an ABM role would be marginal in several critical respects (e.g., RV detection at windshield burnoff, extremely short reaction times, and high false-alarm rates, etc.); and

c. The forward ABM radars, upon which reasonable schemes for utilizing SAMs rely, are extremely vulnerable.

133. Despite these considerations, there are so many SAMs deployed in the USSR that, even if marginally effective, they might be able to reduce somewhat the strength of a retaliatory US attack.

134. In viewing the development of the Soviet ABM program over the past 10 years, it is clear that the Soviets take the technical problems of ABM defense seriously. Thus far, they have sought to overcome them by relying upon big radars, high power levels, large missiles, etc., and have cut no corners in doing so. This probably will apply to the next-generation Soviet ABM system as well. In view of the Soviet commitment to, and understanding of, the ABM problem, it is very unlikely that the Soviets would choose to rely on the SA-5 system—let alone the SA-2 system—to defend against US ICBMs.

135. Furthermore, it is evident that the Soviets take a serious view of the bomber threat. In responding to that threat, they have developed and deployed an air defense sys-

tem unmatched anywhere else in the world. However appealing its use for ABM defense may appear, there is no evidence that the Soviets are willing to compromise their bomber defenses to do so.

136. But in an arms control environment in which Soviet opportunities to deploy ABM defenses were limited, the incentive for upgrading air defense systems to augment allowed ABM defenses might be high enough to cause the Soviets to consider such a step. It is agreed within the Intelligence Community, however, that the shortcomings of upgraded SAMs in an ABM role would be recognized by the Soviets and would discourage them from following such a course. Upgrading SAMs for ABM defense would almost certainly in this situation be in violation of the arms limitation agreement, and would have to be done clandestinely. No matter what degree of SAM upgrading the Soviets achieved, the ABM defense thus provided would be vulnerable to changes in US weapons and tactics. In the effort to overcome these shortcomings, such substantial SAM modifications would be required that the upgrade activity would be detected in the test program. Even in the case of modest modification, the Soviets could never have assurance of successful concealment.

137. The Soviets for years have demonstrated conservatism in assessing their own defense requirements and in designing systems to meet those requirements. With this conservative outlook, conscious of the shortcomings and ephemeral nature of any defense which SAM systems might provide against missiles, and uncertain about the effects of being detected in a treaty violation, Soviet leaders are unlikely to view the upgrading of SAMs as a viable means of altering the strategic balance.

138. Although the inherent ABM potential of Soviet SAMs might be utilized *in extremis* in an effort to reduce the destruction caused by a US missile attack, the uncertainties involved in such a step—even with upgraded SAMs—make it very unlikely that the Soviets would adopt this procedure. In view of these considerations, we believe that a program of SAM upgrading for ABM defense is not likely to be undertaken by the Soviets.

IV. DEFENSE AGAINST BALLISTIC MISSILE SUBMARINES [20]

A. Introduction

This year, for the first time, NIE 11-3-71 addresses the problem of defense against ballistic missile submarines. This section outlines some salient aspects of the problem.

139. The growth of the USSR as a maritime power and, more importantly, the advent of ballistic missile submarines in the US, caused the Soviets to reassess their ASW potential and to undertake a vigorous program of im-

[20] Maj. Gen. Rockly Triantafellu, the Assistant Chief of Staff, Intelligence, USAF, agrees that detecting and fixing submarines in the open ocean is a difficult technical problem. The Soviets have been working on the problem with increased emphasis since the inception of the Polaris program in 1958. They now have their first-generation ASW systems in widespread operation, and in his view it is significant these systems reflect a concept for long-range operations, including long-range ASW aircraft. He notes that intelligence is limited on the type of technical sensors employed on these aircraft but that the suspected sensor complement could include conventional magnetic, infrared, and bistatic reception of sonar. Present systems are considered effective in restricted areas and taking the Soviet penchant for mass, he believes quantity could become a quality in broad ocean ASW operations. He expects that new underwater detection technology will be incorporated into second-generation ASW equipment. This coupled with a surface to space receiver and relay system would improve Soviet broad ocean fixing and attack capabilities. He therefore believes that the vulnerability of the SLBM force will increase.

proving and expanding their ASW forces. Progress has been made, but the magnitude of the task—particularly with respect to the development of a capability against Polaris submarines operating in the open ocean—has precluded rapid solution.

140. If the Polaris threat is to be countered by means other than an ABM defense, ASW is the most likely approach. Though it might be possible to destroy submarines at their bases or to deny them command and control communications when on-station, these tactics do not appear promising against the Polaris retaliatory force. However, such actions would be anticipated as part of any overall effort to blunt or delay an SLBM attack. Operational practices have been designed to assure that more than half the Polaris force is on patrol at any one time and that communications are maintained through use of a complex and highly redundant command and control system. As a result, the defense is forced to attempt to destroy the submarines while on station, before they launch their missiles. Because of the vast areas in which ballistic missile submarines can operate, this must be done in the open ocean where ASW is most difficult and where Soviet ASW capabilities have traditionally been weakest.[31]

141. In order to combat the Polaris submarines, the Soviets would most likely employ either open-ocean search or trailing tactics. Open-ocean search consists of combing suspected submarine operating areas with ASW forces until contact is made. It is thus effective only in relatively small areas, and requires an ability to sweep a wide path in the sea. The Soviets have been experimenting with the Moskva helicopter ship and ASW aircraft in this approach.

142. Trailing involves detecting submarines at those points in their mission when they are most vulnerable to detection—e.g., when leaving port, during transit, or when passing through narrow straits—and then trailing the submarine from that point to its operating area. The best trailing platform is another submarine, and the Soviets have developed new classes of nuclear submarines with improved capabilities for trailing.

143. Covert trail is very difficult. While the trailer must maintain continuous track of the target, it must not let the target become aware of the trail. It thus must use passive sensors only. In order to maintain covert trail the trailing submarine must produce less noise detectable by the target submarine than vice versa, and this by a significant amount. The noise advantage can be obtained either by having a sufficiently quieter submarine, or more capable sonar, or—more likely—some combination of both.

144. Maintaining a covert trail by passive means is difficult because of the short ranges at which passive sonars can detect a quiet submarine. It is estimated, for example, that currently operational Soviet passive sonars are unable to detect US nuclear ballistic missile submarines on-station at ranges beyond a mile or so. Even if initial detection is made, evasive action by the submarine being trailed can preclude such close shadowing as is required to maintain passive track.

145. Likewise, overt trail (where the target is aware of the trail) is very difficult, but for different reasons. It is much less sensitive to acoustic technology. Contact can be maintained either at close range—where passive

[31] Maj. Gen. Rockly Triantafellu, the Assistant Chief of Staff, Intelligence, USAF, does not agree with the judgment that the tactic of destroying Polaris submarines at their bases does not appear promising. He notes the portion of the submarine fleet in port, and he considers it unlikely that these boats could get underway with only tactical warning. Thus, he believes that the ports would appear to the Soviets as lucrative targets.

sonar performance of an acoustically inferior submarine will still be adequate—or at longer range by an active sonar, which is less dependent on the quietness of the trailing submarine. The use of active sonar would carry the advantage of increased trailing ranges. But even so the target submarine could take evasive action, making the trailing submarine's task much more difficult. Although a speed advantage to the trailer is necessary in either covert or overt trail, a high speed advantage is most useful in the overt trail situation.

B. Organization, Command and Control

146. Within the Defense Ministry, a Deputy Chief of Staff is believed to be assigned as director of the Soviet ASW effort. The operational directorate of the main naval staff probably monitors the prosecution of valid submarine contacts within the four fleet areas. Each fleet commander normally is responsible for naval operations, including ASW, within each of the four fleet regions and in designated ocean areas.

147. For ASW operations, the major surface forces and fleet air forces are employed on a fleet-wide basis with control exercised by the fleet commander through the respective force commander. The offshore defense forces of each fleet, which are responsible for coastal ASW operations, are organized under regional commanders. The manner of control of submarine ASW forces depends upon the area of operation. Normally, submarine control is exercised by Naval Headquarters, Moscow, or by individual fleet headquarters. Naval Headquarters, Moscow, is able to assume direct command over any naval forces when the situation warrants.

148. The Soviet organization for ASW continues to indicate a two-part approach to the problem—one directed against the so-called "near zone" and one against the "far zone" of operations. The "near zone" is the area in which the assets (ships and aircraft) available to the local commander can operate. Its radius therefore varies with the capabilities of the forces assigned. The "far zone" is the area beyond the "near zone" extending to at least the range from which enemy ballistic missiles can be launched, and even to the enemy shore itself.

149. Ships engaged in ASW operations are organized into groups called PUGs (Poiskovo-Udarnaya Gruppa, or search-strike groups). The PUG is probably similar to the US Navy's Search and Attack Unit. A Soviet PUG consists of from one to five ships. Two or more PUGs may operate together in a given area. In most cases, ships of the same class, or ships with similar sonar installations, are used to form a PUG. As many as four land-based fixed wing ASW aircraft or helicopters may form part of an air PUG.

C. Antisubmarine Warfare Forces

This section briefly characterizes the surface ships, submarines, and aircraft used by the Soviets in open-ocean search for ballistic missile submarines.

During the past year the Soviets continued construction of major ASW surface ships, submarines with significant ASW capabilities, and have deployed a new ASW version of the Bear bomber.

150. In the effort to overcome its shortcomings in ASW, the Soviets have embarked on a vigorous development program for ASW platforms, sensors, and weapon systems. The development of this mixed ASW arsenal has enabled the Soviets to pursue the task force approach to the ASW problem.

Antisubmarine Warfare Surface Ships

151. The Soviet Navy has a large number of various types of ships which play either a major or auxiliary ASW role. (See Table II.) In the past 10 years, the Soviets have produced

TABLE II

ESTIMATED
SOVIET ANTISUBMARINE WARFARE FORCES [1]
(NUMBER BY CLASS AS OF 1 JANUARY 1971)

MAJOR ASW SURFACE SHIPS	
Moskva	2
Kashin	17
Kresta	6
Kanin	3
OTHER ASW SURFACE SHIPS [2]	
Kynda	4
Krupnyy	5
Kildin	4
SAM Kotlin	7
Kotlin	16
Petya	47
Mirka	20
ASW AIRCRAFT	
Hormone	80
Hound	130
May	30
Mail	75
Madge	10
Bear (ASW)	0 [3]

NUCLEAR ATTACK SUBMARINES	
V	8
E-I (Converted)	2
N	14
A	0
DIESEL ATTACK SUBMARINES	
B	4
F	45
R	14
Z (Including Mod Z)	23
W	110
NUCLEAR CRUISE-MISSILE SUBMARINES [4]	
P	0
C	6

[1] For the purpose of this estimate, we have considered all Soviet forces with a potential for use in ASW. Most of these forces in fact have multipurpose capabilities. Some of these, such as the R- and W-class submarines would have minimal capabilities against FBMs. They can, and would, be used for many other missions besides ASW. For example, interdicting sealines of communications or engaging surface strike forces. In addition, ASW forces, specifically dedicated to countering the FBM threat, cannot be distinguished from those intended to combat US attack submarines. It should not be assumed that all the forces listed in this Table would be employed only to counter the FBM threat.

[2] There are other older smaller classes, numbering about 350 ships, which have very limited ASW capabilities and are not considered important in ASW against ballistic missile submarines.

[3] As many as three ASW Bears have been noted on occasion exercising in the Barents Sea area, but they probably are not yet operational.

[4] Though the P- and C-classes have a potential for ASW, they have a primary antiship mission.

more than 30 major surface ships which they themselves designate for specialized use in ASW. Most impressive of the new ships are the two Moskva-class helicopter ships, each with a complement of about 20 Hormone ASW helicopters. These ships, each with their embarked helicopters and two accompanying Kashin-class frigates, constitute the most effective ASW tactical unit which the Soviets have.

Augmenting the surface ships specifically designated for ASW use are some 90 modern multipurpose combatant ships which are also equipped for ASW operations. All of these ships have been built or modified since 1957. The cruiser-destroyer classes in this category are capable of operations on the open ocean but they have less sophisticated ASW sensors and weapons than the primary ASW ships.

Antisubmarine Warfare Submarines

152. In the past four years, five classes of general purpose submarines, four of which are nuclear powered, have been under construction in the USSR. The V-class, a nuclear attack submarine, is believed to have a primary ASW mission. The C- and P-classes are nuclear cruise-missile submarines with a primary antiship mission and a secondary ASW capability. The roles of the A-class, a small nuclear-powered submarine, and the B-class, a diesel-powered unit, are as yet undetermined. Units of these classes have begun to augment the older attack and cruise-missile forces built around N- and E-class nuclear submarines and several diesel-powered classes. These older classes still constitute about 90 percent of the general purpose submarine force. (Detailed characteristics of these submarines are given in Annex Tables X and XI.)

153. One of the new classes—the V-class torpedo attack submarine—has markedly improved performance over its predecessor, the N-class, and is considered to be the most effective ASW submarine in the Soviet fleet. It is estimated to have a maximum operating depth limit of at least 1,300 feet and a submerged speed capability of 32 knots, making it the fastest nuclear-powered submarine in the world. It is somewhat quieter than the N-class, but not as quiet as US nuclear-powered ballistic missile submarines at comparable speeds. There is potential for further quieting of these submarines, however, because the dominant noise sources are not in the main propulsion system but in auxiliary machinery which should be susceptible to a quieting program. It is equipped with new, low-frequency search sonars which have considerably improved range capabilities over earlier sonars. In addition, it is equipped with new hydroacoustic emitters for underwater communications, and an underwater IFF.

154. These characteristics make the V-class the best submarine in the Soviet fleet to undertake open-ocean trail operations against a Polaris submarine. There are only eight of these units operational now, however, and they are being built at the rate of only two to three per year.

155. Another of the new submarines—the C-class—has a maximum speed of 30 knots. It is believed to have the same propulsion plant and sonar equipment as the V-class. Its armament is different, however, and apparently includes at least one new weapon system. Eight missile tubes located in the forward part of the submarine are believed to be for the submerged launch of short-range (15 to 35 n.m.), antishipping cruise missiles. Fire-control data for the missile system apparently are obtained from passive sonar. In addition to the eight launch tubes, two circular apertures in the bow have been noted whose function is not yet known. They are probably for launching torpedoes, however, they could be used to launch SUBROC-type[22] weapons, if the Soviets had such weapons. Since the main armament of the C-class apparently is intended for use against surface ships, this class probably does not have ASW as a primary mission. The other qualities of this submarine, such as its sonar equipment and torpedo armament, would enable it to play an ASW role, however. There are six operational C-class submarines. They are now produced at the rate of one to two per year.

156. The diesel units in the Soviet submarine force have inherent capabilities for general ASW operations. They are suited for antisubmarine reconnaissance and possibly for attack on submarines at exits to bases and at "choke points" in transit lanes. Their capa-

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[22] SUBROC—Submerged, submarine-launched, surface-to-surface rocket with a nuclear depth charge, or homing torpedo payload.

bilities against ballistic missile submarines, however, probably would be limited to barrier operations at selected places in the oceans.

Antisubmarine Warfare Aircraft

157. The vast areas involved in open-ocean ASW operations cannot be adequately searched by surface and undersea platforms alone. To help with this problem, airborne patrol craft carrying sonobuoys, magnetic anomaly detection (MAD) gear, and ASW weapons, can operate up to hundreds of miles from a base and, working in consonance with other ASW platforms, can improve the overall open-ocean, search-and-destroy capability of the waterborne ASW forces.

158. The Soviets have become increasingly committed to the use of aircraft in ASW operations. Soviet production of ASW aircraft in the 1950s was limited to two types—the Madge seaplane and the Hound helicopter. The Madge, which is only now being phased out of service, has good endurance and range capabilities, but is limited by its slow speed and unsuitability for winter operations. These shortcomings were overcome in the 1960s by the Mail amphibian. Despite the improvement in speed and payload, the Mail has less endurance and range than the Madge, however. Until recently, the Hound was the only ASW helicopter in the USSR. It is a shore-based helicopter of limited range and payload capacities. It is not suited for shipboard deployment.

159. Another Soviet ASW aircraft is the May, which is operational in the Northern and Pacific Fleets. This aircraft has a combat radius of 1,350 n.m., with three hours on-station. These aircraft have recently begun patrolling in limited numbers over the Norwegian Sea, a Polaris submarine patrol area.

160. The newest Soviet ASW aircraft is the latest variation of the basic TU-95 Bear heavy bomber design. The new Bear probably is equipped with submarine detection equipment, and has two weapons bays, indicating a variety of dropable antisubmarine stores, and a lengthened fuselage, possibly for ASW equipment and operators. Since the first new Bear was observed in April 1969, as many as three ASW Bears have been noted on occasion exercising in the Barents Sea area, but they probably are not yet operational. Deployment of the aircraft is anticipated since it appears to be newly produced rather than a modification of older TU-95s.

161. A new medium helicopter—the Hormone A—is now available for deployment aboard major ASW ships. It is in service aboard the Moskva and Kresta classes of antisubmarine cruisers. About 150 Hormones have been built to date and production is continuing. The Hormone has a total expendable payload of about 4,300 pounds. It carries torpedoes and depth charges, and has a mission time of about two hours. We have no evidence to suggest that it has an all-weather capability. The Hormone A is replacing the Hound for shore-based service.

D. Antisubmarine Warfare Sensors

The following pages set forth one method of analyzing the capabilities and mode of operation of Soviet sonars installed on new ASW surface ships and submarines. They give estimates of the capabilities of the sonars, in which the Navy is in disagreement with the rest of the Intelligence Community.

This section also discusses Soviet fixed acoustic arrays and other detection systems.

162. During the last three years, the Soviets have introduced several new antisubmarine sensor systems. Foremost among these are new low-frequency sonars that clearly represent a new generation of Soviet ASW sonars. These

are found on Moskva-class helicopter ships, the Kanin-class destroyers, and on V-class and C-class nuclear submarines. The technical advances incorporated in these sonars, coupled with the introduction of a variable depth active sonar on the Moskva-class and a new helicopter-borne dipping sonar employed by the Hormone operating with the Moskva-class, provide the Soviets with greatly increased detection ranges against submarines at all depths. In addition to these active sonars, the Soviets have also put out over the past three years new passive sonars on the V- and C-class nuclear submarines and new fixed passive arrays in the Pacific, have experimented with sonobuoys fields in narrow straits such as those south of Sicily in the Mediterranean, and have mounted new MAD gear on several types of ASW aircraft.

Low-Frequency Active Sonars

163. The low-frequency active sonars mentioned above have enough features in common that, for purposes of analyzing their capabilities, they may be considered together. They all operate at lower frequencies, emit stronger signals, are more flexible in their modes of operation, and probably employ more sophisticated signal processing than earlier Soviet sonars.

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165. [

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166. [

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167. [

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[redacted]

a. [redacted]

168. [redacted]

a. [redacted]

b. [redacted]

b. [redacted]

169. [redacted]

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170. [

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a. [

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b. [

[redacted]

171. [redacted]

172. [redacted]

173. [redacted]

Fixed Acoustic Arrays

174. Geographical factors currently preclude Soviet use of fixed long-range, hydroacoustic detection stations except in the Pacific Ocean where deep water channels with good sound propagation conditions exist. Short-range (5 to 10 n.m.) active and passive systems are installed near Soviet naval bases and harbors in the Pacific and elsewhere, but these offer no threat to US FBM (Fleet Ballistic Missile) submarines.

175. A medium-range (10 to 50 n.m.) passive hydroacoustic detection station has been installed near Petropavlovsk in the Kamchatka Peninsula and it is estimated that installation of other stations at Shikotan and Onekotan in the Kurile Islands chain has been completed or is underway. There also is evidence which suggests that the Soviets plan to deploy additional sensors at other locations in the Kuriles/Kamchatka area. This area of the Pacific is not restricted by the unfavorable hydrogeographic conditions (i.e., lack of ready access to deep water with acoustic characteristics favorable for long-range sound propagation) that prevail in the strategically important Barents Sea area.

176. When operational, the arrays in the Soviet Far East and in the Barents Sea probably will have some capability against noisy

submarines. The detection range of these arrays is estimated to be about 50 miles against snorkeling diesel submarines, but less than 10 n.m. against Polaris submarines operating under quiet conditions. Like other hydroacoustic sensor estimates, this one rests heavily on judgments as to the state of Soviet technology in this field. Indeed, the state-of-the-art has not developed to the point where quiet submarines can be detected at long ranges by any passive array, US or Soviet.

177. In the coming decade, some of these Soviet shortcomings may be overcome. The possibility exists that the Soviets may be able to acquire access to extraterritorial locations where the emplacement of fixed arrays would be far more effective. The development of remotely emplaced arrays—now underway in the US—might also enable the Soviets to avoid geographic limitations. Though improvement of array technology sufficient for the detection of nuclear ballistic missile submarines on station appears unlikely in the next 5 to 10 years, some improvements will occur. Because of these possibilities, Soviet efforts to develop better systems and find ways to deploy them in strategically significant locations will almost certainly continue.

Other Detection Systems

178. The senors carried by present Soviet ASW aircraft include MAD devices and airdropable sonobuoys. The MAD gear is estimated to have a maximum range of about 1,500 feet in air and water path combined. Until this past year, Soviet air-dropped sonobuoys—and their twin cylinder moored hydroacoustic buoys (Twin Buoy)—had extremely short ranges (less than 1,000 yards) against quiet submarines and thus offered little or no threat. Only by use of a large number of buoys, closely spaced, could an effective barrier be created.

179. We now see evidence of the use of a new air-dropped sonobuoy with the May aircraft. While our information concerning the new air-dropped sonobuoy is limited, it appears to be different from any previous systems. The capabilities and characteristics of the buoy remain unknown, as the Soviets take operational precautions in the use of these buoys to preclude the possibility of recovery by any but Soviet forces.

180. The Soviets have also developed a new moored buoy which is probably hydroacoustic. We have recovered part of such a buoy and have some photos of another floating in the water, but cannot yet provide capabilities or characteristics of either the buoys or a complete system. We know that some type of new buoy system is in place ~~in the Straits of Sicily in the Mediterranean and~~ in the Barents Sea, but we do not know whether they are of this type.

181. In addition to this wide variety of acoustic systems, the Soviets have investigated the use of gamma ray spectrometers for the detection of radioactivity in the wake of nuclear submarines. Little is known about this development, though its testing has been reported [ ] the program had not met with much success; nor indeed, is it to be expected that such an approach would lead to the detection of Polaris submarines.

E. Antisubmarine Warfare Weapons

182. Antisubmarine weapon systems on Soviet surface ships include conventional ASW homing torpedoes, conventional depth charges, MBU systems,[27] rocket-propelled nuclear depth charges, and possibly a variant of this latter weapon which carries a torpedo in place

[27] MBU (Mnogostvolnaya Bombometnaya Ustanovka)—small rocket-propelled depth charges ripple-fired in groups of 12 to 18 to ranges up to 6,500 yards.

of a depth charge. ASW weapon systems on Soviet submarines include conventional ASW homing torpedo systems and possibly rocket-propelled torpedoes and depth charges (SUBROC-type) with either nuclear or conventional warheads. Airborne ASW weapon systems include conventional homing torpedoes and depth bombs.

183. Soviet passive acoustic homing torpedoes were first designed in the late 1940s and had extremely short homing ranges against quiet submarines. Known Soviet active acoustic homing torpedoes were initially designed about 1950 and suffered from a high homing frequency, medium speed, poor homing logic, and apparent difficulties in maintenance and repair. There is little information on later model torpedoes, but it is expected that their design has overcome many of these deficiencies. The Soviets have steadily upgraded the range capabilities of their multiple-tube MBU systems. The rocket-propelled depth charge (FRAS-1), with a maximum range of about 15 n.m., installed aboard the Moskva-class greatly improves the Moskva's standoff weapon delivery capability against submarines.

184. In addition to these weapon systems, the Soviets have both acoustic and magnetic influence mines which could be moored in shallow waters to restrict the use of narrow straits. They also have developed both a rocket-propelled and a buoyant self-rising mine with acoustic detection that can be moored in waters with depths of at least 2,000 feet.

F. Capabilities Against Polaris Submarines

This section evaluates Soviet capabilities to search for Polaris submarines with the Moskva task forces and to trail Polaris, overtly or covertly.

185. Soviet ASW capabilities against Polaris submarines suffer from the historical emphasis which the Soviets have put on ASW operations for the defense of coastal waters. The Soviet Navy still conducts most of its ASW training in the vicinity of its main operational bases. During the past two years, the Soviets have conducted at least 200 small ASW exercises per year in these areas. Although hundreds of ships, submarines, and aircraft have been involved in these exercises, most of the ASW training observed appears to have been of an elementary nature oriented toward convoy and harbor defense. Such training does not provide realistic experience in open-ocean operations against ballistic missile submarines. Only a relatively few large-scale ASW exercises have been conducted outside Soviet fleet operating areas, although the number of such exercises has been increasing.

Surface Search

186. Despite the historical bias toward coastal defense, the development of a capability to detect and counter Polaris submarines on-station is clearly a major Soviet goal. Perhaps the most significant step in this direction has been the development of the Moskva-class helicopter ship. These ships already have engaged in intensive efforts to detect submarines deployed in the eastern Mediterranean. The four exercises in which the Moskva helicopter ship and its sister ship, Leningrad, took part have shown that the Soviets intend to employ this class of ship and its associated helicopters with shore-based aircraft, other ASW ships, escorts, and deployed submarines in coordinated ASW operations. These operations can be viewed as a Soviet approach toward development of an independent, open-ocean ASW task force.

187. During some exercises in the Mediterranean, the Moskva has deployed two groups of two helicopters each about 20 miles ahead of the Moskva, with each group about 20 miles to port and starboard of the Moskva's steaming path. The helicopters move out to station at about 100 knots, put down a dipping sonar at the end of a cable which stays down for about 15 minutes while the helicopters hover in place (and the Moskva covers about 4 to 5 miles toward them). During these periods, the hull-mounted sonar has been observed to be transmitting. One pair of helicopters then pulls up the sonars and goes to a new station 4 to 5 miles further on. Sometimes the two in a group go together, sometimes they leap frog. These operations are tests of the operating techniques and capabilities of the Moskva.

188. What these activities mean in terms of area search capabilities is not agreed upon, however.

a. *CIA, DIA, State, NSA, Army, and Air Force Position:* The observed ship speed of 15 to 20 knots, together with an estimated sweep path of 30 to 50 n.m., indicate that area search rates of 450 to 1,000 square miles per hour are feasible with a 50 percent probability of detection. Under operational conditions, the Soviets would desire a higher probability of detection. In this case, search rates would be lower. The development of such capabilities was a major goal of a long period of research and sensor development and of recent exercises in the Mediterranean by the Moskva-class cruisers. Even if these exercises were not wholly successful, there is substantial evidence to indicate that the search rates cited above are within the capability of Moskva-class ships. This evidence includes published Soviet research on hydroacoustics; demonstrated Soviet capabilities to develop the necessary equipment; and the compatibility of recent Soviet hydroacoustic surveys, observed Moskva operations, and the characteristics of the equipment involved in the recent exercises.

b. *Navy Position:* The Navy believes that to ascribe such theoretically attainable performance to the Moskva, even with its new low-frequency sonar, is to underrate the difficulties inherent in sonar operations at long ranges. [redacted] The Navy believes that it is not meaningful to calculate a search rate except under carefully specified conditions.

189. With two Moskva-type task groups, the Soviets may be able to inhibit Polaris operations in the Mediterranean somewhat, but two of these task groups do not constitute a significant threat to the survivability of Polaris submarines operating there. Because of the larger areas to be searched, the capability of these task groups against Polaris submarines in the relatively unrestricted waters of the Atlantic and Pacific Oceans, and the Norwegian and Barents Seas, would be even more limited.

Trailing

190. The Soviets have also begun to conduct ASW operations in the vicinity of Polaris submarine bases. Soviet surface ships

operating about 300 miles north of Guam have, on at least two occasions, conducted ASW exercises; Soviet submarines may have participated. These exercises suggest that the Soviets may intend to initiate contact with a deploying Polaris submarine as it departs from the base—when detection and trailing opportunities would be greatest, as they exit port on the surface. Soviet intelligence collection ships stationed near Polaris bases play the initial role in the detection of these submarines.

191. Despite the recent advances in Soviet submarines and hydroacoustic detection equipment, present Soviet submarines still are unable to detect and trail covertly a Polaris submarine while it is on, or en route to, station. Although the new Soviet nuclear submarines are faster than present US nuclear submarines, Soviet noise control practices continue to lag those of the US. The higher noise levels not only degrade the performance of Soviet sonars but also make it virtually impossible for present Soviet submarines to approach close enough to a Polaris submarine to detect it with passive sonar without themselves being detected. Elimination of this problem probably would require redesign of the submarines; additional noise control measures would not be likely to correct this deficiency.

192. Overt trail of patrolling or transiting Polaris submarines is a more likely possibility. The V-class submarine appears to have the greatest potential in this regard. The speed advantage and sonar capabilities of this submarine are such that they may have reduced the effectiveness of present US countermeasures in breaking trail. But the theoretical Soviet capability of maintaining an overt trail does not constitute a significant threat to the survivability of the Polaris deterrent, since the Soviets cannot now conduct such trails on a sufficient number of Polaris submarines simultaneously.

193. The development of an open-ocean search or trailing capability sufficient to neutralize the on-station force of Polaris submarines appears well beyond reach of the Soviets during the period of this Estimate. Nonetheless, the Soviets appear determined to continue their efforts to improve their capabilities against ballistic missile submarines operating in the open ocean.

G. Antisubmarine Warfare Systems Under Development

Platforms Under Construction

This section discusses the new cruiser, new destroyer, and two new types of nuclear submarines under construction which will increase Soviet ASW capabilities. It also discusses Soviet research on new ASW sensors.

194. Evidence of continuing Soviet R&D on ASW surface ships has been provided by the recent appearance of a new cruiser and a new destroyer. The first of the new cruisers is in the process of fitting out and could enter operational service in early 1972. It is similar in general appearance to the existing Kresta-class cruisers and, like them, has SAM launchers fore and aft, a helicopter platform and hangar, torpedo tubes, and small guns. Unique ASW weapon systems have not been detected as yet, though it appears to have a large bow sonar dome. The identification of this ship as a new ASW ship is based upon its general similarity to the Kresta, which the Soviets classify as a large antisubmarine ship.

195. Series construction of the new Krivak-class destroyer is underway at two shipyards. These ships apparently will be fitted with torpedo tubes and possibly ASW rocket launchers. In addition, it appears to have SAM defenses and surface-to-surface antiship mis-

siles. These ships probably are intended as the replacements for aging ASW destroyers and destroyer escorts. They undoubtedly will be equipped with late model sonar gear and may have sea-keeping and endurance qualities sufficient for open-ocean operations with the new ASW cruisers. The first units of this class will enter operational service this year.

196. Work continues on two types of submarines, both of which probably are nuclear powered. The first of these, the P-class, is expected to be operational later this year, and little is known about it. Its hull shape is roughly similar to the C-class but considerably larger. It is unusually wide for its length and has its maximum beam near the bow. The bow appears to be fitted with at least 10 missile tubes similar to, but larger than, those of the C-class.

197. The second of these, the A-class, a relatively small submarine still under development, is estimated to be nuclear powered because fitting out is taking place at a nuclear submarine support facility. It has a highly streamlined hull suitable for high submerged speed. It also has a long sail, for a unit of its size, which may house a larger sonar. These characteristics suggest that the A-class will have an ASW role. The first unit of the A-class should be operational later this year.

Sensor Development

198. Little is known about Soviet R&D on ASW sensors, but the general direction of this effort can be estimated on the basis of open literature and other source material. A carefully planned program in hydroacoustics is being conducted by the Acoustics Institute in Moscow. Fundamental data necessary for the design of powerful, low-frequency, active sonar systems, and shore-based active hydroacoustic surveillance stations, are being obtained. The Soviets may be installing experimental hydroacoustic detection systems in the Barents Sea. Substantial effort in the development of signal correlation detection methods, using optical correlators and computer techniques, is known to be underway. These efforts, when coupled with the detailed statistical study of acoustic reflection from the bottom and surface of the ocean, strongly suggest that the Soviets will be utilizing these correlation techniques in the sonars presently being developed for buoys, helicopters, surface ships, and submarines. The Soviets also are training many new acousticians and have recently expanded R&D facilities.

199. In addition, the Soviets are conducting extensive military oceanographic work in all ocean areas. The main thrust of this work is to obtain the oceanographic data needed for the design of both active and passive sonars and to obtain the oceanographic data needed for developing an environmental prediction system for ASW. Such predictions are used to deploy hydroacoustic detection systems most effectively and also provide information necessary for selection of the number and spacing of ships in ASW operations.

200. We believe that the USSR is methodically exploring non-acoustic means for submarine search in the hope of achieving a breakthrough in underwater detection. Practical application of new discoveries in such fields as magnetics, electro-optics, nuclear emanations, and the utilization of satellite surveillance, may have potential for realizing a significant advance in ASW. This is an uncertain judgment, however

There is no basis on which to estimate with confidence the contribution that non-acoustic systems might make to the solution of Soviet ASW problems in the coming decade.

V. ANTISATELLITE DEFENSE

This section evaluates Soviet capabilities to detect satellites, accurately predict their position, and intercept them with direct ascent or orbital weapons or with non-destruction mechanisms. It also gives our assessment of the likelihood of Soviet interference with US satellites.

201. The Soviets began building space surveillance radars in 1963. Since then, the deployment of an extensive space tracking network and the development of an ABM system have provided the Soviets with an antisatellite capability as a by-product. The testing of an ABM interceptor that can be guided to the point of intercept with satellites in low-earth orbits, and the development of an orbital intercept capability with maneuverable satellites, have added to that capability.

202. The technical problems involved in attacking satellites in near-earth orbit are, for the most part, less severe than those of ballistic missile defense. Satellites appear as much larger targets to EW radars than do missile RVs, and, if tracked on successive orbits, their future position can be predicted with precision. In addition, satellites are vulnerable to a wider variety of weapons effects.

A. Detection, Tracking, and Orbit Prediction

203. The primary Soviet means of detecting, tracking, and predicting the orbits of US satellites is the Hen House radar network. These radars could be augmented by the acquisition and tracking radars of the Moscow ABM system and several deep space tracking R&D radars at various locations in the USSR.

204. A number of possible means exist for destroying or interfering with space satellites—nuclear as well as non-nuclear, direct-ascent, as well as orbital—but for each of these methods, the Soviet's Hen House radar system would provide the data necessary for successful engagement.

B. Intercept Techniques

205. The Soviets have both direct-ascent and orbital interceptors suitable for performing non-nuclear intercepts of US satellites at low and medium altitudes. A non-nuclear intercept capability has been demonstrated and could be used at anytime against selected US satellites. The Galosh ABM interceptor could be used in a direct-ascent mode against low-altitude satellites. The Galosh is particularly well-suited to this role because of its ability to fly under power and guidance all the way to intercept. This would permit refinement of the interceptor trajectory throughout the engagement. Based on reasonable estimates of Try Add radar and Galosh missile performance, non-nuclear kill probably could be attained against satellites up to about 300 n.m. altitude, and at slant ranges of a few hundred n.m. Beyond these limits the Galosh could also be used in a ballistic intercept mode against satellites up to about 450 n.m. altitude, with some reduction in accuracy, and possibly requiring a nuclear warhead.

206. The Soviets also have demonstrated a capability to perform orbital intercepts in their maneuverable satellite program. Analysis of [redacted] the Cosmos 248, 249, and 252 series of satellite flight tests in 1968, has revealed [redacted] a 6,500 pound interceptor vehicle [redacted] The purpose of the tests appears to have been to evaluate the orbital components of an antisatellite system. [redacted] the guidance system produced the very small miss distances needed for a high probability of kill with a non-nuclear

warhead. Another test of their system occurred in late October 1970, with the launch of the Cosmos 373, 374, and 375 satellites. This test series was nearly identical to the earlier test. Further developmental flight testing appears necessary, however, before the system could be considered fully operational. In past Soviet tests, the target and interceptor were launched so as to be coplanar, with the interceptor maneuvering in-plane to overtake and close on the target. A fully operational system would require greater flexibility than was displayed in the Soviet tests.

207. Considerably less potential exists for non-nuclear intercept of satellites at stationary equatorial altitudes (19,300 n.m.), but this capability is expected to improve over the next few years. For nuclear kill, a number of space and ballistic launch vehicles, already in the Soviet inventory, could be adapted for use against satellites at all of the altitudes of concern to the Soviets, since payload weight, orbit prediction accuracy, and guidance requirements are less stringent than for non-nuclear kill.

208. Several other means of interfering with satellites are possible, including the use of lasers and of electronic intrusion. Soviet capabilities in lasers are generally on a par with those of the US. [ ] They could employ a system of limited capability at any time, and it is estimated that more powerful systems could be developed in the next two to five years.

209. Opportunities exist to jam satellite command and control links. This approach would depend upon the ability to monitor satellite traffic and to establish critical frequencies to be jammed. Jamming of satellite receivers is within present Soviet capabilities. [ ]

C. Likelihood of Soviet Interference with US Satellites

210. We consider it highly unlikely that the Soviets would undertake widespread and continuing destructive attacks on US satellites in peacetime. We rate the chances for selective or sporadic attacks, or for non-destructive interference, nearly as low. In an arms control environment, the Soviets would probably see such a course as particularly risky.

211. The considerations which presently militate against Soviet interference with US satellites are likely to become even more compelling over the next several years. Both political and military considerations deter the Soviets from such action, and Soviet dependence on satellite-derived intelligence, already heavy, is likely to grow with the growth in China's strategic nuclear capabilities. A strategic arms limitation agreement would also increase the importance of this intelligence source.

VI. SOVIET CIVIL DEFENSE

This section evaluates Soviet civil defense policy in general, and evacuation policy and procedures, in particular.

212. Since 1966, the USSR has intensified and broadened its civil defense efforts. Present Soviet civil defense policy relies on urban

evacuation as the principal means for protecting most of the population of likely target areas. The ability of Soviet civil defense preparations to reduce casualties substantially appears, however, to be significantly circumscribed despite a relatively large commitment of resources—25,000 to 30,000 full-time personnel and annual expenditures of 150 million to 450 million rubles.

213. Reliance upon evacuation makes Soviet civil defense critically dependent on several days' warning time for maximum effectiveness. Under the most favorable conditions—good weather, sufficient transport, accessible dispersal areas, and a disciplined population—three to four days would be needed to evacuate the non-essential personnel from most Soviet cities. It would almost certainly require more time to evacuate Moscow and Leningrad.

214. If a decision to evacuate were made, the Soviets probably would attempt to relocate about 70 percent of the population of their larger cities. The remaining 30 percent would stay in the immediate vicinity to man key industries.

215. The organizational structure responsible for evacuation in the USSR, however, has not conducted any exercises that would demonstrate a capability to evacuate all large cities simultaneously. Such an evacuation would create complications that would almost surely delay the process beyond three to four days. There is, in addition, the strong likelihood that military mobilization would occur at about the same time. In that event, military requirements would undoubtedly have a higher priority in the competition for transportation facilities.

216. Thus, the Soviets probably do not now possess a real operational capability to carry out a rapid and orderly evacuation, and dispersal of the population of all their large cities. Even if adequate warning were given, the Soviet transportation system probably could not meet the simultaneous demands of the military forces and civil defense authorities.

217. The Soviets may not view their reliance on adequate forewarning a serious shortcoming. They have achieved a convincing nuclear deterrent that probably gives them sufficient reason to presume that it is unlikely that the USSR would be the victim of a surprise nuclear attack—an event which would preclude urban evacuation.

218. Several other distinguishing features of Soviet civil defense are its reliance on the use of inherent or hastily improvised shelters for protecting evacuees and residents of non-strategic areas from radioactive fallout; the extensive involvement of the military in its organization; and its emphasis on compulsory public training.

219. The Soviet civil defense program is controlled and administered by the Ministry of Defense. Military officers man civil defense command posts and supervise day-to-day operations even at the local level.

220. Most of the school-age and adult population have undergone compulsory training. The chief objectives of the training are to create a general awareness of protective measures, to provide leaders and specialists for the civil defense organization, and to prepare most of the working population for service in rescue and recovery units. Besides reducing the likelihood of panic and minimizing the probable number of casualties, this training also provides a convenient vehicle for political indoctrination.

221. The Soviets have gradually increased their commitment of resources to civil defense over the past several years. Their attempt to minimize total spending for the civil defense

program, however, is clearly reflected in their extensive use of low cost resources and existing facilities. Compulsory public training, for example, requires relatively little compensation or investment in facilities. The desire to avoid the large cost of constructing enough blast shelters for the Soviet urban population was probably a major reason for the Soviet leaders' choice of evacuation as their basic civil defense policy.

VII. FUTURE FORCES FOR STRATEGIC DEFENSE

Sections A, B, and C of part VII discuss some more general considerations with regard to estimating the future development of Soviet strategic defense forces—the future threat to the USSR, possible influence of an arms control agreement, and the relationship between the offense and the defense.

222. In the decade ahead, the Soviets must determine the extent to which they will develop and deploy new and improved defense forces to overcome their continuing vulnerabilities to ballistic missile and low-altitude air attack. Most of the options open to them depend heavily upon the achievements of their technology in the years to come. The timing of these achievements introduces a large degree of uncertainty to which the forecasting of future forces is extremely sensitive. Forecasts are also sensitive to the rapidly increasing costs of modern forces which cause major problems of resource allocation. At a minimum, the Soviets could accept mutual deterrence as a basis for their strategic defense policy and might do little more than complete deployment programs now underway. They must decide as well the extent and nature of a strategic arms limitation agreement with the US which could lessen a portion of the future threat. With or without a SALT agreement, they might continue to expand their air defenses while searching for better solutions to the problems posed by ballistic missile defense and ASW. In the absence of a SALT agreement, they could attempt to achieve a maximum defense posture through greatly expanded deployment of improved and new air defense, ABM, and ASW systems. Within each of these general courses of action, a large number of strategic defense force packages can be postulated to meet their objectives.

223. The Soviets have traditionally been preoccupied with defense and willing to spend the money needed for nation-wide defense in depth. The momentum of existing programs will continue for at least several years and keep the commitment to strategic defenses high for a time. Thereafter, the resources devoted to strategic defense will reflect Soviet tradeoffs between such considerations as policy aims, technological development, and bureaucratic interests. Their priorities, therefore, may change. This section of the paper considers the shape that future strategic defense forces might take under differing assumptions.

A. Future Threat to the USSR

224. One of the key factors affecting Soviet strategic defensive force goals is the perception of the threat which confronts them. Soviet planners are probably well informed about current US forces, as well as possible changes in these forces over the next few years.

225. [redacted] Soviet planners perceive any weapon system capable of striking their territory as part of the strategic offensive threat. This includes the more obvious elements of the US and NATO strike forces—ICBMs, bombers, and submarine-launched missiles—as well as carrier based aircraft, fighter bombers, and tactical missiles deployed in areas near Soviet borders.

226. The US strategic forces presently programmed for 1975 will be able to mount an attack of 445 intercontinental bombers, and [ ] nuclear warheads delivered by missiles. In 1975 there will also be about 2,100 aircraft deployed aboard US aircraft carriers and at bases in forward areas. In addition, the Soviets will face about 550 aircraft, [ ] missiles belonging to NATO countries, all capable of nuclear attack missions against Soviet targets. Further, the Soviets must keep in mind the possible US deployment of new systems employing advanced technology which will greatly complicate the defensive problem; these include new RVs, the Underseas Long-Range Missile System (ULMS), the B-1 strategic bomber, advanced air-launched cruise missiles and decoys, and quieter, more sophisticated, submarines.

227. We do not know, of course, exactly how the Soviets would project the threat likely to be posed by the US strategic forces during the 1970s. It is probable, however, that they would begin with present forces and presently programmed additions and improvements. To this they would add some further major additions and improvements talked about in the technical press. The range of possible major changes in US strategic forces might look like the following to the Soviets:

228. Advances in both ECM and penetration aids for missiles and bombers will confront the USSR in the 1970s with a threat qualitatively more complex and difficult to meet than that which they face today. The significant increase in US nuclear forces, particularly submarine launched warheads, will make the USSR vulnerable to attack from nearly all directions.

229. In addition to the threat from the West, Soviet planners must continue to deploy forces to deal with the growing and imposing threat from China. During the early 1970s, China will probably deploy ballistic missile systems of intermediate range and possibly intercontinental range as well. These weapons could have warheads in the megaton range. In this same period, China will increase its capabilities for air attack along contiguous borders of the USSR and into key areas of the Soviet heartland.

230. In spite of a buildup of defensive forces during the 1960s, the Soviets remain vulnerable to ballistic missile attack and to aircraft and air-to-surface weapons penetrating at low levels. Soviet R&D activities which might improve defenses against each of these threats continues. But even if substantial technical progress leads to more ef-

MAJOR CHANGES INCLUDED IN PROGRAMMED FORCE	MAJOR CHANGES INCLUDED IN AUGMENTED FORCE I	MAJOR CHANGES INCLUDED IN AUGMENTED FORCE II
Some reduction in B-52s.	Retain all B-52s.	Retain all B-52s.
Minuteman III retrofitted to about half the Minuteman force.	Minuteman III retrofitted to the entire Minuteman force.	Minuteman III retrofitted to the entire Minuteman force.
[		]
Safeguard Phase II, providing light area defense of the entire country, as well as defense of Minuteman complexes.	Additional Safeguard deployment.	Still more Safeguard deployment. B-1 ULMS

[ ]

fective weapons systems, they probably could not be deployed to significant levels before 1975. Thus, the Soviet strategic defensive capability, between 1970 and 1975, will improve only marginally, in spite of the incorporation of new and modernized equipment into their forces.

B. Strategic Arms Limitation Agreements

231. It is apparent that the Soviets take a serious interest in reaching an agreement which would permit a stabilized strategic relationship with the US. In the course of the SALT negotiations, the Soviets have indicated their interest in prohibiting ABM deployment, or limiting it to the defense of the NCA. We have taken this latter possibility into account in postulating illustrative strategic defense forces.

C. The Offensive-Defensive Relationship

232. Several factors govern the defensive response to a perceived offensive threat: technology, tactics, the extent of the defensive coverage required, and the interrelationship between defensive programs and other military and civilian programs. A defensive response can take several forms—the deployment of new weapons or modifications to existing ones, changes in deployment patterns, or changes in tactics.

Technology

233. Since World War II, strategic offensive innovations have usually taxed the limits of available defensive technology. Because of this, the defense has come to lag the offense. Sensor technology has become the most difficult area to advance, accounting for much of the lag in defensive responses. Sensors must accurately pinpoint the target, because without adequate data on the target location, other elements of the system become more complicated. To a degree, weapons technology, and good command and control techniques, can offset shortcomings in sensor technology: system inaccuracies can be compensated for by using nuclear devices with larger yields; faster missiles and aircraft can make up for some delays in target acquisition; prompt decision-making can minimize the engagement delays. Nevertheless, such system improvements can only marginally compensate for sensor deficiencies.

234. Soviet defenses are in significant measure affected by this problem. Indeed, the principal defensive problems being encountered by them stem from the inability of Soviet technology to provide highly efficient sensors at costs which permit widespread deployment:

—The major problem of low-altitude air defense lies in the fact that radar echoes from attacking bombers are lost in reflections from terrain features.

—The fundamental limitation of Soviet ASW is the difficulty of making the initial contact on a submarine in the open ocean, and holding it in trailing operations.

—ABM potential is limited by radar state-of-the-art in such regards as target acquisition, discrimination, and handling capabilities.

Tactics

235. Defensive tactics change as offensive innovations are recognized. US bomber strike forces, for example, adopted tactics designed to neutralize key SAM sites, and open an entry corridor to a coordinated attack. In response, the Soviet air defense forces adopted:

—The use of alternative and dummy SAM sites, and the rotation of equipment between positions, to frustrate effective offensive planning.

—Defenses in forward barriers and ambush sites along key approach routes to attack incoming bombers, thereby reducing the likelihood that defenses around the objective will be hit simultaneously by a coordinated attack.

236. Tactics are in a constant state of change. These changes often result from the introduction of new equipment, and always result, it seems, when forces go into combat and find classroom tactics wanting. Revisions in tactics are limited in what they can achieve, and some problems can be met only with major advances in the performance of defensive systems. The US ballistic missile submarine force, and to a lesser degree the penetration techniques of SAC bombers, currently pose problems of this type. If the concept of defensive tactics is broadened to include counterforce targeting plans for offensive forces, defensive and offensive force developments become more difficult to differentiate.

Soviet Defense Coverage Requirements

237. In their writings and in their defensive deployment patterns, Soviet planners have emphasized the protection of the 150 or so political-administrative centers upon which wartime control of the country depends. Defenses are also situated to protect military command and control centers.

238. Strategic strike and support forces are protected, but the pattern of protection varies. In general, the defensive patterns for the strike forces emphasize the protection of "reusable" military bases—those bases housing weapons and military supplies which Soviet military thinkers see either as decisive at the outset of a nuclear war, or as needed to support a continuous strategic offensive.

239. Soviet doctrine foresees military engagements involving general purpose forces (Soviet ground, air, and naval forces using tactical nuclear and conventional weapons) subsequent to the initial attack. These general purpose forces are to be supported by the military-economic potential of the USSR; i.e., transportation, and about a dozen types of defense related industries. The amount of protection accorded defense industrial centers varies with the importance of the center.

240. Since World War II, Soviet forces and defense related industries have been dispersed throughout the USSR, making them harder to attack. To protect them has required a widespread series of defended strong points within an encircling barrier. Most PVO Strany forces are concentrated in the USSR west of the Ural Mountains, along the Trans-Siberian Railroad to Irkutsk, and in the vicinity of Vladivostok.

Defensive Versus Other Military and Civilian Programs

241. Resource considerations and the interplay of bureaucratic interests also exert an influence over the course of major defensive force developments. Policy makers at the highest level in the USSR must balance their concerns for strategic defense against other needs, both civilian and military, and allocate money, manpower, and scarce technical resources accordingly. New undertakings are fitted into a variety of programs in mid-phase, a fact which tends to inhibit abrupt change.

242. We cannot place precise limits on the resources to be devoted to future defensive programs. Plant capacities, for example, are a constraint in some aircraft and submarine programs—and perhaps in some electronics products as well—but they can be expanded. Military expenditures can be, and have been, redirected within the defense budget and the defense budget itself has been increased.

Even so, past weapons programs provide useful yardsticks for putting bounds on the likely pace and magnitude of future ones. Detailed estimates of Soviet defense spending over the past 20 years have been used to derive rough guidelines of the Soviet willingness to commit resources to priority weapons programs.

243. Policy decisions in the USSR today are the product of a collective leadership in which each of the principal leaders weighs the alternatives against his individual views and interests. This policy environment is conducive to the interplay of conflicting bureaucratic interests, among which military interests—the man in uniform, his system design bureaus, and production facilities—carry considerable weight. Here, as with resource considerations, little is known of the balance of competing forces within the Politburo or the implications of these forces for future defensive developments.

244. In years past, the initiation of significant new military programs at the expense of others has resulted in debate and resistance. When the Soviet Ground Forces were reduced during the growth of the SRF, the controversy erupted into the public media. When the Soviet Navy's strategic strike role was changed in 1961, there was considerable agitation within the Navy which did not end until it was restored.

245. Today, we have no evidence of significant policy or resource shifts in progress which will have direct implications for the strategic defense, unless it is a SALT ABM limitation. We believe, however, that the normal interplay of vested interests continues and that major programs will evolve gradually. Otherwise, significant redirections of resources will probably result in discernible controversy.

D. Development and Deployment of New Weapon Systems

This section sets forth considerations in Soviet development of new strategic defense sensors and weapon systems. It indicates briefly why we think the Soviets will, or in some cases will not, deploy a specific new weapon system.

246. Soviet research on, and development of, military weapon systems has been receiving increasingly greater funding. There is every reason to believe this trend will continue as systems grow in complexity. While we have no knowledge of the share of the R&D funding effort going to strategic defense, the extent of known facilities and the succession of new systems deployed, leads us to believe that the R&D effort is substantial and that it will continue.

247. Major technical advances in weapons for strategic defense must be anticipated from this effort over the next decade. Some advances will result in significant upgrading of systems already deployed, while others will permit the fielding of new systems. The thrust of currently observable R&D programs, and the problems they are intended to overcome, have been described in relevant sections above. This section summarizes the nature and pace of these developments as a basis for the postulations of new weapon systems projected in the illustrative force models.

Air Defenses

248. The key air defense problems, highlighted in the discussion of current systems, are the need for additional and improved radar surveillance at altitudes below 1,000 feet, and the need for additional weapons which can engage attackers effectively at low altitudes in all weather conditions. To this is added a problem for the future—the threat posed by such systems as the United States' short-

range attack missile (SRAM), some 20 of which can be carried by a bomber. Also under consideration is the subsonic-cruise armed decoy (SCAD), 10 of which can be carried by a bomber. Such ASMs will not only present extremely difficult targets to current Soviet air defenses, but will also pose a saturation problem to Soviet command and control systems long before the borders of the USSR have been penetrated by bombers.

Air Surveillance and Control

249. Low-altitude air surveillance can be enhanced either by the improvement and expansion of ground-based radar networks or by the introduction of an overland airborne radar system. Improvements in the near term are likely to be the continuing deployment of Squat Eye radars, the upgrading of other deployed radars through the installation of MTI circuitry and the introduction of new height finders. The illustrative force models include qualitative changes of this type even though total numbers of radars change but slightly. Closing major gaps in the low-altitude air surveillance network by ground-based radars, especially below 500 feet, would require many additional fixed radars.

250. The threat of improved, long-range standoff weapons carried by US bombers will accelerate Soviet efforts to extend radar coverage beyond that now attained by ground-based systems. To engage bombers carrying such weapons before they can launch them will require both the extension of EW and the range at which AI can be controlled by monitoring facilities. Both airborne and seaborne systems will probably be improved and enlarged to meet these requirements.

251. It is possible, that in the course of the next decade, the Soviets might deploy an OHD system for EW use against bomber attacks from the US. If such a system were successfully developed and deployed, it could extend the detection range of the Soviet air warning network 1,000 miles or more from the borders of the USSR. Though there is no evidence that such a system is now being built for air defense, past Soviet activity with over-the-horizon radars has probably included the investigation of their use against aircraft. An OHD system used for this purpose would—like any OHD system—suffer from either the unreliability or high false alarm rates associated with propagation at relatively low frequencies. In the Soviet case, additional problems would be created by having to look into the auroral zones where significant electronic interference is encountered. If accommodations to these problems can be made, however, it would extend Soviet EW against a bomber attack.

252. In some areas, a suitable *airborne radar system,* which can look down over land, as well as over water, and see targets against the background return from the terrain, would offer significant advantages over the vast proliferation of ground radars. In particular, such a system could greatly improve the performance of interceptor aircraft against low flying targets in areas beyond the horizon of ground-control radars. We continue to believe the Soviets will develop an AWACS with an overland look-down radar. They have the requirement and they are working on the technology, though apparently at a slower pace than we estimated several years ago. As the required look-down capabilities have not yet been demonstrated by the Soviets, its introduction before 1976 is unlikely.

Interceptors

253. An interceptor that would work with the AWACS, utilizing a look-down AI radar, and shoot-down missiles with radar guidance that would enable them to engage aircraft penetrating at lower altitudes, is a Soviet requirement which would probably be met be-

fore the end of the decade. An *advanced long-range all-weather interceptor,* with look-down, shoot-down capabilities and capable of Mach 3.0 cruise to a combat radius of 700 to 1,000 n.m., could be available in the late 1970s. Should Soviet experience with the Foxbat show that the costs of building and operating a Mach 3 aircraft are so high as to make extensive deployment too costly, they may choose a design with dash speed of about Mach 2.5.

254. The Soviets may not wish to wait for this interceptor, however. The Soviets have never before had a gap of over five years between introduction of new fighters into APVO. They could bring in *a new low-altitude fighter* with improved MTI capabilities in the mid-1970s. It could be constructed less expensively than Foxbat and could complement the Foxbat which will probably be deployed well forward in peripheral locations and along key approach routes. They could deploy a version of the Flogger, which is now being deployed to the tactical air forces, in 1972.

255. If the US deploys the B-1, the Soviets will need additional modern fighters to intercept the bomber and the numerous ASMs that it can carry. Older systems have shortcomings that limit their adaptation to this role. The Foxbat has good capabilities which can be further improved with a new fire-control system. Although we have no evidence to indicate that the Foxbats currently being deployed have a look-down, shoot-down fire-control system, we believe that an advanced fire-control system with this capability will be incorporated in the Foxbat in the mid-1970s.

Surface-to-Air Missiles

256. The Soviets will probably pursue SAM modification programs as well. Improvement to the low-altitude capabilities of the SA-2 system has probably reached its low-altitude limit, but the *SA-3* may be further improved to enhance its low-altitude capabilities. In addition, the SA-3 engagement radar has been seen in the Leningrad area atop 60 to 100 foot towers—a practice which extends the range of its low-altitude capabilities without redesign of the system. Widespread use of such towers offers an easy means of bolstering low-altitude engagement capabilities in many areas. We may, therefore, see additional SA-3 deployment.

257. The deployment of SRAM by the US will seriously tax current Soviet SAM systems. The small radar cross-section, high speed, and low-altitude flight profile of this ASM will require SAM system performance beyond that which can now be attained by Soviet SAMs without substantial improvement. While the SA-5 system has sufficient range to operate against the weapons-carrying aircraft itself, other systems may not be able to. It is likely, therefore, that the SA-2 system in particular—because of its widespread deployment—will be further improved, particularly if the SRAM system as designed (or others like it) emerges as a threat to the USSR. In order to upgrade the SA-2 system to meet this threat, it is likely that substantial changes, or even the replacement, of the Fan Song Radar will be necessary. Other changes may well include shortened reaction times and faster interceptor missiles. These modifications would pose a serious strategic intelligence problem because they might be confused with those for the upgrading of SAM systems for ABM use.

258. By the mid-1970s, the Soviets could develop a *new SAM* with superior low-altitude intercept capabilities—perhaps as low as 100 feet at ranges greater than now possible.

A continuous wave, semi-active homing system, with the engagement radar elevated above the site, is a possible design approach to such a system. There is at present no evidence of such a program.

Command and Control

259. Finally, the saturation problem posed by the complexity of the defense system and by the large and growing number of targets and decoys, will require improved computer technology in both weapons systems and in the command and control network. We believe that new generation systems and improved computer technology will give the Soviets a capability by mid-1975 to make better tactical use of available forces. This control, on a near real time basis, will encompass both SAM and fighter operations, effectively providing accurate target assignments to those weapons best suited to the offensive threat.

Missile Defenses

260. The Moscow ABM system has two key technical shortcomings: it lacks the means to discriminate between real targets and penetration aids, and, as currently deployed, requires a high ratio of radars per launcher which severly limits the system's firepower. The Soviets apparently recognize these problems and are directing their R&D programs toward their solution in order to establish a basis for the further deployment of ABM defenses.

261. Discrimination between penetration aids and real targets is vital if the ABM site is to avoid exhausting its interceptors against false targets. The most promising approaches to discrimination generally involve either an interceptor which can be launched after the atmosphere has stripped away penetration aids, and unmasked the true target or targets, or one able to loiter after it has been launched in such a way as to allow it to intercept an RV not recognized until minutes after launch.

262. The great propulsion flexibility demonstrated by the *Galosh* missile suggests that it may be a very good interceptor to use in such a *loiter mode.* The Soviets could develop and put into operational use a loiter mode of operation for the Galosh within the next five years. In a loiter mode of operation, the interceptor is launched to the general vicinity of the incoming objects. It then flies up the threat tube at reduced thrust until the real target emerges from chaff, which has pancaked in the upper atmosphere. The interceptor is then committed and accelerated at high thrust to the target. The loiter mode of operation makes exhaustion of the interceptor inventory more difficult for the offense, provided the defense know, the maximum number of real targets which will emerge from the penetration aids. Use of the Galosh in a loiter mode is an improvement that might be incorporated into the Moscow ABM defenses in all the ABM deployment projections.

263. A more effective alternative solution to the problem of discriminating against chaff and decoys, and the one used by the US, is the development of a Sprint-type, very *high acceleration interceptor.* The acceleration of such a vehicle enables the defense to delay launch until the atmosphere has unmasked the real targets. Such a development may now be in progress in its very early stages; no firings of such missiles have yet occurred. It is unlikely that the Soviets could introduce a high acceleration interceptor for operational use much before 1975. Its deployment would be most desirable in more widespread ABM programs designed to defend against heavy attacks.

264. Reduction of the number of expensive radars per launcher is to be expected if there is to be a widespread deployment of an ABM system in the USSR. One method of doing this is suggested by a *steerable phased-array radar* which we believe is under development at Sary Shagan. A planar phased array appears to have been substituted for the large Try Add dish radar. Additionally, the building has been enlarged, perhaps to accommodate expanded data processing equipment. These modifications would most likely result in a radar with greater surveillance and target handling capability than the current Try Add. Incorporated into the Moscow defenses, the new phased-array radar will have a greater capability to maintain surveillance over areas not covered by long-range acquisition and tracking radars. Elsewhere, these new phased arrays could be deployed to cover areas where a major threat is not anticipated, although the larger acquisition and tracking radars will probably be required in ICBM threat corridors. The use of these radars in place of the Try Adds might also be related to reducing the high radar overhead which makes extensive deployment of the current Moscow system extremely expensive. Additional interceptors, remote from major ABM radar, could perhaps be controlled by a new large radar. The development of a system employing long- and short-range interceptors, which is much less dependent upon very large ABM radars with long construction times, may be the intent of current R&D work. If the short-range interceptor does not have Sprint-like acceleration, such a system could probably be advanced enough for deployment by 1973.

265. Another method of increasing the number of launchers per radar may be under development in the *Top Roost acquisition and tracking radar* at Sary Shagan. The Top Roost (which is the prototype of the Chekhov radar) is a bistatic radar which probably incorporates a separate pulsed radar.

266. The follow-on long-range ABM system (which we designate the ABM-X-2) assumed in Illustrative Force Models I, II, and III [27] consists of a Top Roost acquisition and tracking radar, a steerable phased-array radar, and a Galosh missile. The launchers have been projected at eight per site. Larger launcher/site ratios may be possible but there is no positive evidence that such is planned. The pulsed radar in the Top Roost may, on the other hand, be intended to replace the Try Adds. In such a case, this new design may be an attempt to provide a high performance radar which would reduce the overall costs of a follow-on system. For the projection in Force Model IV [28] the Top Roost is assumed to be the only radar in the system and the pulsed radar face on the receiver, about which we know little, is assumed to replace the Try Adds. The cost of radars per ABM launcher is cut significantly by such an assumption and widespread deployment becomes more attractive. The number and siting of Galosh launchers associated with such a system could vary widely. They could number perhaps up to 50, and they could be located within 50 n.m. of the radar.

Antisubmarine Warfare

267. The major ASW problem confronting the USSR is that of coping with hostile ballistic missile submarines on patrol in large

[27] See discussion beginning with paragraph 286.

[28] See discussion beginning with paragraph 319.

ocean areas. Technical progress is required in the development of improved ASW aircraft, ships, submarines, and fixed installations.

268. For several years, the Soviets have had underway a large-scale, aggressive effort to develop a variety of new ASW sensors, weapons, and platforms, some of which employ techniques which are not used by the US. The ASW systems, currently deployed throughout the Soviet Navy, represent a substantial improvement over those available only five years ago. They are indicative of Soviet intentions to achieve a meaningful capability to conduct surveillance and harassment in peacetime and, during hostilities, to destroy any submarine that is detected.

269. Important as these improvements have been, they do not *now* give the Soviets any assurance that they could detect, classify, locate, and destroy a significant number of US ballistic missile submarines at sea. Initial detection remains the crucial ASW problem.[29]

Submarine Systems

270. Recently constructed nuclear submarines—the V-class and C-class, for example—incorporate distinct improvements. They are significantly quieter than their predecessors, although noisier than the best US nuclear submarines. Additional quieting of these submarines is feasible. Such quieting would improve the detection range of their new sonars by reducing self-noise, and would improve their chances of acoustically initiating and maintaining trail on US submarines. The new Soviet classes are faster than previous Soviet classes and, in fact, are faster than US FBM submarines. The preponderance of R&D work on ASW sensors has been on acoustic detection systems, and the sonars mounted on these new submarines are obvious improvements over earlier sonars. Only gradual improvement will occur in these sonars with advances in signal processing, acoustic beam forming techniques, and sensitivity.

271. We believe that improvements in Soviet quieting and sonar signal processing would, by 1975, be more than offset by new improvements in the Polaris program. The programmed sonar improvements of the Polaris will enable it to increase its present [redacted] advantage in covert trailing attempts by V-class submarines.

272. Two new classes of nuclear submarines—*A-class* and *P-class*—will be ready for operation later this year. They probably will have at least the detection capabilities of the C- and V-class, and could now have the improved capabilities projected above as possible for the C- and V-class.

273. A vigorous quieting program could enable the Soviets nearly to match US quieting achievements by the end of the decade. A determined effort to improve both sonar design and processing could, by the late 1970s, also result in considerably improved capabilities. Some quieting and sonar improvements could be brought together, as early as the mid-1970s, in a new *advanced attack submarine*. Even with the improvements projected for the end of the decade, however, a new Soviet submarine could not gain an [redacted] advantage over Polaris sufficient [redacted] to give any significant probability of maintaining covert trail for an extended period of patrol.

Surface Ship Systems

274. A *new cruiser-class*, now under construction, and the new *Krivak-class destroyer*, now undergoing sea trials, are almost surely equipped with one of the new generation

[29] Maj. Gen. Rockly Triantafellu, Assistant Chief of Staff, Intelligence, USAF, does not agree with judgments expressed in this paragraph. For his views, see his footnote to Section IV, page 50.

sonars. The new cruiser will probably have a lower frequency sonar, like those of the Moskva, while the *Krivak* is likely to have the sonar carried by the Kresta-II. The design of the latter sonar probably will permit the refitting of most of the older ASW ships.

275. Deployment of a *new ASW helicopter ship* is estimated by the mid-1970s. It probably will be fitted with improved sonars based upon detailed evaluation of experience with the present Moskva-class ASW helicopter ships. This new ship probably would use a *new ASW helicopter* with improved station keeping, signal processing, and weapons carrying capabilities.

276. *Advanced sonars* and *long-range ASW guided missiles* will probably emerge in the mid-1970s to give surface forces a significantly improved attack capability. Coordinated ASW helicopter operations could further extend the search and attack range. The trend in surface force development has been to provide each ASW task group the ability to operate beyond the umbrella of land-based air, by providing surface-to-air and surface-to-surface guided missiles for defense against both air and surface attack, while extending the range of its own ASW sensors and weapons. By the mid-1970s, we expect to see open-ocean ASW task groups capable of carrying out independent search and attack operations on a regular basis.

Antisubmarine Warfare Aircraft Systems

277. The May and Mail aircraft provide the Soviets with medium-range airborne platforms for both coastal and open-ocean ASW operations in a few selected areas out to about 1,800 n.m. There is some evidence that these aircraft employ new sonobuoys, and possibly electro-optic systems, although details at this time are ambiguous. The *new Bear ASW aircraft* has sufficient range to participate in ASW operations thousands of miles from its bases. It has an increased payload capacity for sensors and weapons, but we do not know how this aircraft is equipped for search and attack. Large numbers of Bear aircraft would be required to achieve and maintain a significant threat to FBM submarines.

278. The Soviets have become increasingly concerned with the development of moored acoustic buoy systems. Improved systems are likely although the efforts to date have not been impressive. The widespread sowing of moored buoys would provide surveillance of substantial portions of the Norwegian Sea Basin, and the northeastern Atlantic, in addition to the closed Mediterranean Sea. Such systems would significantly improve the effectiveness of ASW aircraft capable of monitoring the system, though the exploitation of contacts would probably require an improved air-dropped sonobuoy system.

279. Although we cannot, at this time, predict specific airborne sensor developments, Soviet activity in this field is of sufficient scope to clearly indicate continued development of ASW aircraft over the next decade. The appearance of the new ASW Bear indicates that the Soviets intend to concentrate on sensor performance, area coverage, and aircraft payload. Late in the decade, the Soviets may deploy a much more *advanced ASW aircraft system.*

Fixed Acoustic Arrays

280. Fixed acoustic array systems will also be improved. The deployment of *fixed hydroacoustic arrays* at locations remote from the USSR could be made possible by improvements in underwater cable technology comparable to those made recently by the US. Soviet success in such a development could free them from the geographical constraints they now face in deploying such systems. Such

systems have the advantage of constant surveillance of large ocean areas, though their effectiveness varies greatly depending on submarine radiated noise, and ocean floor and water conditions. They can provide only the general location of a contact, and each contact must be exploited by seaborne or airborne systems. An *acoustic submarine detection system,* able to consistently detect ballistic missile submarines on station at ranges beyond about a thousand miles, is not likely even with significant improvements in Soviet sensor capabilities in the coming decade.

Non-Acoustic Sensor Developments

281. Non-acoustic detection methods seek to exploit the physical changes in the ocean medium caused by a submarine's passage through it, or any radiations from the submarine itself. These include such things as electromagnetic radiation from rotating electrical machinery, heat, disturbance of the earth's magnetic field, or the creation of characteristic wakes.

282. Our information on Soviet research on non-acoustic detection is extremely limited, [redacted] We feel reasonably certain that the Soviets are mounting an intensive effort. [redacted]

283. The Soviets may have already deployed non-acoustic ASW sensor systems and, by the mid-1970s, may deploy more. To the extent that the Soviets are successful in the field of non-acoustic sensors, the result might be a significantly improved system for search of the open ocean. [redacted] Though we might become aware that the Soviets were detecting US submarines with unexpected success, [redacted] the development might come as a technological surprise.[30] There would of course, still remain the problem for the Soviets of incorporating these techniques into an effective counter to the US FBM force.

The Use of Satellites in Antisubmarine Warfare

284. It is possible that, by the end of the decade, satellites may be used as integral elements of ASW systems. The most significant development to be anticipated is the use of satellite relay systems to monitor moored sonobuoy, or possibly magnetic sensor, fields. Though the use of satellites in low-earth orbit in such a role is possible, it would allow only sporadic monitoring unless a large number of satellites were employed. The use of synchronous satellites, with very large antennas would, on the other hand, provide a means for the continuous surveillance of many buoys with a real time return of data. The Soviets have yet to orbit a geostationary satellite, and there is no evidence they are now working on such an ASW program. Systems

[30] Mr. Leonard Weiss, for the Director of Intelligence and Research, Department of State; Vice Adm. Noel Gayler, the Director, National Security Agency; and Rear Adm. Frederick J. Harlfinger, II, the Assistant Chief of Naval Operations (Intelligence), Department of the Navy; believe [redacted] the likelihood of technological surprise very small. Mr. Leonard Weiss, further believes that the translation of such a development into an ASW weapon system capable of neutralizing the US missile-launching submarine force would still be a major undertaking extending over a period of several years, and doubts that such a capability would come as a surprise to the US.

involving the use of satellites to search ocean areas for submarines directly with radar, laser, or infrared (IR) sensors, appear unlikely developments within the next 10 years.

Antisatellite Capabilities

285. In the coming decade, the Soviets will almost certainly maintain a tested non-nuclear antisatellite capability based upon their maneuverable satellite and ABM programs. As these two programs grow in sophistication and as ABM deployment is expanded, antisatellite capabilities will grow. Thus, a reliable capability for the non-nuclear disabling of satellites at synchronous altitude (19,800 n.m.) is to be expected in the late 1970s, and any widespread deployment of ABM defenses will increase the opportunities for attacking satellites in low-earth orbit. In addition, a laser system capable of producing physical damage to the film, the optical system, and other components of a reconnaissance satellite could be available for use by the mid-1970s. The illustrative force models developed below do not treat antisatellite capabilities specifically, as they are basically the same in every case. In those models which include extensive ABM deployment, these capabilities will be appropriately enhanced.

E. The Illustrative Force Models

This section presents four illustrative force models for strategic defense which the USSR could adopt under differing policy objectives. The key assumptions, and force rationale and composition, for each of the forces is set forth, as well as the implications of the several forces for Soviet strategic defense. Section F discusses which of these illustrative courses of action are more likely than others.

An Appendix to Section VII gives illustrative force model projections of specific weapon systems.

286. The alternative force developments present possible directions that Soviet strategic defense forces could take. It should be emphasized that none of the Force Models will be composed of the particular weapons systems in the precise numbers listed. They are intended only to be illustrative models of possible trends and differing emphases. For defense planning purposes, the reader should consult the Defense Intelligence Projections for Planning (DIPP-71).

287. Four illustrative force models are discussed below. Each is based upon different assumptions about key variables such as policy goals, technological progress, coverage requirements, and available resources which influence Soviet strategic defensive deployment.

288. Illustrative Force Model I assumes that the Soviets—possibly as expressed in a strategic arms limitation agreement—will accept mutual deterrence as a basis for continuing US-USSR relations. It projects little more than the completion of deployment programs now underway, although it provides for some improvements late in the 1970s. The key assumptions of this force model turn on the future of the ABM deployment program and the influence it has on subsequent air defense system deployment. The ABM is assumed to be limited to an NCA defense around Moscow, and Soviet planners are assumed to believe that air defenses elsewhere in the USSR would be left largely ineffective by a missile attack. As a result, they are inclined to reduce future air defense deployment programs after completing those already in progress.

289. Illustrative Force Model II makes the same assumptions about the Soviet ABM de-

ployment program but different ones about future air defense programs. In this model, Soviet planners continue to deploy additional air defenses. A SALT agreement limiting the size of the attacking bomber force, and other offensive forces, leads the Soviets to believe that the air threat can now be managed. Alternatively, they may fear that the agreement will collapse and want to hedge against this day with systems that are not constrained. In the event that a limited ABM defense is the result of technical difficulties and not international agreement, they may expand air defenses in anticipation of eventual success in the ABM R&D program. A continuing air defense program will find strong support with elements of the Soviet military who have been associated with it in the past.

290. Both Model I and Model II include a vigorous research program in the areas of ABM and ASW.

291. Illustrative Force Model III assumes that strategic competition with the US continues about as it has in the past, without any strategic arms agreements. It also assumes that the Soviets, as they have in the past, rely on damage-limiting strategic defense programs as well as upon deterrence. Force Model III assumes that R&D programs in the areas of ABM and ASW succeed enough to permit widespread deployment of the systems developed. No attempt is made, however, to achieve a total defense.

292. Force Model IV represents a rough upper limit for strategic defensive forces in terms of a peacetime effort if, as is likely, it should be coupled with a comparable effort in the development and deployment of strategic offensive forces. The forces entailed in this model would constitute an attempt by the Soviets to create strategic defense that could significantly limit damage from the response to a Soviet counterforce strike. Such a force would strain Soviet technical, financial, and production capabilities. Even without such an all-out effort, however, particular systems could exceed the numbers projected in this force model.

293. In none of the force models have we postulated that the Soviets will undertake a major program aimed at upgrading deployed SAM systems for ABM defense. We believe it is unlikely that the Soviets will follow such a course under the assumptions which characterize the force models. The reader is referred to the section on the use of SAMs in an ABM role in Section III for discussion of the ABM potential of SAM systems.

ILLUSTRATIVE FORCE MODEL I

Key Assumptions

294. We assume under this model that:

—The Soviets—possibly because of a strategic arms limitation agreement—will accept mutual deterrence as a basis for continuing US-USSR relations.

—The Soviets will decide not to deploy ballistic missile defenses beyond a very limited system in the Moscow area.

—The Soviets will continue ABM R&D, but not ABM deployment.

—Relying on deterrence, the Soviets will recognize the extreme vulnerability of strategic air defenses in the absence of effective nationwide ABM defenses, and will not consider them necessary to maintain a survivable ballistic missile retaliatory force.

—There will be no significant advance in ASW sensor development which would seriously threaten a major portion of Polaris or Poseidon forces.

Force Rationale and Composition

Missile Defense

295. In this model, national deployment of ABM defenses would not take place. The Soviets would, however, continue ABM R&D and would be alert to the possibilities of major technological improvements that might alter the strategic balance. ABM efforts would increasingly be directed toward the qualitative improvement of NCA defenses to better enable them to cope with the threat of accidental or provocative third country attack. The nature of specific improvements to NCA defenses may be affected by the specific terms of an arms limitation agreement. Were the Soviets not constrained by restrictions on qualitative improvements, however, the following improvements appear likely.

a. By 1975

—The incorporation of ABM-X-2 elements into the Moscow defenses. The large Try Add dish radars will be replaced with steerable phased-array radars. Should there be no limitation on the number of large radars allowed, new long-range acquisition and tracking radars will be added.

—The development of a loiter mode capability, based upon the propulsion flexibility of the Galosh missile.

—The addition of any radars or missile launchers needed to expand the Moscow system to the maximum size allowed by a possible arms limitation agreement.

b. By 1980

—Expansion of Moscow defenses in the absence of any NCA-level ABM agreement.

Air Defense

296. Defense against bomber aircraft would be only marginally effective in limiting damage to the Soviet Union in a nuclear exchange because air defense weapons systems would themselves be severely degraded by an earlier ballistic missile strike. Nevertheless, the momentum of air defense programs already in progress, Soviet institutional rigidities and Soviet preoccupation with the formidable US aircraft threat would assure continuing air defense deployment for awhile. Failure to expand ABM defenses could lead to a gradual de-emphasis of strategic defense near the end of the decade. In this event, some of the more difficult technological problems associated with gearing air defenses to cope with the problems of low-altitude attack and advanced ASMs would not be addressed. Soviet air defenses would continue to be adequate to protect the USSR from third country attacks which do not include significant ballistic missile forces. Changes in existing air defenses would include the following:

a. The SA-3 and SA-5 programs would be completed by 1973—filling out gaps in the air defense barriers and defending a few more key targets.

b. Many existing SAM batteries would be modified and their performance improved.

c. The SA-1 system around Moscow probably would be phased out by 1976.

d. Some older units—the Fan Song C—of the widely deployed SA-2 system would be deactivated around many peripheral and lower priority targets, but the latest models would remain in high priority areas.

e. The Foxbat interceptor would be deployed only in limited numbers. Some older aircraft would be phased out.

f. There would be no increase in the number of AWAC aircraft.

g. Efforts to defend against low-altitude attack—a key air defense problem of the

1970s—would continue. Only limited success would be gained in this area, however. By the mid-1970s, some improvements would appear in the form of a slightly expanded number of EW air surveillance sites located across the approaches to key target areas and continuing emplacement of new equipment on existing sites.

297. No new strategic SAM prototype is being tested currently at the test ranges, a situation which argues against the procurement of a new SAM system for the strategic defenses during the early 1970s. As we assume declining Soviet air defense efforts throughout the 1970-1980 period, no new SAM is introduced later in the period either, even though there is adequate time for a development program.

Antisubmarine Warfare

298. Motivation for the expansion and improvement of ASW forces would remain high and these forces would continue to expand through 1975. Efforts to achieve a capability to destroy a major portion of US ballistic missile submarine forces at sea will be limited, however, because of the apparent difficulties of the problem and the threat of ULMS development which could negate such a capability even if developed. The forces available by 1975 would enable the Soviets to continue to deploy ASW groups in the Mediterranean, Norwegian, and Philippine Seas, and possibly in the Indian Ocean. This capability could protect the operations of Soviet fleets and serve to inhibit the free movement of Polaris submarines in the Mediterranean Sea, and possibly in the Norwegian Sea. Open-ocean ASW capabilities would remain marginal, however.

299. The principal improvements in ASW forces would include the following:

a. There would be improvement in the technology of ASW, but no dramatic developments in the improvement of sensors for submarine detection.

b. Fixed coastal acoustical arrays would be completed in the Barents Sea and in the Kamchatka Peninsula, and Kurile Island areas, but these would not be effective against Polaris submarine operations.

c. A program of quieting Soviet submarines would be undertaken which would improve their performance somewhat, but will not—even by the end of the decade—enable them to trail US ballistic missile submarines covertly.

d. Continuation of naval construction programs, but with major ship starts slowing in the early 1970s, would result in an ASW force of about 18 cruisers, 140 destroyers and escorts, 125 submarines, and 425 aircraft by 1975. Such a force would permit formation of about 18 ASW search-strike units, about two-thirds of which could be available at one time.

e. Forces would increase in the period 1975-1980 to include new classes of ASW cruisers and destroyers.

Implications for the Strategic Defenses

300. The key problems of strategic defenses—ballistic missile attack, low-altitude air penetration, or ASW—would not be solved by 1975. The composition of the Soviet forces and their over-all capabilities would have changed only slightly; and the USSR would remain vulnerable to a US retaliatory missile strike. The combined strategic defenses would receive fewer resources in the late 1970s, as increasing reliance may be put upon strategic arms limitations as a basis for preserving mutual deterrence, and the lack of an ABM defense would inhibit expansion in other new air defense programs.

301. Force Model I depicts a force in which current programs are completed, but no new

ones are introduced, except in the ASW forces. It represents a rough lower limit on possible Soviet defense choices, and would be at variance with Soviet behavior in the past where large defenses have been considered necessary, even if not totally effective. To date, such defenses have been acquired steadily.

ILLUSTRATIVE FORCE MODEL II

Key Assumptions

302. Under this force model, we have again assumed that the Soviets would not deploy the ABM beyond the Moscow area. They would, however, improve and expand it slightly, particularly later in the period. Unlike Model I, the Soviets, under this alternative, would continue to build up their air defense system, particularly against ASMs which pose for them a substantial threat. They would also continue research in the field of ASW sensors.

303. In this model, assumptions match those of Force Model I except that:

—The Soviets act on a concern that aircraft-delivered, stand-off weapons might threaten their retaliatory forces, despite any arms control arrangements that might be in effect.

—More vigorous Soviet efforts, particularly in the development of improved ASW platforms, would take place, but still would not produce advances in ASW sensor development which would permit effective open-ocean operations against enemy submarines.

Force Rationale and Composition

Missile Defense

304. As in Force Model I, there would be no national deployment of ABM defenses. Current components of the Moscow ABM defenses would be improved and upgraded. Vigorous R&D would continue in the ABM field, but it would not result in such an improvement in the protection afforded by an ABM system as to cause the Soviets to abrogate any strategic arms limitation agreement, or to undertake nation-wide ABM deployment.

Air Defense

305. In this model, Soviet programs for air defense would continue vigorously throughout the decade. Emphasis would be placed on defense against low-altitude attack by both aircraft and advanced ASMs, the key air defense problems of the 1970s.

306. Because of a more vigorous air defense program, some differences with the improvements achieved by Force Model I would result:

a. The SA-3 and SA-5 programs would be completed by 1973, but in greater numbers than in Force Model I—filling out gaps in the barriers and defending more key targets.

b. The SA-1 system around Moscow would probably not be phased out before 1977.

c. As before, some older units of the widely deployed SA-2 system would be deactivated around many peripheral and low priority targets, but the latest models would remain in high priority areas. Many existing SAM batteries would be modified and their performance upgraded against ASMs.

d. A new, long-range, low-altitude SAM would be deployed in limited numbers, beginning in 1975, around key locations. Wider deployment might not be undertaken if a reliable low-altitude defense capability can be given to interceptor aircraft. The new SAM would have a low-altitude capability equal to, or better than, that of the SA-3 (300 feet or less) at ranges greater than now possible. (The maximum intercept range could be as much as 20 n.m.)

e. Foxbat interceptors would be deployed into the mid-1970s. Older model aircraft would be retained in the force in considerably greater numbers than in Force Model I. Deployment patterns of interceptors would continue to emphasize defense of the western USSR.

f. Progress against low-altitude air attack would continue. Advanced interceptor aircraft would receive downward looking AI radars and complementary missiles, but only after the mid-1970s.

g. Air surveillance capabilities would be improved for low-altitude coverage. But until the mid-1970s, this improvement would only take the form of a slightly expanded number of EW air surveillance sites located on the approaches to key target areas, and of continuing emplacement of new equipment at existing sites. Equipped with a radar capable of detecting targets over land, a new AWACS would become operational after 1975 and be an effective and economic substitute for the further proliferation of land-based radars. Sufficient AWAC aircraft would be deployed after 1975 to support some 10 AWACS aircraft on patrol in periods of crisis. Major AWACS operating areas would include the Baltic and Barents Sea coastal areas, and possibly the southwestern areas, the Bering Strait, and the eastern maritime provinces.

Antisubmarine Warfare

307. A more vigorous effort to develop an anti-FBM submarine ASW capability is envisaged under this model, though solution of the problem is still likely to elude the Soviets. Despite this, greater improvements than before would be made to Soviet ASW forces. Forces available by 1975 would enable the Soviets to deploy ASW groups in the Mediterranean, Norwegian Sea, Indian Ocean, the approaches to the Sea of Japan, the Philippine Sea, and possibly the West European basin in the North Atlantic. Despite the lack of a long-range submarine detection system, the Soviets could patrol small areas of the ocean. Such a capability could protect the operations of Soviet fleets and serve to inhibit free movement of Polaris-type submarines in the Mediterranean Sea. Their ASW capability in the open ocean would remain marginal, however. Specific improvements would include:

a. Fixed hydroacoustic arrays would be installed in the Barents Sea, and in the Kamchatka Peninsula, and Kurile Island areas. In addition, the Soviets would develop moored sonobuoy systems which they may deploy in several locations.

b. A submarine quieting program, essentially like that of Force Model I, would be undertaken.

c. Present naval construction programs would result in an ASW force of about 23 cruisers, 145 destroyers and escorts, 145 submarines, and 430 aircraft by 1975. Such a force would allow the formation of about 23 ASW search-strike units, about two-thirds of which could be available at one time. Expansion of the force in the period 1975 to 1980 would include new classes of ASW cruisers and destroyers and a new class of helicopter carrier.

d. Expansion after 1975 would probably slow as the ASW force grew to about 35 search-strike units. Larger ASW forces would add little to Soviet open-ocean patrol capabilities without significant sensor advances.

Implications for the Strategic Defenses

308. The key problems of strategic defense—ballistic missile attack, low-altitude air penetration, and ASW, would not be solved by 1975. The composition of the Soviet forces and their over-all capabilities will have changed

somewhat by then, but the USSR would remain vulnerable to a US retaliatory missile strike.

309. New programs for the late 1970s, which promise enhanced capability against low-altitude air attack, would be deployed; but this is the only critical area in which progress would be discernible. Even here the air defenses are subject to disruption by missile attack. The combined capabilities of the strategic defenses would continue to grow in the late 1970s, even though the force levels would decline.

ILLUSTRATIVE FORCE MODEL III

Key Assumptions

310. We assume that the forces in Force Model III would result from a Soviet decision to make a significant investment in ABM defenses while continuing to improve air defenses and ASW. Although these forces would not reflect an all-out arms race, considerable resources would be devoted to strategic defense. Vigorous R&D programs would accompany the deployment of defensive systems in all strategic areas.

311. In distinction to the other models, we assume under this one that:

—Further ABM deployment would follow an improvement in Soviet ABM radar and missiles.

—Extensive R&D efforts in ASW sensors could produce improved capabilities toward the end of the decade.

—A new low-altitude interceptor, perhaps a version of the Flogger, is deployed with the strategic defenses about 1972.

—An advanced long-range all-weather interceptor is introduced in 1978.

Force Rationale and Composition

Missile Defense

312. A follow-on ABM system (ABM-X-2) composed of components currently undergoing tests at Sary Shagan—the Top Roost phased-array radar (Chekhov prototype), the steerable phased-array radar, and a modified Galosh missile—would be available for deployment which could begin in the 1972 to 1973 period. These components would probably be deployed at Moscow to fill out defenses there which were started in the early 1960s but never finished. These complexes could be operational by 1975. The extent of deployment to other areas beyond Moscow would depend upon the effectiveness and cost of the follow-on system, and probably upon the possibilities for hardening its components beyond the level now attained.

313. A follow-on ABM system, emplaced in areas other than Moscow, could be deployed in several different patterns, depending on the Soviet view of the threat and the performance of the system. A redoubt in the northwestern USSR—an integrated system of mutually supporting firing positions at Leningrad, Moscow, and Gorkiy—could be constructed. The Soviets might see this concentrated defense, employed in conjunction with improved ASW, as a means of limiting the damage to the key administrative and control centers of the USSR at the price of leaving the rest of the country unprotected. In connection with such a defense, they would probably see the need for a high acceleration ABM, of the Sprint type (ABM-Z-1), and deploy it along with the long-range Galosh.

314. On the other hand, the Soviets may believe that the follow-on ABM system, perhaps because of its lack of hardness, is not equal to this task, and deploy instead a light area defense of larger regions in the western USSR. Such a defense would provide some

protection against a light attack or accidental launch, but would require greater expansion of the large acquisition and control radar network than would a concentrated defense of a redoubt area. It could provide light ABM coverage in seven key target areas such as Leningrad, Archangel'sk, Yaroslavl', Gorkiy, Dnepropetrovsk, Kiev, and Minsk, and would cost about the same as the redoubt defense.

Air Defense

315. Intensive Soviet programs for air defense would continue throughout the decade, as they have in the past. As in Force Model II, defense against bombers flying at low altitudes, and armed with new ASMs, would be stressed, as would improvements to counter offensive electronic warfare capabilities. In general, the improvements made in air defense would be somewhat greater than those of Force Model II, and the competition for resources would be keener:

a. The Soviets would continue to deploy Foxbat and Flagon interceptors into the mid-1970s, while taking some of their older aircraft out of service. The Foxbat and Fiddler would not be deployed in numbers as great as previous interceptors. The Flagon, on the other hand, would replace the SU-9 all-weather fighter on a one-to-one basis. An improved interceptor, perhaps a version of the Flogger, would be deployed about 1972 (or a new design about 1974 to 1975) in the interim prior to the introduction of a look-down/shoot-down interceptor system.

b. The new long-range, low-altitude, SAM program would be deployed more slowly than under Force Model II, the result of resource delays attributable to significant ABM deployment and to the introduction of an interceptor with improved low-altitude capabilities. Wider deployment might occur should the Soviets fail to develop an effective advanced AWACS and aircraft capable of intercepting targets at low altitudes.

Antisubmarine Warfare

316. ASW technology would improve. Improved sensors for submarine detection could occur late in the decade, but would affect force levels and capabilities only slightly prior to 1980. Forces available by 1975 would—as in Force Model II—enable the Soviets to deploy ASW groups in the Mediterranean, Norwegian Sea, Indian Ocean, the approaches to the Sea of Japan, the Philippine Sea, and possibly the West European basin in the North Atlantic. With a longer range submarine detection system—made possible either by the development of remotely emplaced fixed arrays, or by the granting of extraterritorial emplacement rights to the Soviets—the Soviets, after 1975, would be able to more effectively employ their forces in the several ocean areas. To make effective use of these arrays, forward basing rights for both ships and aircraft would be required. This could hamper Polaris units and necessitate an expansion of existing patrol areas as a counteraction. The improvements achieved would include the following:

a. By 1975, present naval construction would result in an ASW force of about 27 cruisers, 150 destroyers and escorts, 150 submarines, some of which could be fast, quiet attack boats of a new class, and 455 aircraft. Such a force would allow the formation of about 27 ASW search-strike units, about two-thirds of which could be available at one time. During the period 1975 to 1980, some new classes of ASW ships and aircraft would be introduced with improved detection systems. This could include about 20 fast, quiet attack submarines.

b. A vigorous quieting program might be undertaken which would reduce the noise level of new Soviet submarines, appearing late in the decade, to nearly that of US submarines. Reliable covert trail would still not be possible without the improvement of Soviet passive sonar to a level well beyond that achieved by the US. Such an improvement in this period is unlikely.

Implications for the Strategic Defenses

317. Forces projected in Force Model III would diminish the threat of ballistic missile attack and low-altitude penetration by bombers with ASMs. Although the composition and capabilities of the Soviet forces would have changed somewhat, the improved forces would remain vulnerable to US retaliatory missile strikes using multiple warheads and advanced penetration aids.

318. The ABM deployment which occurred would provide only limited defense against missile attack. Because the ABM defenses have limited capabilities, the air defenses are still subject to disruption by missile attack. Moreover, ABM deployment on a significant scale would tend to draw resources from air defense programs unless the over-all level of effort were increased. The combined strategic defenses would continue to grow through the late 1970s. R&D programs directed at ABM and ASW sensor improvements would continue at a high level throughout the decade.

ILLUSTRATIVE FORCE MODEL IV

Key Assumptions

319. This force model assumes a vigorous resumption of the arms race, including the wide deployment of an ABM system designed to protect key areas of the USSR against a heavy US attack. Extensive efforts also would be made in air defenses and, as in Force Model II, deployment of a new SAM and new supersonic interceptor would occur. Quantitative improvement in the number of ASW platforms would take place, as well as the technological improvements of the previous force models. Forward basing rights for ships and aircraft would be necessary to best use the available forces.

320. This force would represent a rough upper limit for Soviet defensive forces in terms of effort the Soviets might expend during peacetime. Even with careful scheduling, the force levels entailed, although achievable, would strain known Soviet production capabilities as well as their technical and financial resources.

321. We assume uniquely under this alternative that:

—A vigorous arms race characterizes the basic strategic relationship between the US and the USSR during the coming decade.

—A significant advance in ABM sensor technology would occur, making reliable, nation-wide ballistic missile defense a realistic possibility. (This is a different ABM system than previously assumed.)

—Extensive R&D efforts in ASW sensors could produce improved capabilities toward the end of the decade.

Force Rationale and Composition

Missile Defense

322. The absence of an agreed limit on ABM deployment, and significant improvement in ABM effectiveness, would probably lead to an ABM deployment throughout the Soviet Union. We assume that such a program, when completed, would emphasize protection of about 18 principal Soviet target areas, and would defend a significant portion of the Soviet strategic offensive force.

323. The pace of a national deployment program would depend upon the timing of needed technological advances. If significant advances have been made in the development of new ABM components under development at Sary Shagan, an entirely new type of ABM system may be fielded by the Soviets in the coming 10 years. The Top Roost phased-array radar, with its separate pulsed radar incorporated into the receiver, may well be able to perform all the acquisition and engagement tasks required of the system. In this case, the steerable phased-array radar would not be required. Deployment of such a system could start within the next two years. By 1975, the first complexes would become operational at Moscow where much of the radar and communications infrastructure already exists. Systems deployed to other locations without the radar and communications base of Moscow would become operational at a later time, and the entire system could be operational in the early 1980s.

324. Although there is no firm evidence of Soviet R&D on a short-range, high-acceleration interceptor, initial deployment of such a missile is projected in the latter part of the decade. It is assumed that this missile is used in conjunction with the Galosh and the Top Roost radar used in the rest of the system.

Air Defense

325. As the prospects for an effective national ABM system grow, air defense programs in general would be pursued more vigorously. As before, emphasis would be placed on defense against bombers attacking at low altitudes and on the counters to offensive electronic warfare capabilities. The achievements of this program would be somewhat above those of Force Model III.

326. Sufficient AWAC aircraft would be deployed after 1975 to support 15 on patrol continuously for short periods. Major AWACS operating areas would include the Baltic and Barents Sea coastal areas, and possibly the southwestern areas, the Bering Straits, and the far eastern maritime provinces.

Antisubmarine Warfare

327. In this force model we assume that there would be vigorous improvement in sensor technology as in Force Model III. Diplomatic efforts might acquire naval base rights in such locations as the Indian Ocean, the western coast of Africa, the Mediterranean, or the Caribbean, from which Soviet ASW search-strike units could be deployed to choke points, like the Straits of Gibraltar, and transit lanes leading to Polaris bases. Large ASW forces could severely hamper submarine movements in such restricted waters.

328. ASW forces would expand with the construction of new classes of submarines, ships, and aircraft. An increase of current naval construction programs could result in an ASW force of about 30 cruisers, 175 destroyers and escorts, 165 submarines, and 560 aircraft by 1975. These forces could include fast, quiet attack boats of a new class, new Moskva-type antisubmarine cruisers, and additional long-range aircraft. About 30 ASW search-strike units could be formed from such a force, two-thirds of which could be available at one time. Forward basing rights for ships and aircraft would be necessary to best use the available forces. By 1975, Soviet forces—especially if supported by expanded sensor networks—could undertake search operations in the open ocean, increasing the likelihood of the detection of current ballistic missile submarines.

329. In the 1975 to 1980 period, a major effort would be made to incorporate qualitative improvements into existing vessels. New construction would be somewhat reduced and a shift in force composition toward advanced attack submarines would occur.

Implications for the Strategic Defenses

330. Significant technical improvement in ABM sensors and the deployment of nation-wide ABM defenses would give impetus to the increased deployment of other defensive systems. Resource constraints would require that some programs be scheduled more slowly than would be the case with less competition. Even so, substantial progress in defense against intercontinental ballistic missile attack, low-altitude air attack, and submarine-launched missile attack, would be made.

331. Heavy strategic defenses are consistent with a variety of Soviet offensive strategies from deterrence to strategic superiority. Depending on their over-all effectiveness, particularly that of the ABM, defenses at these levels could make a critical difference in the US deterrent in circumstances where the USSR might undertake a pre-emptive offensive attack.

332. The strategic defenses posited in this alternative are expensive, but possible. The simultaneous acquisition of the above defenses, and of large offensive forces, would require the extensive redirection of existing civilian and military programs. Hardest hit would probably be consumer programs and general purpose military forces. Institutional rigidity in resource allocation within the USSR, Soviet concerns with NATO, Eastern Europe, the Middle East, and Communist China, and the momentum of non-strategic programs in progress, minimize the likelihood that massive new defensive and offensive forces will develop simultaneously in the 1970s.

F. Likely Soviet Courses of Action

333. We do not consider either of the illustrative limiting cases (Models I and IV) to be a likely Soviet course of action. It seems improbable that if the US went ahead with something like its programmed forces, the Soviets would accept the deterioration in their strategic position implicit in Force Model I. Their historical interest in strategic defense is likely to continue, even under a possible arms control agreement limiting ABM defense to the national capital area. They are likely, if only out of the momentum of ongoing R&D and production programs, to devote more effort to strategic defense than the level of effort represented by Force Model I, although they have been concerned to hold down military spending.

334. On the other hand, we consider it unlikely that the Soviets will wish to make the effort represented by Force Model IV, except possibly in response to a US force buildup well beyond that depicted above as representing probable Soviet perceptions of the threat. This would be particularly true in the likely case that they would wish to parallel the high effort in strategic defense with a parallel effort in strategic offense. We think the Soviets would consider the combined costs of high strategic offensive and defensive programs too heavy, and the requisite disruption of other programs too great.

335. We think that, in absence of an arms control agreement on the one hand, or a significant step-up in the arms race on the other hand, something like the level of effort and technical progress represented by Force Model III is a likely Soviet course of action. This force would maintain, and in some areas improve, Soviet capabilities against their probable view of the likely threat. It could probably be done without straining Soviet resources more than does the current level of effort. In actuality, the Soviets could achieve something less than this, or something more than this, depending on specific developments in specific forces and weapon systems.

336. If there were to be a comprehensive arms control agreement, limiting both Soviet

ABM defense and US offensive forces to something like current levels, we think the level of effort and technical progress, like those represented by Force Model II, is a likely Soviet course of action. It would permit maintaining, and in some areas improving, Soviet capabilities for strategic defense under conditions in which the threat did not grow appreciably, and do this at a cost not much different from the current level of effort.

337. These force models are necessarily illustrative. They represent levels of effort, and show in general our view of what the Soviets might do with regard to developments in specific weapon systems and forces under these levels of effort. They are presented as illustrative courses of action, in the full awareness that our confidence in the projections declines as they move further into the future, and that the Soviets are certain in the course of the next 5 or 10 years to embark on some strategic programs of which we presently have little or no inkling. As in the past, the Soviets will doubtless make strategic program decisions on a year-to-year basis, and their forces will grow and change in gradual increments, in response to their view at the time of the balance between their view of the threat, technological developments in weapon systems, resource and bureaucratic constraints, and the general national policy aims of the leadership.

COMPARISON OF ILLUSTRATIVE FORCE MODELS FOR MID-1975

	Models I	Models II	Models III	Models IV
Hen House Missile Detection and Satellite Tracking Radar Faces	28	28	34	34
ABM Systems				
Regional Radars (Number of Antennas)	6	6	....	3
Missile Site Radars	12	12	....	8
Launchers	96	96	....	64
Option I: Model III				
Redoubt Defense				
Regional Radars (Number of Antennas)			6	....
Missile Site Radars			16	....
Launchers			128	....
Terminal Interceptor (Launchers)			—	....
Option II: Model III				
Western USSR Area Defense				
Regional Radars			6	....
Missile Site Radars			16	....
Launchers			128	....
Follow-On ABM System: Model IV				
Regional Engagement Radars (Number of Antennas)				12
Long-Range Interceptors (Launchers)				110
Terminal Interceptors (Launchers)				—
(Also current Moscow defenses indicated above).				
SAM Systems (Operational Sites)				
Older Systems	610	710	710	740
SA-3	270	300	310	320
SA-5	250	280	300	320
SA-Z-1	—	10	5	—
Interceptor Systems				
Older Models	975	1,225	1,225	1,600
Fiddler	160	175	175	175
Flagon A	600	750	750	900
Foxbat	100	150	150	190
Interim Low-Altitude Interceptor	—	—	200	200
Advanced All-Weather Interceptor	—	—	—	—
Air Surveillance Radars				
Existing Types	3,450	3,500	3,450	3,450
New Types	200	200	250	250
Total Radars	3,650	3,700	3,700	3,700
Total Sites	1,100	1,125	1,125	1,025

COMPARISON OF ILLUSTRATIVE FORCE MODELS FOR MID-1975 *(Continued)*

	Models			
	I	II	III	IV
Airborne Warning and Control Radars				
Flat Jack (Moss AWAC)				
Number of Radars	7	7	7	9
Improved Overland Radar				
Number of Radars	—	—	—	—
ASW Systems				
Major ASW Surface Ships				
Cruisers				
Moskva/Follow-on	2	3	3	3
Kresta	12	16	16	16
CLG	4	4	8	10
Total	18	23	27	29
Destroyers				
Kanin	8	8	8	8
Kashin/Follow-on	18	24	24	32
Krivak	16	17	17	32
Total	42	49	49	72
Other ASW Surface Ships				
Cruisers	4	4	4	4
Destroyers	28	28	30	30
Escorts	67	67	67	67
Total	99	99	101	101
Nuclear Submarines				
Older Attack Units	19	19	19	19
V	16	16	16	24
C	20	21	21	25
A	4	9	18	18
P	4	7	7	7
New SSN	—	1	1	4
Total	63	73	82	97
Diesel Attack Submarines				
Older Units	59	59	59	59
B	5	13	13	13
Total	64	72	72	72

COMPARISON OF ILLUSTRATIVE FORCE MODELS FOR MID-1975 (*Continued*)

	Models			
	I	II	III	IV
ASW Aircraft				
Near Zone				
Older Units	120	120	120	170
Hormone	225	225	225	265
New ASW Helicopter	—	5	10	10
Total	345	350	355	445
Far Zone				
May	60	60	80	90
Bear ASW	20	20	20	40
Total	80	80	100	130

	Force Model I	Force Model II
Policy Aim	Mutual deterrence is the basis. Possible SALT agreement limiting ABM. Gradual decline in strategic defense after current programs completed.	Mutual deterrence is the basis. Possible SALT agreement limiting offensive programs and ABM. Soviets see opportunity to improve air defense against limited offensive forces.
ABM	No development in ABM technology to make it effective against heavy attack. NCA defense only, retrofitted with new components under development at Sary Shagan.	No development in ABM technology to make it effective against heavy attack. NCA defense only, retrofitted with new components under development at Sary Shagan.
Air Defense	No overland AWACS capability developed. Moss AWAC kept at current levels.	New AWACS with capability to look-down over land operational after 1975; by 1980, covers 10 patrol areas in Baltic, and Barents Seas in west, and Bering Strait and maritime provinces in the east.
	No look-down/shoot-down capability developed, although work continues on it.	Look-down air intercept radar developed after 1975 with complementary shoot-down missile system. Retrofitted into 15 squadrons of Foxbat deployed along key approach routes.
	No new interceptors deployed, but Foxbat does get retrofit of new weapons system after 1975. Some older aircraft would be phased out rapidly.	
		Current SAMs modified throughout decade for improved performance. Improved ECCM. Better SA-3 performance against small high speed targets.
ASW	Sonar ranges improve, but are not adequate for long-range detection. No remote hydroacoustic system.	Sonar ranges improve, but are not adequate for long-range detection.
	ASW force capabilities improve in local areas around Soviet littoral, Mediterranean, and in selected areas of Atlantic, Pacific, and Norwegian Sea, where ASW search units operate.	ASW force capabilities improve in local areas around the Soviet littoral, Mediterranean, and in selected areas of Atlantic, Pacific, and Norwegian Sea. Larger forces than those of Model I can search wider areas in Atlantic, Pacific, and Indian Oceans.
	Submarine quieting program permits increased potential to trail US FBM submarines exiting bases.	Submarine quieting program permits increased potential to trail US FBM submarines exiting bases.
	Enough new ASW cruisers and destroyers to form up to 18 ASW search groups by 1975. New ASW helicopter and helicopter ships.	Enough new ASW cruisers and destroyers to form up to 23 ASW search groups by 1975. New ASW helicopter and helicopter ships.

Force Model III	Force Model IV
Strategic competition with the US continues without any agreements limiting weapons. Vigorous R&D programs produce systems successful enough to warrant widespread deployment.	Arms race resumed with vigor; no agreements limiting weapons; successful R&D programs produce new systems which warrant widespread deployment.
ABM technology develops sufficiently to warrant further deployment after 1975 in either light defense of western USSR or heavier defense, using Sprint-type interceptor, for Moscow-Leningrad-Gorkiy area.	New phased-array radar used as ABM acquisition and engagement radar at each complex. Sprint-type interceptors supplement Galosh in the late 1970s at high value targets. Widespread deployment covers the Urals and the west.
New AWACS with capability to look down over land operational after 1975; by 1980, covers 10 patrol areas in Baltic and Barents Sea, in the west, and Bering Strait and maritime provinces in the east.	New AWACS with capability to look-down over land operational after 1975; by 1980 covers 15 patrol areas in Baltic, and Barents Seas in the west, and Bering Strait and eastern maritime provinces in the east; to work with Foxbat and new interceptor.
Look-down air intercept radar developed after 1975 with complementary shoot-down missile system. Retrofitted into 15 squadrons of Foxbat deployed along forward approach routes.	Look-down air intercept radar deployed after 1975 with complementary shoot-down missile. Retrofitted into 25 squadrons of Foxbat deployed along forward approach routes particularly in the northwest. An advanced all-weather interceptor is introduced in the late 1970s.
Interim low-altitude interceptor could be available by 1972 if adopted from a current design like Flogger, or by 1974–1975 if based on designs currently being tested. About 20 squadrons could cover forward areas and key approaches to the Soviet heartland. An advanced all-weather interceptor is introduced in the late 1970s.	Interim low-altitude interceptor could be available by 1972 if adopted from a current design like Flogger, or by 1974–1975 if based on designs currently being tested. About 20 squadrons could cover forward areas and key approaches to the Soviet heartland.
New low-altitude SAM developed by 1975. Deployed to defend about 18 key locations.	New low-altitude SAM developed by 1975. Deployed to defend about 18 key locations.
	SA-2 system upgraded to give a capability against SRAM, and kept at three-fourths of current levels.
Current SAMs modified throughout decade for improved performance. Improved kill in presence of electronic jamming in all areas of SAM coverage. Better SA-3 performance against small high speed targets.	Current SAMs modified throughout decade for improved performance. Improved kill in presence of electronic jamming in all areas of SAM coverage. Better SA-3 performance against small high speed targets.
Sonar ranges improve, but are not adequate for long range detection.	Sonar ranges improve, but are not adequate for long ASW range detection. Remote hydroacoustic arrays are deployed using new cable technology in Greenland Straits. Moored buoys are also available.
ASW force capabilities improve in local areas around the Soviet littoral, Mediterranean and Norwegian Seas. Larger forces than those of Model I can search wider areas in Atlantic, Pacific, and Indian Oceans.	ASW force increases capabilities in local areas around Soviet littoral, Mediterranean, Caribbean, and Norwegian Seas. Larger forces than Model III can search more areas of Atlantic, Pacific, and Indian Oceans.
Submarine quieting program permits increased potential to trail US FBM submarines exiting bases. New quiet submarine introduced in 1975 to patrol Polaris transit areas; up to 20 available by 1980.	Submarine quieting program permits increased potential to trail US FBM submarines exiting bases. New quiet submarine introduced in 1974 to patrol Polaris transit areas; up to 25 units available by 1980.
Enough new ASW cruisers and destroyers to form up to 27 ASW search groups by 1975. New ASW helicopter and helicopter ships.	Enough new ASW cruisers and destroyers to form up to 30 search-strike groups by 1975. New ASW helicopter and helicopter carriers after 1975.

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