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Soviet Strategic Air and Missile Defenses

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CONTENTS

SOVIET STRATEGIC AIR AND MISSILE DEFENSES

THE PROBLEM

To estimate the strength and capabilities of Soviet strategic air and missile defense forces through mid-1970, and general trends in these forces through 1978.[1]

CONCLUSIONS

A. Throughout the postwar period the USSR has devoted a major effort to strategic defense. This effort can be attributed primarily to the size and diversity of US strategic attack forces, although for the future the Soviets must consider the threat posed by third countries, particularly China.

B. We believe that the competition for resources in the USSR is likely to intensify, not only between civilian and military programs, but also within the military establishment. These pressures may exercise a restraining influence on the strategic defense effort, but are unlikely to reduce it below present levels. The trend for the longer term will depend heavily upon Soviet decisions concerning antiballistic missile (ABM) deployment and the related question of strategic arms control.

C. The Soviets have built a formidable system of air defenses, deployed in depth, which would be very effective against subsonic and low-supersonic aircraft attempting to penetrate at medium and high altitudes. The system is less effective against higher performance

[1] This estimate considers only those Soviet strategic defensive forces located in the USSR and Eastern Europe. The Soviet antisubmarine warfare effort, with its implications for Polaris, will be discussed in the forthcoming NIE 11-14-68, "Soviet and East European General Purpose Forces."

aircraft and standoff weapons; it has virtually no capability against low-altitude penetration below about 1,000 feet except in a few, limited areas. The Soviets recognize these shortcomings and are deploying new interceptors, surface-to-air missiles (SAMs), and radars in an effort to overcome them.

D. At present, the major effort is directed to counter the threat posed by high-performance aircraft and standoff weapons. Deployment of the SA-5 long-range SAM system is the largest single defensive weapon program now underway. This system represents a considerable improvement over older systems in terms of range, velocity, and firepower. It is being deployed as a barrier defense around the European USSR and for point defense of selected targets. We estimate that there are some 60 SA-5 complexes, and that nearly half are operational; we believe that some 100 complexes will be operational by 1973. The Soviets have also been testing an airborne warning and control system (AWACS) that will probably enter service soon. This system, deployed in coastal areas and used with long-range interceptors, could greatly extend the area in which incoming aircraft could be engaged.

E. The Soviets are also attempting to strengthen their air defenses against low-altitude attack, but their efforts of the past year have resulted in minor improvements rather than in any fundamental solution to the problem. They have deployed all-weather interceptors with improved capabilities for low-altitude attack, and they will probably introduce more advanced SAMs and interceptors better suited for low-altitude defense. The primary limitation on low-altitude defense, however, is surveillance and control. Deployment of new radars has improved tracking capabilities in limited areas down to altitudes of 500 feet and even below, but we expect little advance in ground-based continuous tracking capability at low altitudes during the period of this estimate.

F. The Moscow ABM system (ABM-1), under deployment since 1962, has probably achieved some operational capability. Its deployment has apparently been cut back substantially from the originally planned level; the elements still under construction will probably be operational in 1970. We believe that the Soviets plan additional

deployment of an improved ABM system at Moscow. ABM development continues, but we cannot determine whether it involves an improved version of the Moscow system or a substantially improved, second-generation ABM system, although we consider the latter more likely. We still do not believe that there is any deployment of ABM defenses outside the Moscow area. We believe that the SA-5 long-range SAM system is unlikely to have a present ABM capability, although the state of available evidence does not permit us to exclude this possibility, and we consider it unlikely that it will be modified for an ABM role.[2]

G. Deployment of ABM defenses beyond Moscow will probably await the availability of a second-generation system. If such a system is now under development, it could reach an initial operational capability in the 1973-1975 period; like the Moscow system, it will probably be designed for long range, exoatmospheric intercept. The extent of future deployment will depend heavily upon economic as well as technical considerations. Deployment of a national defense system on a scale sufficient to cope with the full US missile threat does not appear to be a feasible course of action for the USSR within the period of this estimate. We believe that the Soviets will decide upon a program that would provide some defense for the most important target areas in the USSR. Some part of this defense would probably be deployed against Communist China and other third country threats.

H. We have no evidence of a Soviet antisatellite weapons program nor of Soviet development of hardware specifically for this purpose. It would be technically possible, however, for the Soviets now to have a limited antisatellite capability. With existing radars and missiles armed with nuclear warheads, they could almost certainly destroy or neutralize current US satellites up to about 2,000 n.m. during an early phase of their mission. With terminal homing in the interceptor missile, they may even be able to neutralize satellites using a nonnuclear warhead. Soviet technical capabilities are such that they

[2] For the views of Maj. Gen. Jack E. Thomas, the Assistant Chief of Staff, Intelligence, USAF, and Maj. Gen. Joseph A. McChristian, the Assistant Chief of Staff for Intelligence, Department of the Army, on the mission and capabilities of the SA-5 (Tallinn) system, see their footnote on page 17.

could develop and deploy during the next 10 years any of several types of antisatellite systems if they chose to do so. We believe, however, that the Soviets would realize that any use of antisatellite systems in peacetime would expose their own satellites to attack, and consider it unlikely that they would do so except in retaliation.

DISCUSSION

I. SOVIET STRATEGIC DEFENSE POLICY

1. Soviet strategic defense forces have gone through several stages of development since World War II. Through the mid-1950's the Soviets attempted to counter the large US strategic bomber force in being with large numbers of air surveillance radars and interceptor aircraft, reinforced at Moscow with large numbers of surface-to-air missiles (SAMs). As the US force obtained higher performance intercontinental bombers, the Soviets in the late 1950's developed and deployed Mach 2 interceptors and extended SAM defenses throughout the country. When the US, in the face of this extensive defense, began practicing low-altitude penetration tactics, the Soviets began in the early 1960's deploying the Firebar interceptor and the SA-3, both possessing better capabilities for low-altitude intercept than earlier systems. The US deployment of a standoff capability with air-to-surface missiles (ASMs), was followed by Soviet development and the current deployment of the Fiddler interceptor and the SA-5 system, which have greater ranges than earlier systems.

2. In their efforts to have a defense in being against an immediate threat, the Soviets have generally deployed a system quite early in the development cycle, using available technology, rather than wait for the development of more advanced but unproven techniques. These systems have then generally been modified and improved during the period of deployment. In some cases, however, deployment has been canceled early in the program either because the system proved relatively ineffective or because a better one was in the offing. When an improved system has been deployed, older ones are not rapidly retired or replaced. The Soviets tend to have extensive defenses deployed in depth, usually with considerable redundancy. This redundancy may give the defenses as a whole a greater capability than analysis of each weapon system alone would indicate. On the other hand, some elements of the defenses are always somewhat out of date, and do not represent the most effective Soviet counter to new US systems or concepts of operation.

3. Soviet military planners probably see the US strategic threat in the mid-1970's as consisting of three major forces: bombers and ASMs, intercontinental ballistic missiles (ICBMs), and submarine-launched ballistic missiles (SLBMs). They are aware that the threat will become more sophisticated and formidable with

the incorporation of improvements—new aircraft, ASMs, aerodynamic and ballistic penetration aids, and multiple independently-targeted reentry vehicles (MIRVs). The weight of a US attack could be increased by the strategic forces of Britain and France; the Soviets probably view the British forces as simply adding to the Polaris threat, but French intermediate-range ballistic missile (IRBM) deployment will pose a threat from a new quarter.

4. The Soviets probably believe that the massive air defense forces they have built and are building will provide an effective counter to the medium and high-altitude bomber threat, although they realize the problem of low-altitude defense is not yet satisfactorily solved. The most critical requirement of Soviet strategic defense, and the one most difficult to meet despite more than a decade of effort, however, is defense against ballistic missiles. The nature and extent of anti-ballistic missile (ABM) deployment is almost certainly one of the major questions of Soviet military policy.

5. For the period of this estimate, the US and its allies will continue to pose the principal strategic threat to the USSR, but Soviet military planners must also be concerned with the emerging strategic capabilities of a hostile China. The substantial military buildup along the Chinese border over the past few years has consisted primarily of theater forces. The strengthening of air defenses has been modest in comparison, and at a deliberate pace that in the Soviet view probably matches Chinese offensive capabilities. The Soviets almost certainly believe that their great superiority in offensive strategic weapons will enable them to cope with any threat that might materialize in the foreseeable future, and they hope for a political change in China that would remove this possibility. For the longer term, however, Moscow must consider the problem of ABM defenses against a new threat from the south.

6. Soviet decisions as to how best to meet the strategic threat of the mid-1970's will be affected not only by the Soviet view of the threat and the pace of technological development, but also by the constraints of economics. 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. We estimate that the Soviet strategic defense effort is larger, both in absolute terms and as a share of the total military budget, than that of the US. Developments of the past year, however, have strengthened the demands of competing claimants, both civilian and military. The Soviet leaders have shown rising concern over the adverse effects of military spending upon economic growth; we believe that this was a major consideration in their decision to discuss strategic arms control with the US. Now the Czech crisis has raised new requirements for theater forces in Europe which, together with the continuing buildup on the Chinese border, will probably bring a significant increase in Soviet theater forces.

Thus, we believe that competition is likely to intensify, not only between civilian and military programs, but also within the military establishment.

7. Current pressures may exercise a restraining influence on the strategic defense effort, but are unlikely to reduce it. For the near term, at least, expenditures for strategic defense will probably be maintained at their present high level, while military expenditures as a whole continue to rise. The trend for the longer term will depend heavily upon Soviet decisions concerning ABM deployment—potentially the most costly single military program on the horizon—and the related question of strategic arms control. If the Soviets embark upon any sizable new program of ABM deployment within the next few years, expenditures for strategic defense will increase and by the middle 1970's are likely to exceed those for strategic attack by a substantial margin.

II. AIR DEFENSE

8. Soviet strategic air defense forces are subordinate to the PVO Strany (Anti-air Defense of the country), one of the major Soviet commands. They are composed of three major elements, which carry out air surveillance, interceptor, and SAM operations. These forces are deployed throughout the USSR in a hierarchy of geographical divisions and subdivisions linked by multiple communications channels. We believe that the major divisions are 10 air defense districts (ADDs), which are probably subdivided into some 40 air defense zones (ADZs). Although most of the latter are probably further divided into sectors for air surveillance purposes, integrated control over all three functional elements of the air defense forces is almost certainly exercised primarily at the ADZ level.

9. In addition to the forces directly assigned to it, the PVO Strany also exercises operational control over air defense elements of the general purpose forces at such times as those elements are required for defense of the USSR.[3] In Eastern Europe, air defense of the Soviet forces rests with the local air defense commander; air defense of the Warsaw Pact countries is a national responsibility. Both, however, cooperate with the PVO Strany in the USSR and in effect constitute a westward extension of Soviet air defense. At present, however, the Soviets probably have considerable doubt about the reliability of Czech forces. With Soviet assistance, Mongolia has established an air defense system which is probably also closely coordinated with the PVO. We believe that the cooperation between the air surveillance systems of the USSR and Communist China has ceased.

10. The command, control, and communications network of PVO Strany has a high degree of redundancy, flexibility, and reliability. We believe that the semiautomatic air surveillance reporting system introduced some 10 years ago

[3] The air defense capabilities of Soviet general purpose forces are discussed in the forthcoming NIE 11-14-68, "Soviet and East European General Purpose Forces."

has been extended further throughout the USSR, to the Groups of Soviet Forces, and to a number of other Warsaw Pact countries. We now estimate that more than two-thirds of the ADZs now employ this system in varying degree, and believe that it will be extended to all ADZs. Surface-to-air missile units are almost certainly included in this system. Despite these improvements, however, there are indications that the Soviet air defense system remains vulnerable to saturation.

A. Forces Through Mid-1970

Air Surveillance and Control Systems

11. The Soviets continue to improve their extensive and overlapping air surveillance capability. Some 1,000 radar sites in the USSR containing 4,000-5,000 radars are distributed along the boundaries of the country, along barrier defenses within the country, and around major defended areas. Coverage is particularly dense west of the Urals. The Soviet sites are supplemented by over 300 sites containing 1,000 radars in the Warsaw Pact countries of Eastern Europe. All the sites have several air surveillance radars; practically all have radars which could provide information to ground-controlled intercept (GCI) controllers. The density of coverage increases the likelihood of detection, and frequency diversification among the sets provides some defense against electronic countermeasures (ECM). During the past year the deployment of new radars, especially for low-altitude coverage, continued. We expect the numbers of radars and radar sites to remain relatively stable in the near term, as old equipment is retired at about the same rate as new is installed.

12. During the past year the Soviets have been testing an airborne warning and control system (AWACS) that will extend their coverage for early warning (EW) and interceptor control. Such a system uses an airborne platform for long-range radar surveillance and for the data-processing and communications equipment required for control of interceptors; the Soviet system employs the Moss, a modified TU-114 Cleat. It will probably be operational soon with a few aircraft. The system could be considerably expanded with the conversion of additional Cleats; some 35-40 Cleats have been produced. It is also possible that other transport aircraft will be modified for this role.

Interceptors

13. At present, there are probably some 3,400 interceptors in Fighter Aviation of Air Defense (IAPVO)—about 100 less than last year. In addition, the PVO can call upon the 2,700 fighters of Soviet Tactical Aviation and upon the 2,400 fighters in the East European Air Forces. Nearly all of these 5,100 fighters were designed as interceptors; some 3,400 of them are in regiments which have a primary air defense mission.

14. Some 60 percent of the Soviet interceptor force in IAPVO is still made up of subsonic or low-supersonic models introduced in 1957 or earlier, which have little capability above 50,000 feet. Most of these older models are day fighters and are armed with guns or rockets, limiting them to attack ranges of a half-mile or less. Some 25 percent of the force is composed of Mach 2 all-weather interceptors introduced in 1959-1964, which are armed with air-to-air missiles (AAMs) having ranges of 3-6 nautical miles (n.m.), but capable of tail attack only. The remaining 15 percent of the force is made up of new aircraft which are capable of head-on or multidirectional attack; we estimate that they have AAMs with ranges of 10-16 n.m., improved air intercept (AI) radars, and data link control systems.

15. We estimate that models currently being deployed will continue to enter the IAPVO forces over the next few years, and that older models will be phased out, as indicated below. These older models may be retained as reserve aircraft.

ESTIMATED INTERCEPTOR FORCE LEVELS

	15 October 1968	Mid-1969	Mid-1970
Older Models			
Fresco	1,375–1,400	1,200–1,275	1,050–1,150
Farmer	420–450	350–375	275–325
Flashlight	175–200	150–175	125–150
Fitter	0–25	0–25	0
Fishpot	750–800	750–800	750–800
Newer Models			
Firebar	350–400	350–400	350–400
Fiddler*	50–75	75–100	100–125
Flagon A*	130–150	225–250	325–375
Foxbat	0	0	0–25
TOTAL	3,250–3,500	3,100–3,400	2,975–3,350

* These models are in current production.

Surface-to-Air Missiles

16. The area defense capabilities of the IAPVO are supplemented by the widespread deployment of the SA-2 which makes up the great bulk of Soviet SAM defenses. Deployment of the SA-2 was essentially complete by the end of 1965. We estimate that there are now some 840 operational sites of 6 launchers each in the USSR, and that there are another 200 sites which are probably intended to provide alternate or supplementary positions during periods of emergency. Most of the operational sites are occupied by PVO Strany battalions, but some 30-40 are probably manned by the air defense troops of the ground forces. We believe that Soviet ground forces have about 10-20 additional SA-2 battalions in garrison in the USSR and some 35 deployed in Eastern

Europe. The air defenses of the East European countries include some 130 SA-2 sites. Since its initial deployment, the SA-2 has undergone several model changes, which have progressively increased its maximum effective range from 19 to about 27 n.m., improved its maximum and minimum intercept altitude capabilities, and given it a better tracking and electronic counter-countermeasure (ECCM) capabilities. These improvements have continued during the past year, and are reflected in our estimates of capabilities below.

17. The SA-1 system, deployed more than a decade ago in a double ring around Moscow, is still operational. Under normal conditions, the Soviets apparently keep only about 20-25 percent of the 3,255 launchers in a state of readiness; in times of crisis, however, this level of readiness is probably considerably increased. The Soviets have made improvements in this system which probably give it a capability approaching that of the SA-2.

18. We estimate that there are now about 140 SA-3 sites in the USSR, of which about 80 percent are permanently occupied. In addition, the SA-3 has been deployed widely with the Soviet forces for defense of airfields in Eastern Europe. Deployment of the SA-3 may continue for another year or so. Further analysis of the SA-3, including radar simulations, has led us to estimate better low-altitude capabilities for the system.

19. Deployment of the SA-5 long-range SAM system has continued. We believe that there are now some 60 complexes, and that nearly half are operational. The rest will probably be operational by mid-1970. A typical complex contains 3 sites of 6 launchers each. As presently configured they are highly vulnerable to nuclear attack. We believe that the system is being deployed as a barrier defense around the European USSR and for point defense of selected targets.

B. Capabilities Through Mid-1970

Against the Medium- and High-Altitude Threat

20. Soviet air defenses have a formidable capability under all weather conditions against subsonic and low-supersonic (less than Mach 1.5) aircraft attempting to penetrate at medium and high altitudes to principal target areas. Moreover, Soviet capabilities against higher performance targets are being improved by the introduction of new interceptors and SAMs. Under optimum conditions, the range at which the Soviet ground-based EW system can detect and track is limited only by the radar horizon, and extends 200-250 n.m. out from Soviet borders. Detection and tracking at medium or high altitudes is virtually assured at about 135 n.m. The detection range of the ground-based EW system is progressively reduced against aircraft penetrating at lower altitudes, primarily because of line-of-sight limitations.

21. The new AWACS aircraft will probably operate some 200-500 n.m. from the coastlines of the USSR. Area and frequency of search will be limited by the number and performance of aircraft available. This system will greatly extend the range at which approaching aircraft can be detected in patrolled areas and will permit the full combat radius of the Fiddler and Firebar to be exploited in intercepts under control of the AWACS. Extensive deployment of this system would improve the Soviet radar and fighter control coverage by denying to a large extent undetected low-altitude penetrations over sea approaches.

22. The Soviet interceptor force has good capabilities against subsonic and low-supersonic aircraft at altitudes from 2,000 to 65,000 feet. Its capabilities would be degraded at night or in adverse weather conditions, by attacks at lower altitudes, by standoff attacks, and by attacks using decoys and ECM. Against maneuvering supersonic targets flying at speeds of over Mach 1.5 and at altitudes above 65,000 feet, the Soviet manned intercept capability is marginal, but is being improved with the deployment of Fiddler and Flagon A.

23. Soviet SAM systems provide good medium- and high-altitude defense against subsonic and low-supersonic aircraft and ASMs under all weather conditions. However the earlier SAMs—SA-1, SA-2, and SA-3—are short-range systems. Nuclear warheads are probably available at some SA-1 and SA-2 sites; use of such warheads would greatly increase the kill probability of these systems. The SA-5, however, represents a considerable improvement over older systems in terms of range, velocity, and firepower. We estimate that it is capable of engaging aircraft and ASMs traveling at speeds up to about Mach 3 and at altitudes of about 100,000 feet. Its maximum effective range against aircraft is probably on the order of 100 n.m., and against ASMs on the order of 50 n.m.

Against the Low-Altitude Threat

24. The Soviets are well aware of the low-altitude penetration threat to their air defenses, and have introduced during the past year several improvements in an attempt to overcome the shortcomings of their defenses. The capabilities of the Soviet air defenses to intercept aircraft or ASMs flying at low altitudes decline with the altitude, and at very low altitudes are limited by the line-of-sight of radars and by the difficulty of maintaining track on a target through ground clutter. In addition, Soviet low-altitude capability depends on the training and alertness of personnel, weather, terrain, and other factors. Soviet efforts over the past year have resulted in minor improvements rather than in any fundamental solution to the problem.

25. During the past year the Soviets have continued their efforts to improve low-altitude detection and surveillance capabilities. They have continued to deploy radars on towers which improves line-of-sight coverage of targets at very low altitudes; these radars have the capability to detect moving targets against

ground clutter. In areas where deployment is sufficiently dense, we believe that these installations give a tracking capability somewhat below 500 feet; in the Leningrad area, it may be as low as 100 feet. As they are added to other selected radar sites throughout the USSR, capabilities will improve in those particular areas; future deployment will probably be limited to likely avenues of approach.

26. Generally, in areas of dense radar coverage (Eastern Europe, the western USSR, and the approaches to major military-industrial centers) the air surveillance network is capable of maintaining a continuous track on aircraft flying down to about 1,000 feet. In areas of less dense coverage, Soviet radars are unlikely to be able to accomplish continuous tracking below 3,000 feet.

27. Improvements in the AI radars employed by the new generation of fighters probably provide some capability to distinguish moving targets against ground clutter. Some 400 interceptors in IAPVO probably now have an intercept capability in all weather conditions down to 1,000 feet over favorable terrain (and somewhat lower over water). In clear daylight the older model interceptors, still operational in large numbers, would also be used for low altitude area intercept under visual conditions against slower aircraft. Although we believe the Soviets are working on a look-down capability for their interceptors, we do not expect an operational capability before mid-1970.

28. Elevation of SA-2 missile guidance radars has given some SA-2 sites a capability down to about 1,000 feet. In addition, new information and analysis of the SA-3 electronics has led us to believe that the SA-3 can, under favorable circumstances, effectively intercept aircraft flying as low as 500 feet at a range of about 2-5 n.m. We have no technical evidence concerning the low-altitude capabilities of the SA-5, but we think it is unlikely that it is being deployed to counter the low-altitude threat.

Against the Standoff Threat

29. The key tactic in preventing a successful ASM attack is to destroy the carrier aircraft before they can launch their missiles. Once the attackers have launched their missiles, the ASMs themselves must be engaged. The Soviets are deploying forces with greatly improved capabilities for both of these eventualities. The deployment of Fiddler interceptors with increased range and attack capabilities, together with AWACS aircraft, will extend the areas in which ASM carrier aircraft can be engaged several hundred miles farther from critical target areas. Similarly, the SA-5 barrier defenses will cause the attackers to face an increasing volume of defensive fire as they approach their objectives; the SA-5 range of about 100 n.m., together with nuclear or homing warheads, will greatly increase the probability of intercept of supersonic aircraft at medium and high altitudes. Should the ASM carriers successfully launch their missiles, the SA-5 could probably intercept incoming ASMs at medium and high altitudes at distances of about 50 n.m.

30. These developments permit the Soviets to provide a much better defense against a standoff threat directed at targets in the European USSR from the north and northwest. They are apparently more vulnerable to a standoff attack from the south, but are improving their capabilities. Fiddler deployment and SA-5 point defense of military-industrial complexes will improve defenses in the central and eastern USSR.

Against an Electronic Countermeasure Environment

31. The use of ECM appreciably degrades the performance of air defenses. The Soviets practice a great deal in an ECM environment. The Fiddler uses a different type of radar circuitry than that employed by previous Soviet fighters, and probably cannot be jammed by most Western AI jammers. This technique may be refitted to AI radars carried by other new interceptors. Furthermore, we believe that the new interceptors now being deployed are equipped with infrared missiles and with data links for GCI, which improve their capability in an ECM environment. All Soviet SAM systems are designed to operate in a noise jamming environment; the SA-2 most widely deployed in the USSR and Eastern Europe (but not in Vietnam) can probably degrade angle deception jamming and select moving targets in an ECM environment. Considering Soviet emphasis upon overcoming ECM, we would expect the SA-5 to have features enhancing its ability to operate in the presence of ECM.

C. Capabilities Through Mid-1978

32. Soviet planners almost certainly expect the diverse aerodynamic threat from US and NATO forces to continue well into the 1970's; they probably see this aircraft threat as ranging from low-altitude subsonic speeds up to Mach 3 at high altitudes, and the ASM threat at both high and low altitude, with added decoys. They probably consider that the deployment of the Fiddler-Moss team, the Flagon and the SA-5 will deal reasonably well with the medium- and high-altitude threat posed by both aircraft and ASMs, but they are still concerned about the requirements for adequate air defenses below 1,000 feet. We believe that they will exert major efforts in the 1970's in an attempt to meet this requirement.

33. One limitation on an adequate low-altitude capability is the Soviet reliance on close GCI control, which would require many closely spaced ground radars, even when elevated. Although the Soviets are trying this approach, it is a feasible solution only for relatively small areas. We expect the further Soviet development of radars and techniques specifically designed to handle low-altitude penetration in specific areas, but we foresee little Soviet success in ground-based continuous tracking capability at low altitude for large areas or for the USSR as a whole.

34. An improvement in low-altitude intercept capability could be achieved with look-down radar that can distinguish a moving target against ground clutter. New interceptors probably have a limited moving target indicator capability,

but no true look-down capability. We believe that the Soviets are developing a radar with an overland look-down capability, and an AAM with an ability to pick out a target while shooting down toward the ground. Such systems probably would not be deployed before 1971 or so. The first interceptor incorporating these capabilities would most likely be the Foxbat, which will probably become operational in IAPVO in 1970-1971.

35. In order to utilize interceptors most efficiently against low-altitude targets, the Soviets would need an AWACS with a radar capable of detecting targets against ground clutter. Although we do not know the state of development of such a system in the USSR, the Soviets could deploy an operational system in the mid-1970's, and we believe they have an incentive to do so. The Soviets may also develop and deploy about the same time an advanced all-weather Mach 3 cruise interceptor with the range of the Fiddler and a look-down, shoot-down capability.

36. Improvements in the low-altitude capabilities of current SAM systems have probably approached the limits of these systems. To further improve low-altitude SAM capabilities, the Soviets would probably have to develop a new system with technology specifically tailored to this purpose and deploy it widely. They may develop a system designed purely for low-altitude defense, utilizing the technology of the new tactical SAM, Gainful. They could do this in the early 1970's, but it would probably only be useful in defense of limited areas; its short range would make deployment for continuous effective defense extremely expensive. The Soviets could also develop a more advanced SAM system that might eventually replace both the SA-2 and SA-3 and complement the SA-5. Such an advanced system might incorporate advanced techniques such as phased-array radars, and infrared or coherent radar homing; but it could probably not be deployed before the late 1970's.

37. The continued introduction of higher performance interceptors and SAMs, together with the rapid data transmission requirements of low-altitude intercept, will impose increasing burdens on Soviet air defense communications and control. We believe the Soviets will extend the semiautomatic data system to all ADZs for the direction of GCI controllers and SAM units. We would expect further Soviet attempts to improve the capacity, flexibility, and security of air defense command and control communications. As the newer fighters continue to enter the interceptor force, we believe that a control system sufficiently sophisticated to allow a degree of "hands off" computerized control will be deployed on the Flagon A and later interceptors. Such a system would permit these interceptors to operate in a controlled environment, allowing close coordination of interceptor and SAM operations.

D. Forces Through Mid-1978

38. Although the capability of new air defense radars will increase, the need for low-altitude coverage will continue to require much overlapping, and the

number of radar sites will probably remain substantially at the present level. As new radars with greater reliability and frequency diversification are introduced, however, the need for redundancy at each site will decline. Older radars will probably be phased out faster than newer ones are introduced, and the number of radars will gradually decline over the next decade.

39. The Soviets have in the past kept large numbers of the older model interceptors in service longer than we expected. However, now that new interceptors are being deployed in increasing numbers, the need for extremely large numbers of aircraft for strategic defense will diminish. The overall capability of the force will probably improve during the next decade even though there is a decline in the number of aircraft. We estimate that the numbers of interceptors in IAPVO will decline to about three-fourths of the present level by 1973, and to between one-half and two-thirds of the present level by 1978.

40. We believe the Soviets will continue to deploy the SA-5 so as to provide forward defenses on the likely approaches to the industrial heartland of the European USSR, and a local defense of key targets and selected major cities throughout the USSR. Based on this deployment concept, we estimate that some 100 complexes will be operational by 1973. If the Soviets should decide to deploy more complexes to defend additional selected targets in the interior of the country, another 40 complexes might be operational by 1976. We believe the Soviets will keep the SA-3 system for low-altitude defense of limited areas through the period of this estimate; it may be supplemented by a new low-altitude system in defense of some target areas during the early 1970's. If the Soviets should deploy a new more capable low-altitude system in the late 1970's, numbers of SA-2 and SA-3 would probably decline.

III. MISSILE DEFENSE

41. The Moscow ABM system (ABM-1) under deployment since 1962, has probably achieved some operational capability. The deployment of ABM-1 launchers and Triad radars has evidently been cut back substantially from the level originally planned by the Soviets. However, R&D related to the ABM problem is continuing.

42. We still do not believe that there is any ABM deployment outside the Moscow area. We continue to estimate that the SA-5 (Tallinn) system was designed and deployed as a long-range SAM. We consider it unlikely that it has any present ABM capability, although the state of available evidence does not permit us to exclude this possibility.[4]

[4] For the views of Maj. Gen. Jack E. Thomas, the Assistant Chief of Staff, Intelligence, USAF, and Maj. Gen. Joseph A. McChristian, the Assistant Chief of Staff for Intelligence, Department of the Army, on the mission and capability of the SA-5, see their footnote on page 17.

A. Forces and Capabilities Through 1970: The Moscow System

43. Early warning, identification, and initial tracking for the Moscow system is probably to be provided by large phased-array dual Hen House radars at Olenegorsk on the Kola Peninsula and at Skrunda in Latvia. The capabilities, location, and orientation of these radars indicate that they are intended primarily to cover ICBMs launched from the US against targets in the western USSR; some coverage of the Polaris threat from the north and northwest is also obtained.

44. [ ] the Hen House radar [ ] system has a detection range [ ] against missiles launched from the US toward most targets in the western USSR. There are some indications, however, that such a high degree of accuracy could not be achieved for large numbers of targets simultaneously. Moreover, the Hen House radars would probably be highly susceptible to blackout in a nuclear environment. These characteristics, together with the fact that these radars are soft and vulnerable, indicate that their primary function is to detect such a ballistic missile attack.

45. We believe that long-range acquisition, early target tracking, and target sorting are to be provided by another large phased-array radar, the Dog House, located about 35 n.m. southwest of Moscow. [ ] It will probably be used to control the assignment of targets to the launch complexes.

46. The Dog House will provide radar coverage in two opposite directions. The northwest face is oriented toward the US ICBM threat; the southeast face is oriented toward the Indian Ocean. The northwest face may be operational now, and the southeast face probably will be by late 1969.

47. The other major components of the Moscow system include the terminal target tracking and missile guidance radars (called Triads) and the Galosh interceptor missile. Each launch complex includes two Triads and associated launchers; these complexes are located at SA-1 sites about 45 n.m. from Moscow. We believe that 16 Triads and 128 Galosh launchers were planned for the Moscow system. We now estimate that deployment of the present system will include only 4 complexes with a total of 8 Triads and 64 launchers. Three Triads probably have reached operational status, and the remaining elements will probably be operational in 1970.

48. We believe that the large Triad radar is the final target tracker and that the two small Triad radars track and control the interceptor missiles. The large radar receives its acquisition information from the Dog House [ ]

[ ]; it may also be able to receive such information from the Hen House radars. One or more Galosh interceptors could be launched almost immediately after acquisition, and intercept could occur at a maximum effective slant range of about 350 n.m.

49. The large Triad radar is a significantly limiting element of the Moscow system, particularly in sectors not covered by the Dog House or the Hen House. It can probably track only one, or at most, a very few targets at a time. Thus the system could cope with only a small number of targets at a time. The large Triad probably has a limited capability to search for and acquire targets in its assigned sector. But once a target was acquired the Triad's search capability would be lost as long as a target was being tracked.

50. We continue to believe that the Moscow system is designed for a long range, exoatmospheric intercept using a high-yield nuclear warhead. [

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51. This analysis of the Moscow system indicates that, as presently deployed, it will furnish a limited defense of the Moscow area, but that it has some apparent weaknesses. It appears to be extremely limited in its ability to handle such sophisticated threats as long chaff clouds and certain other penetration aids. Apparent limitations on the Triad radar and on the numbers of launchers indicate that it is highly susceptible to saturation and exhaustion. Its capability to deal with precursor bursts is probably not high, and none of the system components appear to be hardened to withstand the effects of nuclear bursts. Finally, the Moscow system is primarily an anti-ICBM system; it provides long-range radar coverage of only a part of the multidirectional Polaris threat. Additional large radars will probably be deployed to improve this coverage.

B. Forces and Capabilities Through Mid-1978

System Development

52. Current ABM development is probably building upon Soviet experience with the Moscow system and its technology. We cannot, however, make a confident estimate as to the system or systems under development. It may be directed toward an upgrading of the Moscow system by improvements to its present components. Such improvements could be incorporated in the existing

facilities around Moscow by 1971 or 1972; if the improved version of the system is deployed in additional sites at Moscow, it could reach IOC in the 1973-1974 period. It is also possible that the Soviets are developing a second-generation ABM system that would represent a substantial improvement over the Moscow system; such a system probably could reach IOC in the 1973-1975 period.

53. We doubt that both an improved version of the Moscow system and a second-generation system are being developed concurrently. Apart from the difficulty of such an undertaking, the present level of activity does not reflect a development effort of this magnitude. Our evidence provides no good basis for choosing between these alternatives, but considering the probable timing of these programs and Soviet requirements, we think that development of a substantially better, second-generation system is the likelier possibility.

Possible Modification of the SA-5 System[5]

54. We consider it unlikely that the Soviets will modify the SA-5 system for an ABM role. Considering the great technical problems associated with ballistic missile defense and the number of attack options open to the offense, a system designed specifically against ballistic missiles would provide greater effectiveness than one converted from an air defense role. Moreover, modification of the

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[5] Maj. Gen. Jack E. Thomas, the Assistant Chief of Staff, Intelligence, USAF, and Maj. Gen. Joseph A. McChristian, the Assistant Chief of Staff for Intelligence, Department of the Army, believe that [redacted] Because of continuing uncertainties in our understanding of the system and how it might operate, it is their view that the mission and capabilities of the SA-5 system should be summarized as follows:

a. It is highly probable the system was developed to provide an atmospheric intercept capability against medium and high altitude aircraft, air-to-surface missiles and submarine launched ballistic missiles. Thus judgment is consistent with both the analysis of presently observed system components and available evidence on ABM testing.

b. Chances are about even that the system also was designed to enable exoatmospheric point-in-space ABM intercepts, in which mode the SA-5 would be dependent upon external tracking sensors (HEN HOUSE/DOG HOUSE type radars or some other long-range radar), a centralized command and control system, and the use of nuclear warheads. Evidence currently available neither confirms nor denies the existence or interrelationships of these elements.

c. It is possible, but unlikely, that the SA-5 could perform endoatmospheric intercepts of ICBM's, except perhaps against older, larger RV's such as TITAN.

In Gen. Thomas' view an estimate that some of the SA-5 complexes are intended to function in an ABM role gains credence from the large and growing Soviet investment in this new system at a time when missiles rather than manned aircraft pose the largest number of targets to Soviet strategic defense systems.

SA-5 system to give it an ABM role would tend to degrade its performance in an air defense role. Finally, such modification would probably be very costly and would involve very difficult technical problems, some of which are discussed below. If the Soviets should modify the SA-5 system for an ABM role, we believe it unlikely that they would design to exploit a specific weakness (e.g., closely following tankage) of a particular system.

55. It is possible that the SA-5 system could be given a limited capability for area defense by modifying it to perform an exoatmospheric, point-in-space intercept. This would require provision of off-site acquisition and tracking data, a centralized command and control system, a system for exoatmospheric control of the missile, and a suitable nuclear warhead. An effective command and control system would be the most difficult to achieve. Furthermore, the only external sensors that could now provide the necessary data are the two northern Hen Houses and the Moscow Dog House. A system which relied on only a few sensors for all target tracking would be highly susceptible to saturation by a massive attack, and could be completely negated by the loss of those sensors. Moreover, these radars have only a limited discrimination capability against exoatmospheric penetration aids, and do not provide multiazimuth coverage against the SLBM threat. And finally, we believe that only about two-thirds of the SA-5 complexes are so deployed that they could utilize target data from these radars.

56. Modification of the SA-5 system to provide a self defense or terminal defense capability would be even more difficult. [redacted] The principal limiting factor is the current engagement radar. It does not appear that upgrading the capabilities of this radar—for example, by providing increased power—would yield a high confidence ABM system. Deployment of a totally new engagement radar, possibly of the multifaced phased-array type, would be necessary to provide an effective self and terminal defense against a multiazimuth ballistic missile threat. In addition, if the system is to discriminate among incoming objects, radars utilizing atmospheric sorting and a much higher performance, high-acceleration missile would be required.

Other Possible Developments

57. We have no specific evidence that the Soviets are developing a short-range intercept system that utilizes atmospheric sorting for discrimination. Characteris-

tics of the large Triad radars indicate a capability to track RVs at high-elevation angles, which would be required for terminal intercept. We have not, however, detected any test program for a high-acceleration missile that is required for short range, endoatmospheric intercept. Nevertheless, US programs for penetration aids and advanced warheads may lead the Soviets to develop such a system. Considering development time, it probably could not reach IOC before the mid-1970's. We would probably learn of and detect such development and deployment at least two years before IOC.

58. The Soviets have been investigating over-the-horizon detection (OHD) techniques, possibly for missile EW, [ ] We believe that their level of technology is such that they may be able to detect ballistic missile launches out to about 2,000 n.m. We have no evidence now of an operational OHD system for detection of missile launches, and we cannot tell when or even if the Soviets could develop a sufficiently reliable system to warrant deployment. The Soviets may now also be developing space-borne systems (such as infrared launch detection sensors) which could be used in support of their strategic defense forces.

ABM Deployment

59. Further ABM deployment is probably the subject of continuing and current debate within the Soviet military and political leadership. A decision has evidently been made to halt any extension of the current Moscow system. But there are undoubtedly those who advocate primary reliance on strategic attack forces and oppose further extension of ballistic missile defenses as well as those who wish to extend such defenses as soon as an improved system is available. Even if there were no possibility of strategic arms control, any decision on these questions would probably be held in abeyance pending technical solutions of the problems involved; nevertheless they almost certainly remain lively issues. If an agreement on strategic arms control is concluded, any further Soviet ABM deployment would depend upon its terms, but in its absence, the Soviets will almost certainly extend their ABM defenses beyond the Moscow area, though the timing and extent of such deployment remains uncertain.

60. We believe that the logical first step in any future ABM deployment would be to augment the defenses of Moscow. As we have noted above, new deployment at Moscow could involve either an improved version of the Moscow ABM system with an IOC in the 1973-1974 period or a substantially better,

second-generation system, reaching IOC in the 1973-1975 period. We consider the latter possibility more likely. Whichever of these systems is involved, however, the additional deployment at Moscow will probably bring the number of launchers at least to the level originally planned.

61. We doubt that the Soviets would consider even an improved version of the Moscow system suitable for widespread deployment. Deployment of ABM defenses beyond Moscow will probably await the availability of a second-generation system.[6] The first of these defenses could become operational in the mid-1970's if such a system is now under development. Like the Moscow system, it will probably be designed for long range exoatmospheric intercept. We believe that the Soviets will eventually see the need to supplement these long-range systems with a short range terminal intercept system for point defense of key targets. Deployment of such a system could begin in the mid-1970's, but [redacted] believe that it would probably enter service later.

62. The extent of ABM deployment beyond Moscow will depend heavily upon economic as well as technical considerations. Deployment of a national defense system on a scale sufficient to cope with the full US missile threat does not appear to be a feasible course of action for the USSR over the next 10 years. Programed improvements in US forces, however, have almost certainly added to already existing pressures to provide defenses for key target areas. The US decision to proceed with ABM deployment has probably also strengthened these arguments. We believe that the result is likely to be a compromise, and that the Soviets will decide upon a program that would provide some defense for the most important target areas in the USSR. Some part of this defense would probably be deployed against Communist China and other third country threats.

63. As a measure of Soviet capabilities and willingness to commit resources, we have systematically examined major weapon programs of the past. We find that a deployment program for a second-generation, long-range ABM system that would be roughly comparable with the largest and most vigorous of these past programs would provide an ABM force of some 500-700 launchers. We estimate that procurement of a force toward the high side of this spread would cost about 5 billion rubles (approximately $9 billion) over a period of eight years; this estimate excludes the substantial R&D costs which would be involved. Except for the prolonged (11-year) SA-2 procurement program, which went through several phases of equipment modification and cost marginally

[6] For the views of Maj. Gen. Jack E. Thomas, the Assistant Chief of Staff, Intelligence, USAF, and Maj. Gen. Joseph A. McChristian, the Assistant Chief of Staff for Intelligence, Department of the Army, on the mission and capabilities of the SA-5 (Tallinn) system, see their footnote on page 17.

more, we believe that it would be the largest single advanced weapon program to date.[7] [8]

IV. SPACE SURVEILLANCE AND ANTISATELLITE DEFENSE

64. Since 1962, the Soviets have been building an elaborate space surveillance system based upon Hen House radars. When all of these radars are operational, they will provide the Soviets with the capability for rapidly detecting and accurately determining the orbits of virtually all low-altitude satellites crossing over the USSR. They probably will be capable of detection and tracking out to about 2,000 n.m. Against a near-earth orbiting satellite (at 100 n.m. altitude) detection range would be limited by radar horizon to about 800 n.m. The system is not deployed so as to achieve first orbit detection of all new objects, but most high inclination satellites will be covered on a first pass, and the network appears designed for rapid detection. If, as appears likely, the individual radars are netted so that tracking data can be merged, the Hen House-Dog House network will be able to provide extremely accurate prediction of satellite position after several tracking passes.

65. We have no evidence of a Soviet antisatellite weapons program nor of Soviet development of hardware specifically for this purpose. It would be technically possible, however, for the Soviets now to have a limited antisatellite capability. Using existing radars and a currently operational space launcher or ballistic missile armed with a nuclear warhead, the Soviets could almost cer-

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[7] Mr. Thomas L. Hughes, the Director of Intelligence and Research, Department of State, regards this paragraph as illustrative of costs rather than as an estimate of the likely Soviet ABM deployment. While economic factors doubtless will figure in Soviet decisions on levels of ABM deployment, there is not enough data to judge what specific limitations on deployment might result from economic constraints. For the moment at least, technological rather than economic factors probably are limiting Soviet ABM deployment.

[8] Lt. Gen. Joseph F. Carroll, the Director, Defense Intelligence Agency, Maj. Gen. Joseph A. McChristian, the Assistant Chief of Staff for Intelligence, Department of the Army, Rear Adm. Frederick J. Harlfinger, II, the Assistant Chief of Naval Operations (Intelligence), Department of the Navy, and Maj. Gen. Jack E. Thomas, the Assistant Chief of Staff, Intelligence, USAF, concur that budgetary and economic considerations will influence Soviet decisions concerning ABM deployment. However, they believe that assuming a ballistic missile defense program will be given no higher priority than any specific past weapon system is not consistent with the traditional emphasis placed on defense by Soviet leaders. They believe that the extent of the SA-2 system deployment, for example, was determined primarily by an evaluation of effectiveness and requirements, not cost. Similarly, the Soviet decision concerning the extent of deployment of a ballistic missile defense system will be made primarily by weighing effectiveness and need as well as investment of resources. They believe any projection of the second-generation, long-range ABM threat for the late 1970's should recognize the size of the force may range from a very small number of launchers largely focused around Moscow to a geographically widespread system with considerably more launchers than the 500-700 listed in paragraph 63.

tainly destroy or neutralize current US satellites up to about 2,000 n.m. during an early phase of their mission—i.e., after the first few orbits but before the end of the first day. With terminal homing in the interceptor missile, they may even be able to neutralize such satellites using a nonnuclear warhead; we have no evidence of the existence of terminal homing or a nonnuclear warhead appropriate for such use,[ ] The Soviets could possibly use the existing Galosh ABM system with a specialized nonnuclear warhead utilizing pellets or rods against satellites up to altitudes of about 300 n.m.

66. The Soviet ability to interfere with satellites in highly elliptical orbits or at synchronous altitude (19,300 n.m.) is much more limited. The Soviets can probably acquire and track such satellites by using their deep space tracking facilities. It is possible that the Soviets could neutralize or destroy such satellites with a nuclear weapon, but such action would require a costly and complex space operation. We believe, therefore, that if the Soviets seek to interfere with satellites operating in highly elliptical orbits or at synchronous altitudes during the period of this estimate, they will use some other means.

67. Soviet technical capabilities are such that they could develop and deploy during the next 10 years any of several types of antisatellite systems if they chose to do so. They could develop and deploy a ground-based missile system similar to the current Moscow system; in fact, any further deployment of a long-range ABM system could be adapted for use in an antisatellite role. They might explore techniques (such as electronic interference) for the nondestructive neutralization of satellites. These techniques might utilize mechanisms on the ground, in missiles, or in space. A manned coorbiting satellite inspector could be developed as an outgrowth of a large near-earth manned space station in the early or mid-1970's. Although the costs of such a system would be high, the operational advantages, i.e., inspection, electronic intrusion, capture, dismantling, etc., might outweigh the cost consideration.

68. We believe, however, that the Soviets would realize that any use of antisatellite systems in peacetime would risk opening their own military support systems to retaliation.[9] They probably would attempt to retaliate against our satellites if they believed that we were interfering with theirs. It is also possible that they would attempt to neutralize US military support systems if they thought that war with the US was imminent. But they would probably judge that such action would be regarded by the US as part of a more general attack, and we doubt that they would undertake such an effort prior to the initiation of hostilities.

[9] For a fuller discussion of this subject, see SNIE 11-10-68, "Likelihood of Interference with US Satellites," dated 23 May 1968, ALL SOURCE.

V. CIVIL DEFENSE

69. The Soviets view their civil defense program as an integral part of their strategic defense effort. This program is controlled by the Council of Ministers through the Chief of Civil Defense, a Soviet marshal, who uses a corps of specially trained civil defense staff officers for the day-to-day operation and coordination of the program. Staff officers are assigned to all levels of the Soviet Government. All or most of these staff officers are military personnel; operational civil defense units are manned largely by civilians. The civil defense effort is mainly one of training civil defense personnel and the population on evacuation, disaster control, and shelter construction techniques; this is done in close coordination with internal defense organizations and various civilian agencies. This training becomes more widespread and more highly publicized each year. It emphasizes planned urban evacuation of nonessential personnel in advance of the outbreak of hostilities, and thus appears to assume several days warning. The Soviets are probably providing shelters for key personnel but the leadership apparently continues to reject on economic grounds the feasibility of a nationwide shelter program for the population.

70. Improvements in civil defense preparedness are being advocated by high levels of the party, government, and the military. There is little evidence, however, that basic concepts are being modified because of the accelerated pace of advanced weapons development, nor does it appear that substantially increased resources are being made available. Measures taken to date appear to be directed toward greater pressures on local administrators and civil defense staffs to force them to act on their own responsibilities for planning shelter spaces, securing stocks of emergency supplies and equipment, and for organizing and equipping operational units. Civil defense still encounters some apathy in the USSR and probably will continue to lose in the competition for funds among various Soviet economic and military programs. Nevertheless, the unusual public endorsement of civil defense efforts by Brezhnev at the 23rd Party Congress indicates that civil defense will have some high-level support in pursuit of the goals it has established—a trained citizenry, tested evacuation plans, a large mobile rescue force, and secure control and communications.

TABLES

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TABLE I

SOVIET INTERCEPTOR AND FIGHTER AIRCRAFT
Estimated Characteristics and Performance

Model	IOC	MAXIMUM SPEEDS (KNOTS) [a]			COMBAT RADIUS (NM) [a c]			Radar Range Search/ Track (n.m.)	MAIN ARMAMENT			MAXIMUM EFFECTIVE ATTACK RANGE (n.m.)		
		Sea Level	36,000 Feet	50,000 Feet	Combat Ceiling (Feet) [a b]	W/O Ext. Fuel	With Ext. Fuel	All Weather Capability		Guns	FFAR [d]	Air-to-Air Missiles	Guns Rockets	AAM's [e]	Attack Capability
Fresco A and B (Mig-17)	1953	570	545	535	48,500	280	490	No; day	..	2x23 mm 1x37 mm	32x57 mm	..	0.5	..	Tail
Fresco C (Mig-17)	1954	570	570	530	51,500	250	440	No; day	-/1 [f]	2x23 mm 1x37 mm	48x57 mm	..	0.5	..	Tail
Fresco D (Mig-17)	1955	570	570	530	51,000	220	410	Yes	6/2 [g]	3x23 mm	48x57 mm	[g]	0.5	[g]	Tail
Fresco E (Mig-17)	1954	570	545	535	48,500	280	490	Yes	6/1 [g]	3x23 mm	48x57 mm	[g]	0.5	[g]	Tail
Flashlight (Yak-25)	1955	610	540	510	48,900	500	580	Yes	12/8	23x37 mm	..	..	0.5	..	Tail
Farmer A (Mig-19)	1955	650	785	680	55,600	310	550	No; day	-/1 [f]	2x23 mm 1x37 mm	32x57 mm or 64x57 mm	..	0.5	..	Tail
Farmer B (Mig-19)	1957	650	785	680	55,600	310	550	Yes	6/2	2x30 mm	..	..	0.5	..	Tail
Farmer C (Mig-19)	1957	650	785	680	55,600	310	550	No; clear air mass	-/1 [f]	2x30 mm	16x57 mm or 64x57 mm	..	0.5	..	Tail
Farmer D (Mig-19)	1957	650	785	680	55,600	310	550	No; clear air mass	-/1 [f]	3x30 mm	16x57 mm or 64x57 mm	..	0.5	..	Tail
Farmer E (Mig-19)	1959	650	745	655	54,400	280	510	Yes	6/3	..	..	4xAA-1b	..	2-3	Tail
Fitter (SU-7) [h]	1959	660	1,205	1,205	60,000	440	580	No; clear air mass	-/4 [f]	2x30 mm	32x57 mm	2xAA-2b	0.5	5-6 [i]	Tail
Fishpot B (SU-9)	1959	660	1,205	1,205	60,500	400	540	Yes	11/5	..	..	4xAA-1c	..	3-4	Tail
Fishbed C/E (Mig-21) [h]	1960-1961	595	1,050	1,150	60,500 [i]	360	450	No; clear air mass	-/4 [f]	1x30 mm	..	2xAA-2b	..	5-6 [i]	Tail
Fishbed D (Mig-21) [h]	1962	595	1,050	1,150	59,600 [i]	380	470	Yes	11/8 [h]	..	..	2xAA-2b or 2xAA-1b	..	5-6 3-4	Tail

Fishbed F (Mig-21) [b]	1965	595	1,050	1,260	62,600 [j]	400	480	Yes	11/8 [b]	..	..	2xAA-2b or 2xAA-1b	..	5-6 3-4	Tail
Fishbed H (Mig-21) [b]	1968	595	1,050	1,260	61,000 [j]	380	615	Yes	11/8 [b]	..	..	2 or 4xAA-2b or 2 or 4xAA-1b	..	5-6 3-4	Tail
Firebar (Yak-28)	1964	515	1,070	1,030	55,900	570	[i]	Yes	22/16 [m]	..	..	2xAA-3a/3b	..	10-12	Tail/Nose
Fishpot C (SU-9)	1964	660	1,205	1,205	60,500	400	540	Yes	22/16	..	..	2xAA-3a/3b	..	10-12	Tail/Nose
Fiddler (TU-28)	1966	540	995	995	52,700	760	1,060	Yes	32/24	..	..	4xAA-5a/5b	..	12-16	360°
Flagon A	1967	600	1,100	1,320	61,100	370	465	Yes	22/16	..	..	2xAA-3a/3b	..	10-12	Tail/Nose
Foxbat	1970-1971	540	1,000	1,400 [o]	75,600	800 [o]	1,130 [o]	Yes	40/30 [p]	..	..	2 or 4xAA-Z-2 [p q]	..	15-25	360° [p]

[a] Maximum speeds, combat ceilings and combat radii have been calculated independently and cannot all be achieved on the same flight profile. Maximum speeds and combat ceilings are with air-to-air armament.

[b] Without external fuel tanks.

[c] These combat radii are calculated on the basis of subsonic cruise to and from the combat area and five minutes maximum speed in the combat area, except for the Advanced Long-Range All-weather Interceptor, which is calculated on the basis of Mach 3 cruise.

[d] Folding Fin Air Rockets.

[e] Assumes an optimum operational attack situation for each weapon system involved.

[f] These figures are for radars that give target ranges only. The pilot must acquire the target visually, and aim by optical gunsight; the range only radar tells the pilot when he can fire.

[g] Some of these aircraft assigned to Tactical Aviation and a few in PVO Strany are equipped to carry four AA-1b air-to-air missiles; in these cases the search/track radar range in 6/3 n.m. and the maximum effective attack range is 3 n.m.

[h] There are a few Fitters and no Fishbeds in PVO Strany; both aircraft, however, are deployed in large numbers in Tactical Aviation units. These models are included in the Table because of their capabilities as interceptors.

[i] These aircraft have infrared missiles which do not require radar guidance; therefore visual attack can be made at the effective range of the missile.

[j] These aircraft have the capability to make intercepts, with limited effectiveness, in dynamic climb against subsonic targets at altitudes on the order of 65,000-70,000 feet when under close GCI direction.

[k] Has limited ground clutter suppression capability; radar does not have "look-down" ability.

[l] Some Firebar carry external fuel.

[m] Radar has ground clutter suppression capability; radar does not have "look-down" ability.

[n] Foxbat has a maximum speed without external stores of Mach 3.0 at 60,000 feet or higher, and can cruise at speeds up to at least Mach 2.8 at these altitudes.

[o] Optimum combat radii for Foxbat on an all-supersonic mission would be 420 n.m. with 4xAA-Z-2 or 580 n.m. with 2xAA-Z-2 and external fuel.

[p] Expected to have a radar with a "look-down" ability, and AAMs with a "shoot-down" ability.

[q] We have no evidence on what AAM the Foxbat might carry. We have assumed a new missile developed for the aircraft which we designate AA-Z-2.

TABLE II

SOVIET SURFACE-TO-AIR MISSILE SYSTEMS
Estimated Characteristics and Performance

	SA-1	SA-2 (S-Band) [a]	SA-2 (C-Band) [b]	SA-3	SA-5
IOC	1954	1959	1962	1961	1967
Launchers Per Site	48-60 [c]	6	6	4 dual	6
Maximum Operational Range (nm) [d]	18-24	19	27 [e]	About 13	50-100 [f]
Maximum Effective Altitude (ft)	60,000 [g]	80,000-90,000	90,000	About 50,000	110,000
Minimum Effective Altitude (ft) [h]	3,500	3,000 [i]	1,000 [j]	About 500 [k]	[l]
Simultaneous Target Handling Capacity Per Site	12-20 [c]	1	1	1	[redacted]
Rate of Simultaneous Fire Per Site (missiles)	12-20 [c]	3	3	2 [m]	[redacted]
Guidance	Track while Scan/ Command	Track while Scan/ Command	Track while Scan/ Command	Track while Scan/ Command	Command/Terminal Homing
Accuracy (CEP in ft)	100-200	75-100	About 75	About 30	[redacted]
Warhead	HE [n] [o]	HE	HE [o]	HE	HE with nuclear option
Warhead Weight (lbs)	465	420	420	140	700-750
Mobility	Fixed	Transportable	Transportable	Transportable	Fixed

[a] The S-Band SA-2 system has been almost completely eliminated from deployment in the USSR but is still deployed in Eastern Europe, North Vietnam, and elsewhere. Characteristics shown are for the most widely deployed Fan Song B radar and guideline Mod 1 missile.

[b] Characteristics shown here are for the combination of the Fan Song E radar and the guideline Mod 3 missile, which is widely deployed in the USSR, and becoming more widespread in East Europe.

[c] Under normal conditions, the Soviets apparently keep about 12 missiles on launcher per site; in times of crisis, this number has been doubled.

[d] Range will vary with size, altitude, speed, and approach direction of target.

[e] For sites with Fan Song C radar, the maximum range is 24 n.m.

[f] Lower side is against air-to-surface missiles; the higher against bombers.

[g] The SA-1 system has some limited capability up to 80,000 feet.

[h] Variations in such factors as target speed and size, radar location, and terrain features could significantly influence low-altitude capabilities.

[i] Modifications can be made to lower this capability to about 1,500 feet.

[j] For sites with Fan Song C radar, the minimum capability is about 1,500 feet.

[k] This capability would nominally exist at about a 2-5 n.m. range for an unmasked site. Depending on the actual conditions of site masking, clutter rejection technique employed, elevation of the radar, speed, and reflective area of the target, this figure could be somewhat higher or lower.

[l] This system was probably not designed to counter the low altitude threat [redacted] The system may have some capability against targets at about 1,000 feet depending on a number of factors not presently known.

[m] This capability is based on the similarity of the SA-3 to the SA-N-1 which is known to have this feature. There is no direct evidence of SA-3 missile guidance capacity.

[n] We believe the SA-1 and SA-2 (C-Band) may have a nuclear capability, which greatly improves their kill probability.

TABLE III

SOVIET ANTIBALLISTIC MISSILE SYSTEM
Estimated Characteristics and Performance [a] [b]

	Moscow System (ABM-1)
System	
IOC	1968
Maximum Effective Slant Range	350 nm [a]
Minimum Intercept Altitude	[redacted]
Maximum Intercept Altitude	200-300 nm
[redacted]	

	Moscow System (ABM-1)
Missile	Galosh
Missile on Launcher	1
Additional Missiles on-Site per Launcher	1
Launcher Reload Time	About 30 min
Maximum Velocity	[redacted]
Maximum Warhead Weight	2,000-3,000 lbs
Missile Weight	65,000-70,000 lbs
Launchers/Site	8

[a] Full system capability against a RV launched from the US. This is a system range based on a Triad/Galosh combination.

[redacted]

[b] For the views of Maj. Gen. Jack E. Thomas, the Assistant Chief of Staff, Intelligence, USAF, and of Maj. Gen. Joseph A. McChristian, the Assistant Chief of Staff for Intelligence, Department of the Army, on the mission and capabilities of the SA-5 system, see their footnote on page 17. In an ABM role, they believe the SA-5 could have the following capabilities:

System	
IOC	1967
Maximum Intercept Range	About 150 nm
Minimum Intercept Altitude	[a]
Maximum Intercept Altitude	About 110 nm
[redacted]	

Missile	
Missiles on Launcher	1
Additional Missiles on-Site per Launcher	3
Launcher Reload Time (minutes)	2-4
Maximum Velocity (fps)	[redacted]
Maximum Warhead Weight (lbs) [a]	750
Missile Weight (lbs)	Up to 22,000
Launchers/Site	6

[redacted]

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