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Soviet Strategic Air and Missile Defenses

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SOVIET STRATEGIC AIR AND MISSILE DEFENSES

THE PROBLEM

To estimate the strength and capabilities of Soviet strategic air and missile defense forces through mid-1968, and general trends in these forces through 1976.

CONCLUSIONS

A. The Soviet leaders give a higher priority to strategic defenses than does the US; they allocate about equal resources to their strategic attack and their strategic defense forces. The Soviet object in building their strategic defenses is to contribute to deterrence and to foreign policy support, and to limit the damage the US could inflict on the USSR. The Soviets will continue to emphasize strategic defense throughout the next 10 years, and will pursue their efforts to meet the changing US threat. They will seek, through both offensive and defensive programs, to improve their strategic position relative to that of the US. (*Paras. 1-5*)

B. The Soviets have steadily improved their strategic defenses against aerodynamic vehicles over the last decade, by upgrading their air surveillance system and by developing and deploying both manned interceptors and surface-to-air missile (SAM) systems. Through these systems they have achieved a formidable capability against subsonic and low-supersonic aircraft attempting to penetrate at medium and high altitudes to principal target areas. Current systems are progressively less effective against higher performance aircraft, standoff weapons, and low-altitude penetrations. At present, Soviet strategic air defenses have virtually no effectiveness at altitudes below about 1,000 feet.[1] (*Paras. 10-16, 20-22, 29-32*)

[1] Rear Adm. E. B. Fluckey, Assistant Chief of Naval Operations (Intelligence), Department of the Navy, believes that the strategic defense manned interceptors have a greater capability at altitudes below 1,000 feet than indicated in the text, particularly in some sea approaches.

C. The Soviets will be deploying over the next few years improved air surveillance radars, air defense communications and control systems, and defensive weapon systems with capabilities against aerodynamic vehicles. They are now deploying an interceptor with improved low-altitude capabilities. We believe they will also deploy new interceptors with a better capability to defend against standoff weapons and higher performance aircraft. Although we think the Soviets will continue to work on the problem of defense against penetrations below 1,000 feet, we do not expect any system with such capabilities to be operational before about 1970. (*Paras. 17-19, 23-28, 38*)

D. Since 1964 the Soviets have been constructing complexes for a new missile system for strategic defense, which we call the Tallinn system. There are now probably 20-25 complexes (each with multiple launch sites) under construction. We believe all of these will become operational in 1967 and 1968. The deployment concept appears to include both forward defense on likely approaches to the industrial region of European USSR and local defense of selected targets. We believe that the rate at which new complexes have been started has increased in the past year or so, and that this system will be widely deployed throughout the USSR. (*Paras. 33-34, 37*)

E. The information available at present is insufficient for us to estimate with high confidence the capabilities and mission of the Tallinn system. Such evidence as we have leads us to believe that the system has significant capabilities against high-speed aerodynamic vehicles flying at high altitude and that its mission is defense against the airborne threat.[2] Depending on the characteristics of some components, however, the system could have capabilities against ballistic missiles. We have therefore assessed the potential of the Tallinn system in both the SAM and antiballistic missile (ABM) roles. (*Para. 35*)

[2] Lt. Gen. Joseph F. Carroll, Director, DIA; Maj. Gen. Chester L. Johnson, Acting Assistant Chief of Staff for Intelligence, Department of the Army; and Maj. Gen. Jack E. Thomas, Assistant Chief of Staff, Intelligence, USAF, believe that the many uncertainties stemming from analysis of available evidence do not support a confident judgment as to whether the mission of the Tallinn-type defensive system is SAM, ABM, or dual purpose. They acknowledge that the available evidence does support a conclusion that these sites may have a defensive mission against the aerodynamic threat. However, on balance, considering all information available, they believe it is more likely that the systems being deployed are for defense against ballistic missiles with an additional capability to defend against high flying supersonic aerodynamic vehicles.

F. In the SAM role, we believe the Tallinn system represents a considerable improvement over currently operational Soviet SAMs in terms of range (on the order of 100 n.m.), altitude (up to 100,000 feet), and ability to deal with supersonic targets (up to Mach 3 or 3.5). We do not believe it is the Soviet answer to the low-altitude threat. If the system was designed as an ABM, then data would have to be fed to the complexes from off-site radars in order for them to defend areas large enough to provide a strategic ABM defense. Some of the Tallinn complexes are in locations where they could take advantage of such data from known radars of appropriate types, but some are not. With such data, the Tallinn complexes may be capable of exoatmospheric intercept of incoming ballistic missiles at distances out to about 200 n.m., and thus each complex could defend a fairly large area. Without such data, the ABM capabilities of each complex would be seriously reduced and limited to local and self-defense. (*Paras. 36, 51*)

G. After an intensive ABM research and development program, the Soviets decided at least five years ago to deploy an ABM system at Moscow. This system (which we call the Moscow system) will achieve an initial capability in the next year or two, and all sites now under construction will be completed by about 1970. We believe that it is a long-range exoatmospheric system with a large kill radius, and that the primary purpose of its present deployment is the defense of Moscow. (*Paras. 39, 43-47*)

H. The Moscow ABM system probably will have a good capability against a numerically limited attack by currently operational US missiles. Its capabilities could be degraded by advanced penetration systems, and it could not cope with a very heavy attack. Furthermore, the system utilizes data from large radars for it to function most effectively. Without these radars, the capabilities of the system would be seriously reduced, though if the launch sites were designed to operate autonomously, the system could still intercept some missiles targeted against Moscow. The present deployment will cover only a part of the Polaris threat to Moscow. (*Paras. 48-50*)

I. We cannot now identify any wholly new ABM system in development and we do not expect any to become operational before the early 1970's. In view of the presently limited capabilities of the ABM defenses now under construction, we believe the Soviets will devote sub-

stantial efforts to upgrading their present hardware, developing improved ABM systems, and improving their detection and tracking capabilities. The Soviets might decide that ABM defenses for the general defense of the USSR are too costly. We think it likely, however, that they will extend their ABM defenses. But we think they will be cautious about committing themselves to a fixed policy with respect to ABM deployment over the long term. They will probably adjust whatever program they pursue on the basis of a number of factors, including the capabilities of present defenses to deal with penetration aids, the advances in ABM technology, the cost of additional deployment relative to the protection it is likely to afford, and the US reaction to Soviet strategic developments.[3] (*Paras. 52, 55-60*)

J. In the course of their ABM program, the Soviets have developed large radars which have good capabilities for tracking ballistic missiles and space vehicles. A number of radars of this type, now under construction, will become operational in 1967-1968. Although they do not all have the same functions, we believe that in the aggregate they will provide the USSR with a national space surveillance capability. Within the next 5 to 10 years the Soviets will probably develop and employ a variety of space systems (such as infrared detection and other types of warning) in support of their strategic defensive forces. (*Paras. 40-42, 53-54, 62-63*)

K. We have no positive evidence that the Soviets are developing antisatellite defenses, but we believe they have had an incentive to do so for some time. It would be technically possible for them to have a limited antisatellite capability already, based on existing radars and missiles and requiring a nuclear weapon to achieve a kill. When their new space surveillance radars are operational in 1967-1968, they could have a capability to destroy satellites by either nuclear or nonnuclear means after the satellites had passed over the USSR a few times. The Soviets may also explore techniques for neutralizing satellites without destroying them. A manned satellite inspection and antisatellite system could be developed in the 1970's. We believe, however, that the Soviets would seek to destroy or neutralize US satellites only if they believed general war were imminent. There might also be some other special circumstances in which they would use antisatellite systems in

[3] For the views of Rear Adm. E. B. Fluckey, Assistant Chief of Naval Operations (Intelligence), Department of the Navy, see his footnote to paragraph 58, page 20.

peacetime, such as an occasion in which they believed they were retaliating against US interference with their own satellites. (*Paras. 61, 64-67*)

L. Over the past decade or more the Soviets have developed an extensive civil defense program, which is now administered by the Ministry of Defense. The current program is characterized by widespread public training, the use of simple shelters, and plans for urban evacuation in advance of hostilities. Shelter space is available for less than one-sixth of the urban population, and adequate shelter for key personnel only. We have detected no recent major changes in the priority or pace of the program and we have no indication that the Soviets would regard a stepped up civil defense effort as a necessary adjunct to extended ABM deployment. We anticipate continued slow but steady improvement in overall civil defense effectiveness. (*Paras. 68-73*)

DISCUSSION

I. POLICY TOWARD STRATEGIC DEFENSE FORCES

1. The Soviet leaders give a higher priority to strategic defensive forces than does the US. This is partly due to the longstanding Soviet preoccupation with defense of the homeland, but more specifically to the great size and diversity of US strategic attack forces. The US, with a strategic attack force in being at the end of World War II, has long tended to rely mainly on retaliatory capabilities, and thus has concentrated on building strategic attack forces. The USSR, on the other hand, confronted by these US forces, has placed more nearly equal emphasis on both strategic defense and strategic offense. In 1965, about one-fifth of the total Soviet force-oriented military expenditures were allocated to each of these strategic missions.[4]

2. Faced with the US threat, the Soviets have developed and deployed successive generations of increasingly effective radars, communications systems, interceptors, and surface-to-air missiles (SAMs) over the past two decades. In addition, they have already embarked upon deployment of antiballistic missile (ABM) defenses. In their efforts to have a defense in being, the Soviets have generally elected to deploy a defensive system quite early, even if it did not meet the whole threat, rather than to wait for the development of a more effective defense. When an improved system has been developed, deployment of an older system has often stopped, but it has not been rapidly retired or replaced. Consequently the Soviets tend to have extensive defenses deployed in depth, usually with considerable redundancy. But some elements of these defenses are somewhat out of date and do not represent the most effective counter to new US systems or concepts of operation.

3. In our view, the Soviets continue to regard strategic defense and attack forces as their primary instruments for deterring the US and for providing a military buttress to their foreign policy. In the past, the Soviets have not had a sufficiently powerful strategic attack force to justify high confidence in its effectiveness for the foregoing purposes. Now, with the large-scale deployment of dispersed and hardened intercontinental ballistic missiles (ICBMs), their confidence in their assured destruction capability[5] must be growing. Despite this improving posture, however, the Soviets evidently believe that a rational strategic policy for them continues to require a combination of offensive and defensive forces which could limit damage to the USSR if war comes.

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[4] The force-oriented military expenditures are the expenditures for the three major force components (strategic attack, strategic defense, and general purpose) as distinct from expenditures for space, command and general support, and research, development, testing, and evaluation, which support all the forces. The major force-oriented expenditures account for about 60 percent of total estimated Soviet military expenditures. Some portion of the remaining 40 percent is also expended in support of the strategic defense forces.

[5] An assured destruction capability is a capability, even after the enemy strikes first, to guarantee the devastation of his population and industrial centers in retaliation.

4. Soviet calculations of their damage limiting requirements will, of course, be complicated by manifold uncertainties regarding the effectiveness of the offensive and defensive forces of both sides under the various circumstances which could exist at the outset of a war. Among the most critical uncertainties will be those concerning the effects on their defenses of US penetration tactics and (especially in the case of ABM defenses) US penetration aids. Indeed, the variables are so great that we think the Soviets almost certainly cannot make a confident calculation of the actual damage limiting capabilities of their own forces over the period of this estimate. For this and other reasons, we believe the Soviets would not consider it feasible to achieve, by the mid-1970's, strategic capabilities which would make rational the deliberate initiation of general nuclear war. Nevertheless, the Soviets will seek, through both offensive and defensive programs, to improve their strategic position relative to that of the US.[6]

5. We believe that Soviet emphasis on strategic defense will continue throughout the next decade, and that the Soviets will pursue their efforts to meet the changing US strategic threat. Their most critical requirement, and the one most difficult of solution, is ABM defense. Increasing efforts will probably be devoted to pushing research programs in the field of ABM defense and to developing ABM systems of increasing effectiveness. We also expect a continuing Soviet effort to counter the low-altitude aircraft threat as well as the long-distance standoff threat. Soviet planners probably foresee a quantitative reduction in the US bomber force over the next 10 years, but a qualitative improvement as the US introduces new systems and concepts for air attack.

II. ORGANIZATION OF STRATEGIC DEFENSE FORCES

6. The Soviet air defense mission is the responsibility of PVO Strany (Antiair Defense of the Country), whose Commander-in-Chief is a Deputy Minister of Defense ranking with the heads of the ground, naval, air, and strategic missile forces. The PVO is composed of three major elements, each of which performs one of the key functions of the air defense mission, i.e., air surveillance,[7] interceptor, and SAM operations. In addition to forces directly assigned to the PVO Strany, other Soviet forces which can contribute to the air defense mission are also operationally available to this command.

7. The Soviets have occasionally mentioned Antirocket Forces (PRO) as the organization responsible for operational ABM forces. The Commander of PVO Strany probably is assigned the mission of ballistic missile defense, but we have no information on how ABM forces fit into PVO Strany. During the past year there have also been a few references to a "blue belt of defense." One Soviet officer implied that this is a "complex of four elements—air defense missiles, aircraft, submarines, and the antimissile system." We have no indication in intelligence that such command relationships exist in practice.

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[6] For further discussion of these questions, see NIE 11-4-66, "Main Trends in Soviet Military Policy," dated 16 June 1966, SECRET and NIE 11-8-66, "Soviet Capabilities for Strategic Attack," dated 20 October 1966, TOP SECRET, RESTRICTED DATA.

[7] The air surveillance mission includes early warning and tracking.

8. The PVO forces are deployed in a system of geographical divisions and subdivisions. The major divisions are 10 Air Defense Districts (ADDs). These are divided into some 40 Air Defense Zones (ADZs), most of which are divided into sectors for air surveillance purposes. Each of the ADDs in the USSR probably maintains direct communications with PVO Strany headquarters, and also with neighboring ADDs. We believe command and control over all three functional elements of the air defense mission is exercised at the ADD and ADZ level.

9. The air defense organizations of the Warsaw Pact countries are coordinated with each other and with PVO Strany, and for all practical purposes constitute an extension of the Soviet system. Each of the Eastern European countries of the Warsaw Pact has a separate national system organized in much the same manner as an ADD. The East European air defense forces are equipped almost exclusively with Soviet materiel, and the USSR will continue its policy of improving their capabilities. Although the Soviet and Chinese Communist air defense systems still maintain some contact, cooperation between them is minimal. We believe that the Soviets are providing limited assistance in establishing some elements of an air defense system in the Peoples' Republic of Mongolia.

III. AIR DEFENSE

10. The Soviets have steadily improved their strategic defenses against aerodynamic vehicles over the last decade by upgrading their air surveillance system and by developing and deploying both manned interceptors and SAM systems. Through these systems they have achieved a formidable capability against subsonic and low-supersonic aircraft attempting to penetrate at medium and high altitudes to principal target areas. These systems are progressively less effective against higher performance aircraft, standoff weapons, and low-altitude penetrations. The low-altitude penetration tactics of Western bomber forces probably motivated the development of the Firebar interceptor, the deployment of the SA-3, and certain modifications to the SA-2 system. We believe the USSR is now trying to counter the threat of more advanced US aircraft and of air-to-surface missiles (ASMs).

A. Air Surveillance and Control

Early Warning

11. During the past year the Soviets have continued to improve their early warning (EW) capability, in particular by further deployment of their most modern EW radars in both the USSR and Eastern Europe. Under optimum conditions, the Soviet EW system can detect and track aircraft flying at medium or high altitudes at least 200 n.m. distant from Soviet borders; under normal conditions detection and tracking is virtually assured at about 135 n.m. The detection range of the EW system is progressively reduced against aircraft penetrating at lower altitudes, primarily because of line-of-sight range limitations. In those areas having adequate overlapping radar coverage—mainly in the

western USSR and in Eastern Europe—continuous tracking of an intruding aircraft may occur down to 1,000 feet. In other areas the radars are unlikely to be able to accomplish continuous tracking below 3,000 feet. The Soviets have virtually no continuous tracking capability below about 1,000 feet.

12. We estimate that there are some 5,000 radars deployed at about 1,000 operational sites in the USSR. In addition, information is fed into the Soviet air defense system by over 1,000 radars deployed at some 300 sites in the East European countries of the Warsaw Pact. All radar sites have an air surveillance capability; most also have a limited capability to provide an input to GCI controllers. Soviet radar sites have a multiplicity of radars although only a few of the sets at any one site normally operate at one time. The operation of adjacent radar sites is normally alternated on a schedule. The density of coverage heightens the probability of detection, and frequency diversification among the sets provides some defense against electronic countermeasures (ECM).

13. The Soviets have for the past decade been gradually introducing a semiautomatic reporting system into their air surveillance network, probably to increase the speed and volume of data handling. We believe that, with this system, a greater number of target tracking reports can be passed, an automatic display capability exists, and manual plotting is reduced. We estimate that the semiautomatic system is deployed extensively in about one-fourth of the ADZs, but conventional systems probably are still employed in large measure even in these zones. The semiautomatic system probably is deployed to a lesser extent in most of the remaining ADZs and certain East European Communist nations. We believe that semiautomatic reporting has been introduced at ADZ headquarters, thereby improving centralized control in the ADZ, and leading to more efficient operations.

Ground Controlled Intercept

14. About one-third of the Soviet radar sites are capable of conducting GCI operations. We estimate that GCI range capabilities vary from about 100 to 200 n.m. We believe that most Soviet GCI radars now employ moving target indicators or anticlutter techniques in order to improve low-altitude coverage. Nevertheless, Soviet low-altitude GCI capability probably drops off sharply below about 3,000 feet and would be almost nonexistent below about 1,000 feet.

15. We believe that for a number of years the Soviets have been introducing a data transmission system for interceptor control into their ground-to-air communications. We estimate that this system has been deployed extensively in the USSR and is being used by Soviet forces in East Germany, Poland, and Hungary. It is probably also being employed by the East German, Polish, and Czech air forces. We believe that it is used only with current model interceptors, which comprise about one-third of the force. The Soviets probably are developing variants of the system which would have improved data handling capacity.

Communications

16. The Soviet air defense system employs a communications network which has a high degree of redundancy, flexibility, and reliability. We estimate that the Soviets continue to use older high frequency (HF) radio and open wire communications systems, but they probably have superimposed newer high capacity cable and microwave systems, which could account for a large proportion of circuit capacity. We believe that in the last few years, the Soviets have also been introducing tropospheric scatter communications in the north; if such communications become operational, they presumably will be used for more effective air defense communications.

Future Trends

17. We believe that the Soviets will continue to upgrade their air defense surveillance and control capabilities and will probably concentrate operational control at the zonal echelon. We believe that semiautomatic reporting will increase, and that by 1971 it will be standard in the western and far eastern USSR, in the Soviet forces in East Europe, and in East Germany, Poland, and Czechoslovakia. By 1976 it will probably extend over the entire USSR and Eastern Europe. The reporting system will probably be improved. SAM units probably will be included in it.

18. The Soviets will probably continue to introduce improved radars with increased power and greater design sophistication. The maximum altitude capabilities of the most widely deployed radars will continue to exceed the operational altitudes of Western aircraft. The Soviets may include frequency diversification in their new radars to reduce mutual interference problems and vulnerability to ECM. A considerable effort will probably be expended on solving the problem of detecting and tracking low-altitude targets. We anticipate the appearance of radars and techniques specifically designed for handling such targets, particularly in areas which offer the best routes for low-level penetration.

19. We believe that, although the capability of new radars will increase, the need for low-altitude coverage will continue to require much overlapping. Therefore, the number of radar sites will probably decline only slightly. As new radars with greater reliability and frequency diversification are introduced, the need for redundancy at each site will decline. We estimate, therefore, that the older radars will be phased out faster than newer ones are introduced, and that the numbers of radars will decrease over the next 10 years, perhaps by as much as one-third.

B. Interceptors[8]

20. We estimate that, as of 1 October 1966, there were about 3,600 interceptors in Fighter Aviation of Air Defense (IAPVO)—some 200 less than in mid-1965.

[8] See Table I, Annex, for a listing of Soviet interceptor aircraft and their characteristics and capabilities.

In addition, the 2,400 fighters of Soviet Tactical Aviation are available as an auxiliary force for strategic air defense if required, and there are some 2,300 fighters in the air forces of the European Communist countries of the Warsaw Pact. Nearly all these 4,700 fighters were designed as interceptors; some 3,200 of them are in those regiments which probably have a primary role of air defense.

Capabilities

21. The Soviet interceptor force has good capabilities against subsonic aircraft attacking at medium and high altitudes in daylight and under clear weather conditions, and somewhat lesser capabilities against supersonic aircraft under the same conditions. Its capabilities are degraded at night or in adverse weather conditions, by standoff attacks, by attacks using decoys and ECM, and by attacks at low altitudes. All presently operational models have only a tail attack capability. The Soviets probably also plan to use their interceptors against ASMs, at least as an interim measure.

22. About two-thirds of the Soviet interceptor force is still made up of subsonic or low supersonic models introduced in 1957 or earlier, which have little capability above 50,000 feet. (We have termed these old models in this estimate.) These models are armed with guns or rockets and are thus limited to attack ranges of a half-mile or less. Most of these old models are day fighters. The other one-third of the force is composed of Mach 2 models introduced in 1959 or later, armed with air-to-air missiles (AAMs), with an effective attack range of about 3-6 n.m. (We have termed these current models.) During the past two years the peripheral deployment of Firebar, gave IAPVO for the first time an all-weather intercept capability, probably down to 1,000 feet, especially over water approaches to the USSR. Under optimum conditions, current model interceptors are capable of all-weather zoom attack on aircraft flying at up to about 70,000 feet.

Future Models

23. Until recently, the Soviets have concentrated on interceptors which achieved high acceleration, speed, and altitude at some sacrifice of other desirable characteristics. For example, these aircraft have limited range, armament, and fire-control capabilities, which limit their effectiveness. The Soviets are now developing interceptors that will probably have greater range, be capable of attack from any direction, and be equipped with improved airborne intercept (AI) radars, more sophisticated missile armament, and some automation of interceptor control. (We have termed these aircraft future models.)

24. The first of these future model interceptors is the Fiddler. We believe it is now in production, and that it will probably begin to enter operational units in late 1966 or early 1967. Although Fiddler will probably have the Mach 2 speed of current interceptors, we estimate it will have a combat radius of about 1,000 n.m. (double that of current models), and a better capability to attack standoff ASM carriers. We estimate that it will be the first Soviet all-weather

interceptor capable of attack from any direction, and it may have an improved semiautomatic intercept system. We also estimate that it will have all-weather missiles with an effective range of up to about 16 n.m., and a nuclear option.

25. We believe the Soviets are now testing two new improved all-weather interceptors with a combat radius of about 500 n.m. We believe the first of these is being developed for defense against Mach 2 targets up to about 80,000 feet. When operational, it will probably have speeds up to about Mach 2.8 and may be capable of 360° attack. The second interceptor is probably capable of maximum speed approaching Mach 3 and of sustained flights at altitudes in excess of 70,000 feet. Both interceptors will probably utilize data link equipment for semiautomatic intercept control. We believe that the first interceptor will be deployed and that it could be operational as early as 1968. The second interceptor could probably not be ready until a year or so later. We cannot now judge whether it will be deployed then or improved further before becoming operational.

26. We believe that the Soviets see a need for more advanced interceptor systems suitable for use in the 1970's, and may already be testing such models. They probably could have an advanced all-weather long-range interceptor, capable of cruising at speeds of Mach 3, in the 1972-1976 period. If they were to develop the second interceptor (see paragraph 25) for this role, it would probably have a range approximating 700 n.m. but be operational early in this period. It is possible, though less likely, that the Soviets will develop a new aircraft. It could have a longer range, but be available later in the period. We believe they will deploy one or the other of these aircraft, but probably not both. The extent of deployment would depend largely on their view of the US threat, their SAM capabilities in 1970, and their assessment of the costs of the new system.

Future Force

27. We estimate that over the next few years the Firebar will continue to enter operational units, and the Fiddler will be deployed. The total number of interceptors in IAPVO will probably continue to decline through mid-1968 at about the same rate as over the past four years.

ESTIMATED INTERCEPTOR FORCE LEVELS

	1 October 1966	Mid-1967	Mid-1968
Old Models*	2,550	2,200-2,300	1,800-2,000
Current and Future Models*	1,050	1,100-1,200	1,200-1,400
TOTAL	3,600	3,300-3,500	3,000-3,400

* See Table I, Annex, for a listing of the specific models included in these groups.

28. We estimate that, after 1968, the future model interceptors will begin to enter service in somewhat larger numbers. The total size of IAPVO will continue to decline, and in 1972 may be about two-thirds the size of the present force. The force may remain at about this level through mid-1976; alternatively, if an

advanced Mach 3 cruise interceptor is introduced in large numbers, the overall force level may decline further.

C. Operational Surface-to-Air Missile Systems[9]

29. The presently operational Soviet SAM systems provide good medium and high-altitude defense against aircraft under all-weather conditions. However, they are short-range systems and are considerably less effective against small, high-speed ASMs; they are ineffective against low-altitude penetrators below 1,000 feet. We believe that new deployment of these systems has virtually ceased.

30. The SA-1 system, deployed more than a decade ago in a double ring of 56 sites around Moscow, remains operational. We believe that the USSR has since 1962 made improvements in the system which give it a better capability against high performance aircraft. The Soviets continue to train SA-1 troops and, most importantly, to use the system for the defense of Moscow in the face of changes in the potential threat. Accordingly, we now believe that the SA-1 system will probably continue in operation for some years, at least through 1970 and possibly through mid-1976.

31. The SA-2 system remains the principal deployed SAM system in the USSR. It is also widely deployed in the Communist countries of Eastern Europe. Since it was first deployed in 1958, this system has undergone several model changes both in the guidance radar and in the interceptor missile. These changes have progressively increased its effective range to about 27 n.m., raised its maximum intercept altitude to about 90,000 feet, improved its low-altitude capability down to about 1,500 feet, and given it better tracking and electronic counter-countermeasure (ECCM) capabilities.[10] We estimate that there were about 1,000 SA-2 sites in the USSR in mid-1966. We believe that some 800-900 of these sites are occupied by operational units. We believe that the remaining unoccupied sites are used only occasionally during peacetime and will probably provide positions for additional units during periods of emergency. We believe that the SA-2 system will remain in service over the next 10 years.

32. The SA-3 system appears to have been deployed primarily for low-altitude defense. We estimate, however, that its minimum effective altitude is about 1,000 feet, which makes it little more effective than an improved SA-2. We believe that new deployment had virtually ceased in 1965, with only about 110 sites completed. The Soviets may be continuing their attempts to improve the capabilities of the SA-3, but we expect no further deployment. Present force levels will probably be maintained through the mid-1970's unless an improved low-altitude SAM system is developed, in which case the SA-3 will probably be phased out.

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[9] See Table II, Annex, for a listing of SAM characteristics and capabilities.

[10] The earlier model SA-2 system, now used in North Vietnam, has been almost entirely retired from service in the USSR.

D. Tallinn System

33. Since 1964 the Soviets have been constructing complexes for a new strategic defensive system, which we call the Tallinn system in this estimate. Construction was begun initially near Tallinn and other locations in the northwestern USSR. At about the same time modifications were started on three complexes near Leningrad, which had been partially constructed for another defensive system, so that they could accept the new system. During 1965 and 1966 additional complexes were under construction, and we believe the program is continuing.

34. We estimate that there are now some 20-25 Tallinn complexes. Most are located near important Soviet target areas; others may be the beginning of forward defenses across the northern and southern parts of the European USSR. We believe all of these complexes will become operational in 1967 and 1968.

35. The information available at present is insufficient for us to estimate with high confidence the capabilities and mission of the Tallinn system. Such evidence as we have, however, leads us to believe that the system has significant capabilities against high-speed aerodynamic vehicles flying at high altitude and that its mission is defense against the airborne threat.[11] The capabilities of the missile and engagement radar remain major unknowns. Depending on the characteristics of these components, the system could have capabilities against ballistic missiles; these are assessed in paragraph 51.

36. In order to assess the capabilities of the Tallinn system against aerodynamic vehicles, we have assumed characteristics of an engagement radar and of a missile which, we believe, are reasonable for the SAM role and are not inconsistent with our limited evidence. On this basis we think the Tallinn system could engage aerodynamic targets having speeds of up to Mach 3 or 3.5, at altitudes up to 100,000 feet, at ranges on the order of 100 n.m. We believe that at these heights and distances, the system could use either a nuclear warhead or a conventional warhead with homing guidance. We cannot at present define the minimum altitude capabilities of the system. We do not believe it is the Soviet answer to the low-altitude penetration threat.

37. The current pattern of Tallinn system deployment suggests a concept embracing both a forward defense 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, the

[11] Lt. Gen. Joseph F. Carroll, Director, DIA; Maj. Gen. Chester L. Johnson, Acting Assistant Chief of Staff for Intelligence, Department of the Army; and Maj. Gen. Jack E. Thomas, Assistant Chief of Staff, Intelligence, USAF, believe that the many uncertainties stemming from analysis of available evidence do not support a confident judgment as to whether the mission of the Tallinn-type defensive system is SAM, ABM, or dual purpose. They acknowledge that the available evidence does support a conclusion that these sites may have a defensive mission against the aerodynamic threat. However, on balance, considering all information available, they believe it is more likely that the systems being deployed are for defense against ballistic missiles with an additional capability to defend against high flying supersonic aerodynamic vehicles.

distance separating existing adjacent complexes, and the estimated rate of starts over the past year, we estimate that some 75 Tallinn system complexes (containing at least 230 sites of six launch positions each) will be operational by about 1972. Deployment may be extended to another 50 complexes or so by 1976. We would expect improvements to the system during its deployment life.

E. Future SAM Systems

38. We know of no wholly new SAM systems under development; R&D activity appears to be directed toward modification of existing systems. The Soviets could seek to improve their systems by such developments as a better low-altitude acquisition radar, a modified fire-control radar and guidance system, and could possibly adopt terminal homing. No Soviet SAMs deployed or under development are estimated to have a capability under about 1,000 feet. As we think the Soviets will be unable significantly to improve their present low-altitude capability by modifying existing SAM systems, they may develop a new low-altitude system. We would not expect any new low-altitude system effective under 1,000 feet to be operational before about 1970.

IV. BALLISTIC MISSILE DEFENSE

39. For the past decade the Soviets have carried on an extensive, varied, and costly R&D program to create defenses against ballistic missiles. They probably have explored various ABM techniques, radars, interceptor missiles, and concepts of system integration. They have tested their radar capabilities under conditions of nuclear blackout. In 1960, they began to deploy at Leningrad a defensive system which, we have previously estimated, probably was intended to have a capability against a small unsophisticated ballistic missile threat and against aerodynamic vehicles as well. This system was later abandoned before completion. We believe that the Soviets began deployment of an ABM system at Moscow in 1962 before they had fully tested it. This, in our view, is one measure of the urgency they have attached to fielding ABM defenses.

40. Any ballistic missile defense program, of course, requires a good capability to monitor the objects in space which may be near or over one's territory. Since the beginning of their own space program, the Soviets have developed and employed a wide range of space tracking facilities. However, the capabilities of these facilities have been generally limited to tracking space objects which radiate signals. In the course of their ABM development and deployment, the Soviets have also developed radars which are evidently more specifically designed to perform such functions as detecting and tracking ballistic missiles and nonradiating objects in space. A number of radars of this type (which we call Hen House and Dog House) have been under construction in the USSR since 1962. In the following sections of this paper, we discuss these radars in various contexts (i.e., ballistic missile warning, data acquisition for ABM systems, and antisatellite defense), depending on their locations and configurations. It should be kept in mind, however, that in the aggregate they will provide the USSR with a national space surveillance capability when they are operational.

41. When we relate these radars to each other and to other elements of ABM defense, we are relying at present on deduction rather than on positive evidence. Moreover, in discussing ABM system performance, we have assumed the existence of data links and computers with a capacity to utilize the full effectiveness of the radars and other system components. The actual capacities of the data-handling elements, though unknown to us, will obviously be critical to Soviet ABM defense capabilities.

A. Detection/Tracking Radars

42. The Soviets are constructing two detection/tracking radars, designated Hen Houses, on their northwestern borders at Olenegorsk on the Kola Peninsula and at Skrunda on the Baltic coast. We estimate that both radars will be operational in 1967 or early 1968. These radars, developed at Sary Shagan, are electronically-steered phased arrays. We believe these radars will serve a ballistic missile early warning function and provide early tracking and prediction data for use by ABM launch units. They are oriented to detect ICBMs launched from the US toward targets in western USSR; they will also be capable of detecting ballistic missiles launched by submarines from parts of the north Atlantic and Arctic Oceans toward targets in the Soviet northwest. [ ] Their tracking and prediction accuracies are excellent for missiles launched from the US toward most targets in the western USSR; they are degraded for other trajectories, depending on the direction of approach and the length of time the RV is within the radar coverage. The presently identified Hen Houses provide no coverage for extensive areas of the USSR.

B. Moscow ABM System

Components

43. The principal components of the ABM system under construction at Moscow will include a huge radar, which we call the Dog House, and Triads with radars and launch positions for Galosh missiles. We believe the system will also utilize inputs from the northern Hen House radars. Even though we have not detected tests against targets having or simulating ICBM characteristics, we believe the Moscow ABM system will achieve an IOC to intercept ballistic missiles in 1967 or early 1968. We believe an operational capability for all the Moscow system facilities now under construction will not be achieved until about 1970.

44. *Dog House.* The Soviets are constructing the Dog House radar about 35 miles southwest of Moscow. It has a unique configuration and is probably of a phased-array type. It is oriented so that its northern face can scan the ICBM threat corridor from the US to most targets in the western USSR. A southern face now being added will be able to scan toward the Indian Ocean.

We have no evidence of construction of a similar radar facing the Polaris threat from the west. We think that the Dog House is intended to serve as a long-range acquisition and early target tracking facility for ballistic missile defenses in the Moscow area. It is estimated to have a large target handling capacity and a tracking capability somewhat better than a Hen House. It is probably partially redundant to the Hen Houses, but is placed within the heavily defended Moscow area, while the Hen Houses are presently less well defended.

45. *Triads.* The Soviets have also been working on pairs of Triads located at some of the outer ring SA-1 sites, about 45 n.m. from the center of Moscow. A Triad consists of one large building and two smaller ones, on each of which a radome is mounted. We believe that the Triads will provide terminal target tracking and missile guidance for the Moscow ABM system. We believe there are launch positions associated with each Triad. They are likely to have a reload capability, but it probably will be rather slow (i.e., 10-30 minutes after arrival of the missile at launcher [12]). We believe this configuration and deployment indicates on the order of 100 launchers, and therefore a capacity to deal with only a limited number of attacking missiles.

46. *Galosh.* We believe that the Moscow system will employ the Galosh missile, which was first displayed in a Soviet parade in November 1964. The size and configuration of the Galosh indicate that it is designed for long-range exoatmospheric intercept. [

] The Galosh does not appear to be suitable for low-altitude high-acceleration intercept.

Capabilities

47. The estimated characteristics of the Moscow system are such that it could probably accomplish intercepts of incoming missiles at distances out to several hundred miles from the launch positions. The small number of interceptors apparently to be employed by the system suggests that each warhead is expected to have a large lethal radius. The system's apparent reliance on exoatmospheric intercept also suggests that some large volume kill mechanism is employed. We believe the chances are about even that the Galosh has a nuclear warhead[

[12] Rear Adm. E. B. Fluckey, Assistant Chief of Naval Operations (Intelligence), Department of the Navy, believes that reload would require a considerably longer time.

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[14 15] Thus we estimate that the Moscow system is a longe-range, exoatmospheric system with a large kill radius. The deployment of launch sites in a ring around Moscow and the relatively small number of launch positions under construction suggests the purpose is primarily the defense of Moscow.

48. The estimated characteristics of the Moscow ABM system are such as to allow late midcourse interceptions without waiting for atmospheric discrimination and thus permit more effective neutralization of threat clouds containing both penetration aids and unhardened warheads. Against these advantages of the system, however, must be set certain present or potential weaknesses. For example, we believe that all the components of the Moscow system are unhardened to nuclear attack. Moreover, it appears that the Dog House will be susceptible to nuclear blackout, although the Soviets may have resolved or circumvented to their satisfaction the problems of detection of oncoming RVs in a nuclear environment, as construction of the Dog House has progressed after Soviet tests in the fall of 1962 investigating this problem. If the Hen Houses and Dog House were destroyed or blacked out, the capabilities of the system would be seriously reduced, though if we assume that the Triads are designed to operate autonomously, the system could still intercept some missiles targeted against Moscow.

49. There has been no evidence that the Soviets have incorporated the use of penetration aids or advanced warheads in their ABM tests. The ability of the Galosh to achieve a large kill radius would be subject to reduction if the attacker employed hardened warheads.

50. Considering the foregoing, we believe that the Moscow ABM system will have a good capability against a numerically limited attack on the Moscow area by currently operational missiles, but that its capabilities could be degraded by advanced penetration systems and it could not cope with a very heavy attack. Moreover, the present deployment will not cover all of the multidirectional Polaris threat to Moscow.

C. Tallinn System

51. Although we believe that the mission of the Tallinn system is defense against the airborne threat,[16] we have also assessed its capabilities against ballistic missiles.[17] In this assessment, we have assumed alternate characteristics for a missile, which we believe are reasonable for the ABM role and are not

[14] See NIE 11-11-66, "Impact of a Threshold Test Ban Treaty on Soviet Military Programs," dated 25 May 1966, TOP SECRET,

[16] Lt. Gen. Joseph F. Carroll, Director, DIA; Maj. Gen. Chester L. Johnson, Acting Assistant Chief of Staff for Intelligence, Department of the Army; and Maj. Gen. Jack E. Thomas, Assistant Chief of Staff, Intelligence, USAF, do not agree with this judgment. See their footnote to paragraph 35, page 14.

[17] Capabilities of the system against aerodynamic vehicles are discussed in paragraph 36.

inconsistent with our limited evidence. The assessment indicates that this system would need Hen House and/or Dog House target tracking data to function most effectively. Assuming that such data were available, the system may be capable of exoatmospheric intercept of incoming ballistic missiles at distances out to about 200 n.m. We believe a nuclear warhead for this system might have a kill radius of up to 30 n.m. against unhardened RVs. Some of the Tallinn system complexes are so located that presently known Hen House or Dog House radars could not furnish useful target tracking data to them. Where this is the case, or if the Hen Houses and Dog House were destroyed or blacked out, the capabilities of the system would be seriously reduced and limited to local and self defense. Thus, under these assumptions, if Hen House or Dog House data were available, the Tallinn complexes could defend areas large enough to provide a strategic ABM defense; without such data, they could not.[18]

D. Future Trends

Research and Development

52. We cannot now identify any wholly new ABM system in development, but in view of the presently limited capabilities of the ABM defenses now under construction, we believe that the Soviets will devote substantial effort to upgrading their present hardware. At the same time we expect them to devote a major effort to developing improved ABM systems. These may include a short-range missile, possessing capabilities for atmospheric intercept, and a new long-range missile. We would not expect such new systems to become operational before the early 1970's.

53. We expect the Soviets to continue their efforts to develop improved detection and tracking systems. We expect additional R&D to be undertaken in order to provide a capability for the discrimination of advanced penetration aids. Soviet interest in this problem is suggested by analysis of recent Hen House radar signals which may reflect an attempt to improve the radar's capabilities to define trajectories and characteristics of targets in a multiple target environment. Within the next 5 to 10 years the Soviets will probably develop and employ a variety of space systems (such as infrared launch detection satellites or other types of warning systems) in support of their strategic defensive forces.

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[18] Lt. Gen. Joseph F. Carroll, Director, DIA; Maj. Gen. Chester L. Johnson, Acting Assistant Chief of Staff for Intelligence, Department of the Army; and Maj. Gen. Jack E. Thomas, Assistant Chief of Staff, Intelligence, USAF, believe that the last two sentences in this paragraph unduly depreciate the potential capabilities of the Tallinn system in an ABM terminal defense mode. They believe it is more accurate to state that the Tallinn system is seriously degraded in an area defense role when off-site radar data are not provided, but that this degradation does not apply to the Tallinn system operating in a terminal defense mode. In the terminal defense mode the defended area is considerably reduced, but the firepower of the complexes and the performance of the on-site radar may be such that the capability to defend the terminal area targets would remain significant.

54. There is evidence that the Soviets have been investigating over-the-horizon-detection (OHD) radar techniques. Evidence of such interest appears in Soviet literature beginning in the mid-1950's. Signals coming from within the USSR for years have been suspected of being related to OHD and since early 1964 new signals, which we think are more compatible with OHD experimentation, have been noted. General Soviet practice of designing large antenna arrays for communications purposes has resulted in the construction in the USSR of many antennas which could be adapted to OHD. We believe detection of missile launches is a major purpose of the Soviet OHD effort, and that their level of technology is such that they should be able to detect such launches out to about 2,000 n.m. We have no evidence now of an operational OHD system for detection of missiles, and we cannot tell when or even if the Soviets could develop a sufficiently reliable system to warrant deployment.

55. We expect more research in the Soviet nuclear weapon test program on nuclear kill techniques having still greater lethal radii.

Deployment[19]

56. We expect the surveillance system to be extended as necessary to support ABM defenses. Less expensive technical alternatives to the Hen House or Dog House will probably be used if they become available.

57. We believe that the Moscow system will be completed by 1970 or 1971 with a total of about 100 launchers. The Soviets may continue construction to fill out the southern Triads, in which case the number would be somewhat larger.

58. What the Soviets will do for the general ABM defense of the USSR is still far from clear. They might deploy the Moscow system more widely; they might deploy more advanced systems based on the Moscow or Tallinn systems; they might deploy an entirely new system. On the other hand, they might decide that ABM defenses for the general defense of the USSR are too costly, but we consider this unlikely.[20]

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[19] Lt. Gen. Joseph F. Carroll, Director, DIA; Maj. Gen. Chester L. Johnson, Acting Assistant Chief of Staff for Intelligence, Department of the Army; and Maj. Gen. Jack E. Thomas, Assistant Chief of Staff, Intelligence, USAF, believe that any discussion of the deployment of the Soviet ballistic missile defenses should take into consideration the likelihood that the Tallinn system is an ABM system. In this event, the future deployment levels set forth in paragraph 37 would reflect the deployment of the Tallinn system in an ABM role.

[20] Rear Adm. E. B. Fluckey, Assistant Chief of Naval Operations (Intelligence), Department of the Navy, believes that the Galosh system could be a part of a Soviet retaliatory assured destruction defensive weapons system. Moscow, at the hub of all defense and counter strike and the center of command and control, must avoid destruction long enough to provide time for decision, retaliation, damage assessment of the Soviet Union, and rapid communications with the outside world. Should the US strike first, the Soviets would have only about 10 minutes tactical warning, compared to our own short 15 minutes if the Soviets strike first. They may consider this reaction time insufficient and so are willing to expend substantial funds to cover Moscow with an effective ABM system to gain as much as 24 hours grace before fallout moving in from other attack areas would degrade their capability to decide and respond. Having attained this, they might decide that ABM defenses for the comprehensive defense of the USSR are too costly.

59. There are no indications that the Moscow system is being deployed elsewhere in the USSR, and its probable great cost per launcher suggests that it may not be deployed further with its present capabilities. If the Soviets succeed in improving its capabilities and do not develop a better long-range system, an improved Moscow system might be deployed at additional locations in the early 1970's. The deployment of a short-range missile to supplement the Galosh system may also take place in about the same time period.

60. We cannot now judge how successful the Soviets will be in improving existing systems or in developing new systems. We think it likely, however, that the Soviets will extend ABM defenses during the next 10 years. We base this judgment on the magnitude of the threat, the wide dispersion of targets to be defended, and past Soviet proclivity for deployment of defenses when they believe they have found a system which provided at least a partial answer to their needs. We think the Soviets will be cautious about committing themselves to a fixed policy with respect to ABM deployment over the long term. They will probably adjust whatever program they pursue on the basis of a number of factors, including the capabilities of present systems to deal with penetration aids, the advances in ABM technology, the cost of additional deployment relative to the protection it is likely to afford, and the US reaction to Soviet strategic developments.

V. ANTISATELLITE DEFENSE

61. The development by the US of military support systems, such as communications and navigation satellites, as well as the possibility of spaceborne weapon systems, give the Soviets adequate incentive to develop defenses against these systems. In addition, the US announced capability of an antisatellite system must have added impetus to Soviet efforts along these lines. In fact, the Soviets could have had for some time a limited antisatellite capability based on existing electronic facilities and an operational missile with a nuclear warhead (e.g., the SS-4).

62. Hen House radars at Sary Shagan and Angarsk will have a coverage pattern which indicates a space surveillance system. In addition, the Skrunda and Olenegorsk dual Hen House radars and the Dog House probably have a secondary role of space surveillance.

63. This space surveillance system would enable the Soviets to observe and track satellites during most of the passes over the USSR. It probably would allow the Soviets to predict the orbits and positions of non-Soviet satellites and space vehicles with a high degree of accuracy after two to four crossings over the USSR, and thus could provide the information required by an antisatellite system.

64. A Soviet antisatellite system employing these radars could use an existing missile with a nuclear warhead. Nonnuclear kill, on the other hand, would probably require a ground-guided missile system of high precision or a homing missile capable of exoatmospheric maneuver, either of which could be developed in

about two years after a decision to do so. Although we have no evidence of such development, it could be well underway without our knowledge. We believe, therefore, that at about the time the Hen Houses become operational in the 1967-1968 time period, the Soviets could have an antisatellite capability with either nuclear or nonnuclear kill.

65. A manned coorbiting antisatellite system could be developed in the 1970's as an outgrowth of the Soviet manned space program.[21] Although the costs of such a system would be high, operational advantages—including opportunities for inspection, nondestructive neutralization, dismantling, or capture—might justify its development.

66. As a more immediate measure, the Soviets might explore techniques (such as ECM) for the nondestructive neutralization of satellites. These techniques might utilize mechanisms on the ground, in missiles, or in unmanned coorbiting satellites. The time at which any such techniques could be available would depend on the type of neutralizing mechanism adopted.

67. 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. We think it likely, therefore, that the Soviets would use antisatellite systems only if they believed that war with the US were imminent and that neutralization of our military support systems were consequently an overriding consideration. There might also be some other special circumstances in which they would use antisatellite systems in peacetime, such as an occasion in which they believed they were retaliating against US interference with their own satellites.

VI. CIVIL DEFENSE

68. The Soviets view an organized civil defense program as a part of their overall defensive posture. Since 1960, when operational responsibility for the civil defense program was shifted to the Ministry of Defense, increased numbers of military officers of high rank have appeared on civil defense staffs. The current head of the program is a prominent Marshal. Subordinate headquarters at the republic and oblast levels staffed with military personnel are responsible for dissemination and implementation of instructions from the headquarters in Moscow. Military district headquarters have civil defense officers which are probably prepared to assume operational control in any emergency. Local organizations are manned largely by civilians, and encompass rural as well as metropolitan areas. Civil defense activities are integrated with those of air defense and internal security organizations.

69. Soviet civil defense organizations, facilities, and capabilities have been growing over the past decade. We believe, however, that the recent calls to "perfect" civil defense, made at the 23rd Party Congress, do not indicate any major changes in the Soviet civil defense system or any expansion of civil defense

[21] See NIE 11-1-65, "The Soviet Space Program," dated 27 January 1965, SECRET.

plans. Rather, these high-level exhortations seem intended to spur lagging efforts within already existing programs. These programs are generally characterized by widespread public training and the use of simple shelters. However, special purpose shelters for civil defense, communications, and government control staffs probably are being constructed outside the major cities. Shelters for essential government, communications, support services, and civil defense control personnel are reportedly well equipped and stocked. But adequate shelters are available only to such key personnel.

70. We estimate that there are shelter spaces available for less than one-sixth of the urban population. Most of these shelters were built during the 1950's, when new public buildings and apartment houses were constructed with special basements for civil defense purposes. Since the late 1950's the Soviets have severely curtailed their urban shelter construction program. We have no evidence to indicate that they are planning a resumption of a major shelter construction program except insofar as the new deep-level subway lines undoubtedly serve this purpose. They have, however, suitable areas in apartments, public buildings, and factories that could be designated and stocked as fallout shelter areas for most of the urban population. We have no indication that the Soviets would consider a stepped up civil defense program for fallout shelters as an integral and necessary adjunct to extensive ABM deployment.

71. A network of civil defense courses and schools is operated in the USSR to train civilians charged with command, operational, and technical duties in the civil defense organization and the instructors who are to give training courses to the general public. All Soviet citizens are obligated to take civil defense instruction regularly in schools and at places of work. The fifth public course given since 1955 is approaching completion. About half the Soviet population has probably been exposed to basic self-help instruction and many have probably taken repeated courses, but apathy on the part of the public has tended to reduce the planned effectiveness of this training.

72. Since 1960 the Soviets have been emphasizing in their training ways to conduct planned urban evacuation in advance of the outbreak of hostilities. Current plans for a developing emergency call for substantial evacuation of Soviet cities, with most of the population resettled temporarily in rural areas. Such plans, of course, would be feasible only if the Soviet civil defense authorities received several days warning.

73. The civil defense program does not now have a high priority call on either budgetary or economic resources, and there is no indication that this trend will change. The civil defense program is geared to a slow but steady improvement in overall effectiveness We believe that the demands of other defense systems and of the economy will continue to preclude any costly augmentation of the Soviet civil defense program.

ANNEX

TABLE I

SOVIET INTERCEPTORS: ESTIMATED CHARACTERISTICS AND PERFORMANCE IN AN AIR DEFENSE ROLE

MODEL	IOC	MAXIMUM SPEED AT OPTIMUM ALTITUDE (KNOTS) [a]	COMBAT CEILING (FEET) [a b]	OPTIMUM COMBAT RADIUS WITH EXTERNAL FUEL (NM) [a]	ALL-WEATHER INTERCEPT CAPABILITY	RADAR RANGE SEARCH/TRACK (NM)	MAIN ARMAMENT	MAXIMUM EFFECTIVE ATTACK RANGE (NM)	ATTACK CAPABILITY
Old Models									
Fresco A/B (Mig-17)	1953	605	53,400	540	No	..	Guns/Rockets	0.5	Tail
Fresco C (Mig-17)	1954	620	54,500	510	No	2/1 [c]	Guns/Rockets	0.5	Tail
Fresco D (Mig-17)	1955	620	54,500	510	Yes	6/1	Guns/Rockets	0.5 [d]	Tail
Fresco E (Mig-17)	1954	605	53,400	540	Yes	6/1	Guns/Rockets	0.5 [d]	Tail
Flashlight (Yak-25)	1955	610	49,400	575	Yes	12/8	Guns	0.5	Tail
Farmer A (Mig-19)	1955	755	54,500	520	No	2/1 [c]	Guns/Rockets	0.5	Tail
Farmer B (Mig-19)	1957	755	54,500	520	Yes	6/2	Guns	0.5	Tail
Farmer C (Mig-19)	1957	755	54,500	520	No	2/1 [c]	Guns/Rockets	0.5	Tail
Farmer D (Mig-19)	1957	755	54,500	520	No	2/1 [c]	Guns/Rockets	0.5	Tail
Farmer E (Mig-19)	1959	745	54,900	520	Yes	6/3	AAMs	3–4	Tail
Current Models									
Fitter (SU-7)[f]	1959	1,205	57,600	580	No	4/3 [c]	Guns/Rockets	0.5	Tail
							or Guns/AAMs	5–6 [c]	Tail
Fishpot (SU-9)	1959	1,205	58,000	540	Yes	11/5	AAMs	3–4	Tail
Fishbed C/E (Mig-21)[f]	1960/1961	1,150	59,500	450	No	5/4 [c]	Guns/AAMs	5–6 [c]	Tail
Fishbed D (Mig-21)[f]	1962	1,150	61,500	470	Yes	11/8	AAMs	5–6	Tail
Fishbed F (Mig-21)[f]	1965	1,260	62,600	480	Yes	11/8	AAMs	5–6 [c]	Tail
Firebar (Yak-28)	1964	1,100	54,000	550	Yes	22/16	AAMs	10–12	Tail

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Future Models										
Fiddler		1966–1967	1,080	52,700	1,050	Yes	32/24	AAMs	10–16	360°
Improved All-Weather Interceptor A.		1968	About 1,600	70,000	540 [e]	Yes	18/16	AAMs	10–12	360°
Improved All-Weather Interceptor B.		1969–1970	About 1,700	70,000–75,000	Up to 560 [e]	Yes	18/16	AAMs	10–12	360°
Advanced All-Weather Interceptor.[h]		1972–1974 [h]	Mach 3 cruise	75,000–80,000	700 [e h]	Yes	About 60/45	AAMs	At least 10–16	360°

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

[b] Current model Soviet Mach 2 interceptors equipped with search/track radars have the capability to make intercepts, with limited effectiveness, in dynamic climb against subsonic targets at altitudes on the order of 70,000 feet when under close GCI direction.

[c] These figures are for radars that give target ranges only.

[d] Some of these aircraft, assigned to Tactical Aviation, and a few in PVO Strany are equipped to carry four AA–1 AAMs. In this case their effective attack range would be 2–3 n.m.

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

[f] There are few Fitters and no Fishbeds in the 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.

[g] Without external fuel.

[h] The Soviets have a capability to develop and deploy by 1974–1976 a new advanced all-weather long-range interceptor capable of cruising at speeds of Mach 3, with a combat radius of 1,000 n.m. and carrying armament similar to the advanced all-weather interceptor. See paragraph 26.

TABLE II

SOVIET SURFACE-TO-AIR MISSILE SYSTEMS
ESTIMATED CHARACTERISTICS AND PERFORMANCE [a]

DESIGNATION	SA-1	SA-2 [b] (C-Band)	SA-3
IOC	1954	1960	1961
Sites per Complex	56	...	...
Launchers per Site	60 [c]	6	4 Dual
Maximum Slant Range (nm)	... [d]	27 [e]	About 12
Maximum Altitude (ft)	... [d]	90,000 [f]	Up to 50,000
Minimum Altitude (ft)	3,000	1,500	About 1,000 [g]
Target Handling Capability per Site	20 [c]	1	1
Rate of Simultaneous Fire per Site	20 [c]	3	4
Accuracy (CEP in ft)	200	75-150	About 50
Warhead Weight (lbs)	465 [h]	420 [h]	Up to 200
Mobility	Fixed	Transportable	Transportable

[a] The surface-to-air capabilities of the Tallinn system against aerodynamic vehicles are discussed in paragraph 36.

[b] An earlier version of the SA-2 system, no longer deployed in the USSR but still deployed in East Europe, North Vietnam, and elsewhere, has a maximum slant range of 17 n.m. and a minimum intercept altitude of 3,000.

[c] For the past several years no more than 12 missiles have been seen on launcher per site.

[d] Original system had a maximum slant range of 20-25 n.m. and a maximum intercept altitude of about 60,000 feet. There are indications that the SA-1 range and altitude capabilities probably have been improved. The capabilities of this system could approach those of the SA-2.

[e] This range is estimated for sites equipped with the Fan Song E fire-control radar which is standard in the USSR.

[f] The SA-2 has some effectiveness above this altitude.

[g] We have no evidence as to the minimum effective altitude capabilities of this system.

[h] The Soviets almost certainly will provide some of these missiles with nuclear warheads, and may have begun to do so.

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