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SPECIAL INTELLIGENCE ESTIMATE

THE SCALE AND NATURE OF THE SOVIET AIR DEFENSE EFFORT 1952-54

SIE-5

3 December 1952

The intelligence organizations of the Departments of State, the Army, the Navy, the Air Force, and the Joint Staff participated with the Central Intelligence Agency in the preparation of this estimate.

All members of the Intelligence Advisory Committee concurred in this estimate on 20 November 1952.

CENTRAL INTELLIGENCE AGENCY

WARNING

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3 December 1952

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CENTRAL INTELLIGENCE AGENCY

OFFICE OF NATIONAL ESTIMATES

25 November 1952

SUBJECT: SIE-5: THE SCALE AND NATURE OF THE SOVIET AIR DEFENSE EFFORT 1952-54

NOTE

This estimate is the best assessment of the scale and nature of the Soviet air defense effort which can be made at present. The IAC proposes to keep the subject under continuing review. It is impossible realistically to assess Soviet air defense capabilities except in reference to an assumed attacking force. In the absence of such an assumed attacking force, the best that can be done is in effect to estimate the inventory of Soviet air defense assets. The IAC hopes that this estimate will provide the intelligence basis for a realistic assessment of the Soviet air defense capabilities relative to an assumed attack.

THE PROBLEM

To estimate the present scale and nature of the Soviet air defense system and the possible development of the system through 1954. 1/

CONCLUSIONS

1. The USSR is carrying out an intensive program for the improvement of its air defense system, with a priority which is probably second only to the Soviet atomic weapons program. Although the USSR almost certainly faces numerous developmental and production problems, there appear to be no insoluble economic or technological limitations which would prevent the development and quantity production of high quality air defense material, provided that this program continues to receive sufficiently high priority.

1/ This estimate considers only active defense measures against air attacks on the USSR. It excludes air defense of the field forces, except insofar as it contributes to strategic air defenses, and any indirect air defense measures such as spoiling attacks, sabotage or subversion, as well as civil air defense (NIE-60), and various economic measures, such as stockpiling and dispersal. Chinese Communist and Satellite air defenses are considered insofar as they contribute to the air defense of the USSR.

2. The USSR's large and elaborate air defense system includes not only the forces assigned to PVO-Strany, the Soviet air defense organization, but also has available to it those active air defense resources of the Soviet army, tactical air forces, and navy not otherwise committed. Although the European satellite and Communist Chinese air defense forces are less well developed, they add to and are integrated with the Soviet system. As of 1 October 1952 the total T/O and E strength of the forces potentially available for air defense of the USSR are estimated at about 12,850 aircraft, of which roughly 8,400 are jets (see paragraph 39).

3. Because of the rapid Soviet progress in the electronic field, and corollary development in interceptors and antiaircraft weapons, we believe that:

a. The approaches to the most important areas in the USSR are well covered by an early warning system (see paras. 37 and 38 and paras. 10-18 of Appendix B and map between pages 25 and 26. 2/

2/ The D/I, USAF considers this statement implies an extent of radar coverage greater than available evidence would indicate. It is known there exists considerable early warning coverage in Western and far eastern sectors of the USSR, but intelligence data gives little indication as to whether or to what extent important areas in the central portion of the USSR may be provided with early warning coverage.

b. Soviet interception capabilities have considerably increased with the widespread use of MIG-15 interceptors and the introduction of modern GCI radar similar to current US operational models (at least 19 or 20 such installations have been identified as to possible location. There are indications of several additional sets). Under conditions of good day or night visibility this equipment is probably capable of controlled interceptions of bomber flying at up to 450 knots and 40-42,000 feet, or perhaps higher. 3/

c. The USSR has now some all-weather aircraft equipped with experimental AI radar (there have been one almost certain and several possible identifications of such aircraft). It may now have some all-weather aircraft

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3/ The D/I, USAF considers this statement should be qualified by the comment that effective controlled interceptions at the speeds and altitudes stated would be possible only if the new Soviet GCI radars have performance capabilities approximately equal to the US CPS-6 and if radar crews have achieved a high level of competence with the equipment. There is no evidence that the Soviet radars actually possess such capabilities, nor that training exercises at these speeds and altitudes ever have been attempted.

with some form of AI equipment in operational units around a few key Soviet areas (see paras. 19 and 42 and paras. 20-21 of Appendix A). 4/

d. Soviet antiaircraft capabilities are gradually increasing as new heavy AA guns (estimated at 100 mm.) with modern fire control radar and probably new directors become available in increasing numbers in key Soviet areas (see paras. 44-45 and para. 26 of Appendix A). These guns are capable of continuously pointed fire to 35,000 feet and barrage fire to 40,000 feet. However, we believe that these guns will not be capable of a high percentage of kills at these altitudes, even if controlled by the most modern fire control equipment.

e. Soviet low level defenses are also being improved by the introduction of a new medium AA gun estimated to be 57 mm. (see para. 25 of Appendix A).

4/ The D/I, USAF has carefully examined all available intelligence on Soviet fighter units and finds no positive indication of the employment of airborne intercept equipment in any of these units. Further, there is a large volume of evidence obtained during interception exercises in European Russia and during both exercises and intercept operations in the Far East pointing to a positive lack of airborne intercept radar in operational fighter units.

f. Surface-to-air and air-to-air guided missiles could be available in limited quantities, although there is no evidence of operational training or employment. Unguided rockets are probably in limited use (see paras. 27-29 and paras. 36, 41 and 42 of Appendix A).

4. However, the following deficiencies probably still exist in the Soviet air defense system:

a. At present there are probably insufficient numbers of trained personnel, modern interceptors, radars, and heavy AA guns to provide effective defenses for all important areas. We are unable to estimate the extent of these deficiencies.

b. That portion of the Soviet air defense communications network which places primarily dependence upon radio frequencies below 30 megacycles is vulnerable to long range jamming. Because of the lack of intelligence on supplementary land lines, we cannot estimate the seriousness of this deficiency.

c. Existing Soviet interception capabilities under conditions of poor visibility are seriously limited by the lack of adequate numbers of all-weather

interceptors,[5/] and by the almost certain inadequacy of Soviet training and experience in all-weather interception techniques.

5. The USSR is making efforts to overcome these and other deficiencies. We believe that these efforts will further improve Soviet air defenses but will not overcome all of the above deficiencies by the end of 1954:

a. Substantial quantities of the new equipment already identified (radar, interceptors, AA weapons, etc.) should become available in most important areas. For example, by mid-1954 the Soviet fighter forces, which are already 80% jet-equipped, will probably be entirely equipped with an estimated 10,000 jet fighters and interceptors, including 2,800-3,000 in the IA PVO.

b. Soviet all-weather interception capabilities will almost certainly increase considerably, although various deficiencies in training, maintenance, and experience probably will still exist. We estimate

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5/ The Deputy Director for Intelligence, the Joint Staff, wishes to point out that there are no known Soviet all-weather interceptors at the present time.

that by mid-1954 Soviet fighter strength probably will include a few hundred of some type of true all-weather interceptors. 6/ 7/

c. The vulnerability of Soviet communications will probably be reduced by the installation of new higher frequency radio equipment as well as more land lines (see paras. 11 and 12).

d. There will probably be other new developments, particularly in interceptors, radar, guided missiles, and rockets, designed to counter Western progress in offensive aerial weapons.

DISCUSSION

7. World War II Soviet Air Defenses. Soviet air defenses in World War II were never fully tested by the Luftwaffe, whose

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6/ The D/I, USAF agrees that a few hundred interceptors could become available by 1954, but considers it does not necessarily follow that "all-weather interception capabilities will almost certainly increase considerably" by that time. As there is no evidence that either the aircraft or the airborne equipment have as yet become available, the time remaining in the period of this estimate is not considered sufficient to achieve the desired level of competence for the necessary technical and operating personnel.

7/ The Deputy Director for Intelligence agrees in general with the position taken by the DI/USAF, with reference to this paragraph.

long range assaults against Soviet cities outside the battle zone were on a modest scale. The Soviet organization for air raid warning, consisting largely of visual and sonic observer posts, was relatively effective throughout the war; in some areas defenses were alerted fifteen minutes in advance of a raid. However, German attacks on strategic targets generally revealed a low level of effectiveness on the part of the Soviet air defenses. The Soviet forces were more successful in defensive cover of the forward defense zones in the latter stages of the war, owing both to numerical superiority and to improvement in the warning and control system. Soviet antiaircraft fire was effective against low flying aircraft, although as a rule less effective against medium and high altitude targets.

8. Postwar Developments. Available evidence indicates that the USSR has given a high priority in its postwar military program to the development of defenses against air attacks. We believe that this program has received an over-all priority second only to the atomic weapons program. This priority is evident from authoritative statements of Soviet political and military leaders, from the postwar emphasis on production of modern air defense materiel, and from the development of an elaborate air defense organization, the PVO-Strany, with the sole mission of defending the Soviet Union against air attack. Soviet concern over air defense is apparent, for example, from postwar developments in

the Soviet aircraft industry, which was apparently given the priority mission of developing a high speed, high altitude interceptor and was producing jet fighters in operational quantities by mid-1947. Another indication is the extent to which Soviet air training programs stress interception exercises. There has also been a concentrated airfield building program bordering key strategic areas of the USSR, which provides a network of bases capable of supporting jet fighter operations.

9. Recent Communist air activity in Korea has provided further indications of increasing Soviet capabilities in the field of air defense. While air defense problems in Korea are not comparable to those involved in defense of the USSR itself, Korean developments have demonstrated that: (a) the USSR has been able to develop and mass-produce a first-class modern jet interceptor (MIG-15); (b) the USSR has been able rapidly to create a Chinese Communist-North Korean air defense force, thus demonstrating a relatively high degree of organizational ability as well as a good logistical capability; (c) the Communists have been able to establish an effective early warning system, utilizing World War II radar equipment; (d) the Communists have employed a GCI system of sufficient effectiveness to place fighters in good position for visual attacks on UN aircraft; and (e) the Communists have developed substantial defenses against low-flying aircraft. However, thus far the Communist air defense system has not displayed an effective all-weather interception capability.

SOVIET WEAPONS AND EQUIPMENT CAPABILITIES 8/

10. Early Warning Radar. The large number of 70 mc. early warning radars in general use in the Soviet early warning system are judged technically deficient by US standards because of limited range and angle discrimination characteristics. However, the density of their deployment, as indicated by observation in the European USSR and some Soviet Far East areas, and the well-integrated organization backing up these radars largely compensates for these technical deficiencies. It is probable that large numbers of this lower frequency equipment will be retained as the principal early warning radar, but there is evidence that the USSR is already employing some improved sets providing greater range and accuracy. At least 19 or 20 installations similar to the US CPS-6 type have been identified as to possible location. There are indications of several additional sets. We believe that as time passes more of these sets will be added to supplement the present radar net. The radar warning service may be augmented by passive detection devices in the form of radar receivers. The USSR has the capability to develop and place in operational use by 1954 early warning radar with performance equivalent in all respects to the best US radars now in operational use.

8/ See Appendix A for more detailed examination of these capabilities.

11. Communications. We believe that the Soviet ground-to-ground air defense communications system, which includes both point-to-point radio circuits and land lines, will not normally limit the performance of the air defense system, except possibly in handling large multiple attacks. However, the widespread use of frequencies below 30 megacycles in the radio circuits makes these circuits vulnerable to long range jamming and susceptible to unintentional interference from manmade and atmospheric noises and signal fading. In the light of Soviet experience with these frequencies, their known jamming proficiency, and their knowledge of Western electronic countermeasures potential, we assume that dependence upon these radio circuits is being overcome by increased use of land lines. Such use is indicated by the fact that the volume of radio traffic on some nets is decreasing. Moreover, the USSR is procuring from the Soviet Zone of Germany at least 750 sets of UHF equipment, which may indicate an intention to incorporate equipment of this type in its air defense networks, thus greatly reducing their vulnerability. We estimate that by 1954 a substantial portion of the Soviet air defense communications network could probably be converted to a UHF net, provided this project has sufficient priority.

12. For ground-to-air communications, the USSR has generally depended on medium and high frequency equipment, which is also susceptible to noise interference and jamming. Furthermore the

lack of pretuned multi-channel transmitters in Soviet interceptors would present a difficult problem in the passing of control interceptor aircraft from one station to another under jamming conditions. However, the USSR is capable of overcoming these deficiencies by developing and producing VHF or UHF multi-channel equipment. Some Soviet aircraft are already employing VHF radio. We estimate that a Soviet plan to convert to VHF equipment in fighter units is probably underway, and might be operationally completed by 1954.

13. The USSR presently has the necessary radio navigation facilities in many areas to insure staging of interceptor aircraft at desired points and to aid their return to their bases.

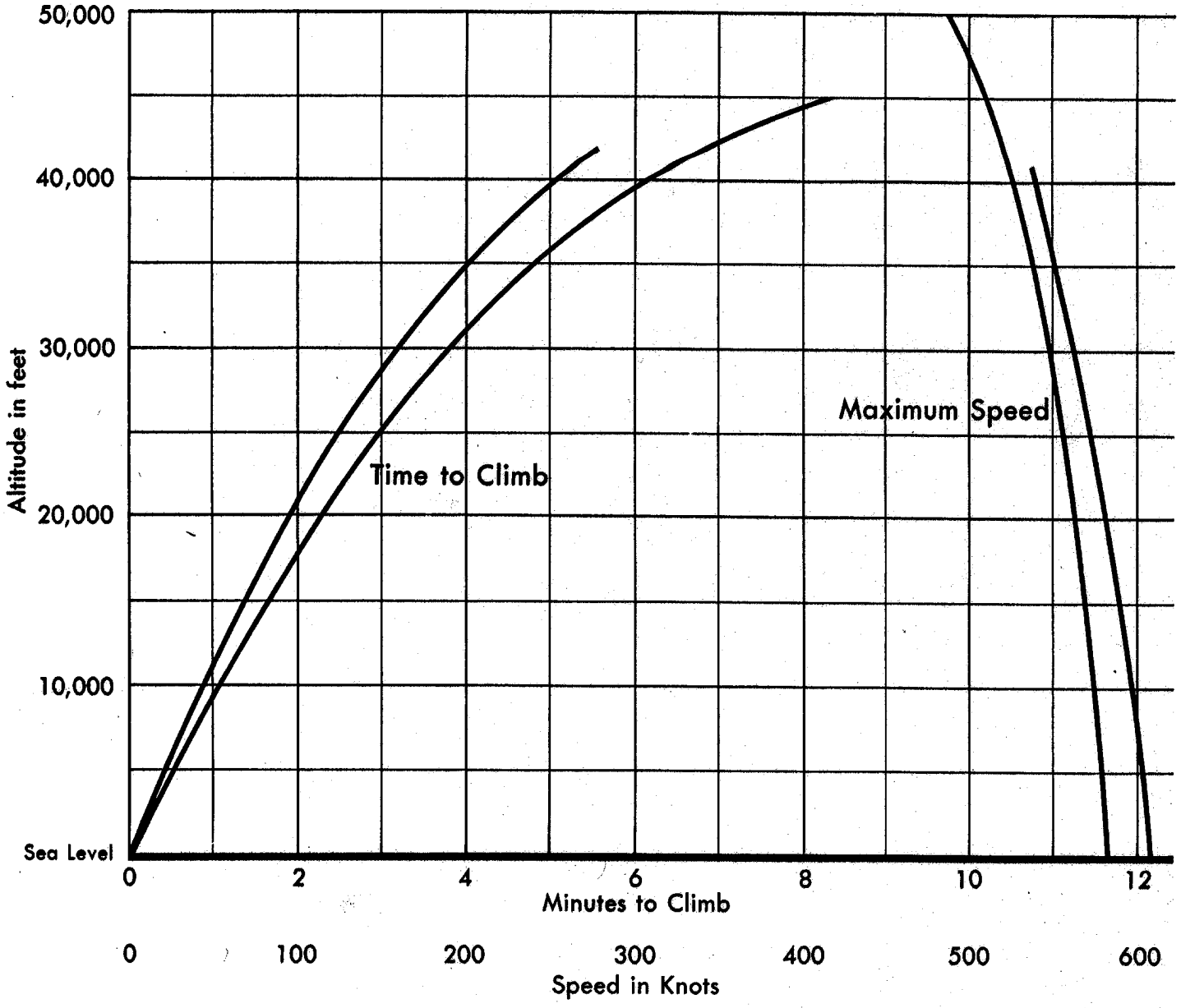
14. Ground Control Intercept. The USSR is currently producing an improved GCI radar similar to current US GCI sets. Such radar is now becoming available for defense of selected areas, augmenting or replacing the older, less accurate radar now used. Even if these radars do not have performance characteristics equal to those of current US radars, this development will substantially increase Soviet capabilities for close control of interceptor aircraft. By 1954, the USSR will be capable of developing and producing GCI radar with performance equivalent to current US operational models in quantity for the defense of strategic areas, provided sufficient priority is given to this project.

15. Interceptors. The USSR has placed great emphasis on producing fighter aircraft and we believe that it will continue to exert vigorous efforts to develop and produce effective interceptors. The MIG-15 is testimony to Soviet success in producing a modern jet interceptor. It is capable of 580 knots at sea level and has an estimated combat ceiling of over 50,000 feet. Its armament suggests that it was designed primarily for defense against high altitude bombers.

16. We estimate that by 1954 the USSR could increase the performance of its new interceptors by use of afterburners and rocket boost. The estimated armament for such an improved aircraft would consist of 23mm or 37mm cannon in the nose with ammunition for about six seconds of fire. However, unguided air-to-air rockets might be used.

17. The USSR might, as the next logical step, develop interceptors capable of supersonic flight. The USSR has shown considerable interest in research in this field. The German aircraft design group working at Podberezye is known to have been working on a supersonic rocket-powered interceptor, reportedly a delta wing type designed to attain a speed of Mach 1.5. In the absence of any major development and production problems, we estimate that a supersonic, rocket-powered interceptor might be available in very limited operational quantities by late 1954.

INTERCEPTORS
ESTIMATED PERFORMANCE CHARACTERISTICS



MIG-15 (VK-1 Engine @ Mil. Power) (Combat Ceiling 50,500 ft.)

Estimated Soviet Interceptor – 1954 (Combat Ceiling 54,000 ft.)

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18. Airborne Intercept Equipment. We know the USSR has samples of World War II airborne intercept equipment obtained from the Germans and through lend-lease; however, there is no evidence of their intent to adopt and produce such World War II equipment for standard operational use in air defense units. We estimate that the USSR has the technical knowledge and production capability to produce an AI radar superior to World War II types as well as effective passive detection equipment of electronic, infrared and possibly sonic types. Recent intelligence has shown airborne radar in the 67-76 mc. region that gave evidence of having searching, tracking, and intercept capabilities. [redacted] signals emanated from an airborne radar similar to the ex-German Leichtenstein AI radar which had several versions. From this and other indications we estimate that the USSR almost certainly now has limited experimental quantities of some type of AI equipment, and probably now has some type of AI equipment available for limited operational use.2/

2/ The D/I, USAF, considers that the "other indications" referred to in the last sentence of paragraph 18 are not sufficiently valid to be considered in this estimate, and that the one incident described does not constitute sufficient evidence to provide the basis for the conclusion that the USSR"... probably now has some type of AI equipment available for limited operational use."

19. Night and All-Weather Interceptors. The USSR is employing jet aircraft in a night interceptor role and has displayed several aircraft types which appear to be either designed for or adaptable to all-weather roles. We estimate that the USSR now has some all-weather aircraft equipped with experimental AI radar. Despite the lack of direct evidence we estimate that it may now have small numbers of all-weather aircraft with some form of AI equipment in operational units around a few key Soviet areas.10/

20. It is also within Soviet capabilities to develop a true all-weather interceptor. The type 17, which was flown in the July 1949 Air Show, appears to be the best Soviet design now known. We estimate that if the USSR should decide to produce this aircraft a limited number could be made available to operational units by 1953. In any case we estimate that the USSR

10/ The D/I, USAF considers that this estimate is not justified by the available evidence. The lack of AI equipment in operational interceptor units is believed to be demonstrated by the following: a. The physical characteristics of the aircraft assigned to interceptor units do not indicate the probable installation of any interception equipment; b. The tactics employed in Korea and in GCI exercises in Russian controlled areas are not indicative of interceptions assisted by airborne equipment; c. The continued use of searchlights in Korea and in the Soviet Union as an aid to intercepting target aircraft; d. The failure of intercepted electronic signals to indicate anything other than one incident where obsolescent German AI radar not suitable for an interceptor fighter apparently was employed.

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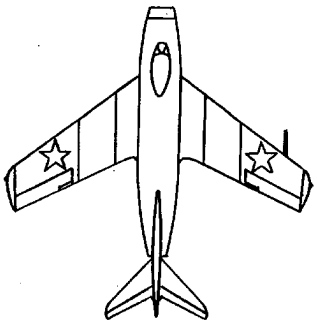
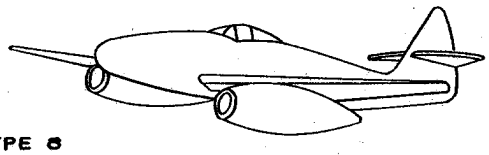


VMAX @ S.L. ----------582 KTS.

MIG-15

VMAX @ S.L. -- 582 KTS.
VMAX @ 40,000 FT. -- 525 KTS.
TIME TO 40,000 FT. -- 6.1 MIN.
COMBAT CEILING -- 50,500 FT.
COMBAT RADIUS -- 285 NAUT.MI.

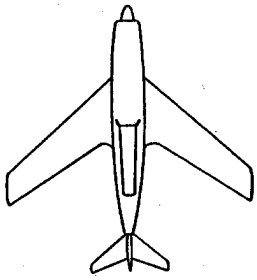


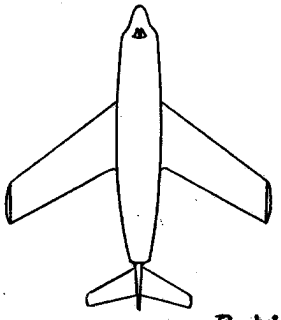
TYPE 8

VMAX @ S.L. -- 444 KTS.
VMAX @ 40,000 FT. -- 430 KTS.
TIME TO 40,000 FT. -- 22.5 MIN.
COMBAT CEILING -- 39,000 FT.
COMBAT RADIUS -- 930 NAUT.MI.

TYPE 18

VMAX @ S.L. -- 550 KTS.
VMAX @ 40,000 FT. - 518 KTS.
TIME TO 40,000 FT. - 16 MIN.
COMBAT CEILING - 45,000 FT.
COMBAT RADIUS - NOT AVAILABLE

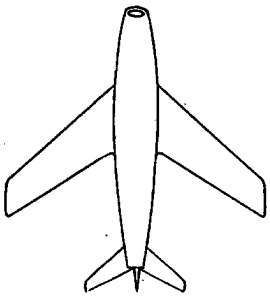




TYPE 19

VMAX @ S.L. -- NOT AVAILABLE
VMAX @ 40,000 FT. " "
TIME TO 40,000 FT. " "
COMBAT CEILING " "
COMBAT RADIUS " "

Estimated performance characteristics similar to MIG-15

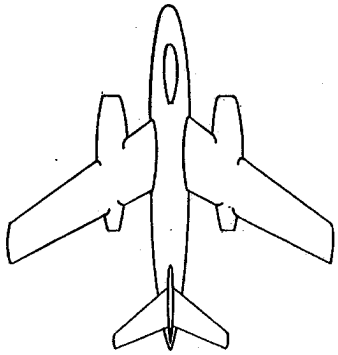


TYPE 21

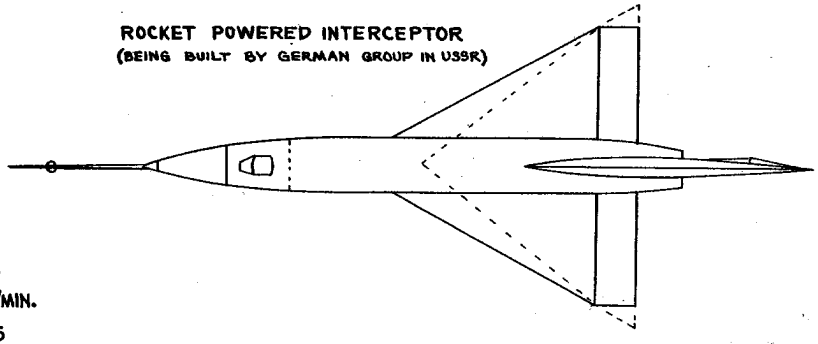
VMAX @ S.L. - NOT AVAILABLE
VMAX @ 40,000 FT. " "
TIME TO 40,000 FT. " "
COMBAT CEILING " "
COMBAT RADIUS " "

TYPE 17

VMAX @ S.L. -- 525 KTS.
VMAX @ 40000 FT. - 475 KTS.
TIME TO 35,000 FT. - 13 MIN
COMBAT CEILING - 41,500 FT.
COMBAT RADIUS - NOT AVAILABLE



ROCKET POWERED INTERCEPTOR
(BEING BUILT BY GERMAN GROUP IN USSR)



DESIGN MAX. MACH NO. - 1.5
DESIGN MAX. ALTITUDE - 70,000 FT.
RATE OF CLIMB - OVER 20,000 FT./MIN.
ENDURANCE - APPROX. 0.5 HOURS
LENGTH -- 38 FEET APPROX.
WING SPAN -- 27.2 FEET APPROX.

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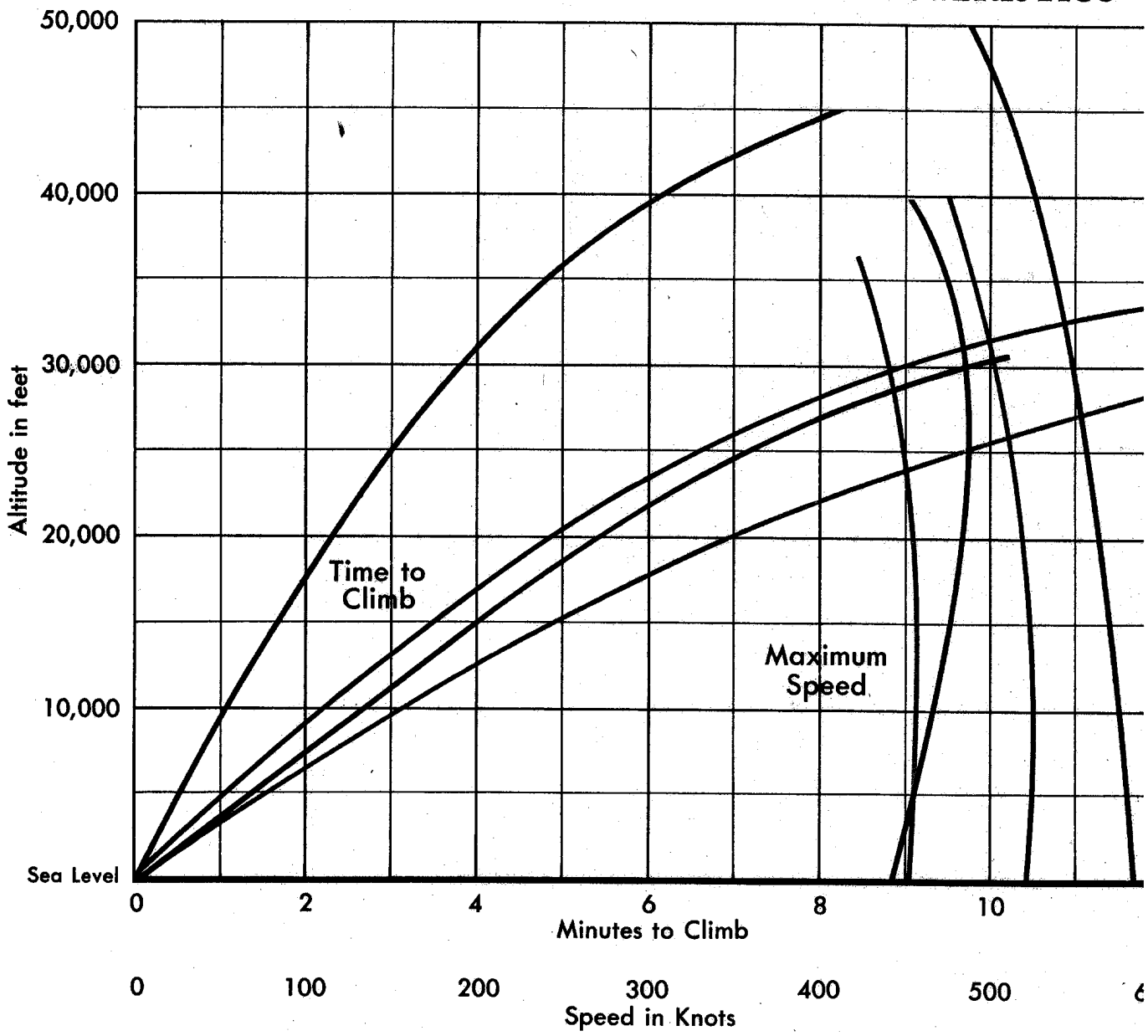
POTENTIAL ALL-WEATHER INTERCEPTORS
ESTIMATED PERFORMANCE CHARACTERISTICS



Type-17 (Combat Ceiling 42,000 ft.) } *Combat configured and loaded for bomb mission.*

Il-28 (Combat Ceiling 37,200 ft.) } *Characteristics would be improved if modified for interceptor role.*

Type-8 (Combat Ceiling 39,000 ft.)

Type-19 } *Tentative combat characteristics similar to MIG-15; would be less if equipped as an all-weather interceptor.*

Note: The Il-28 is the only one known to be in production.

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will probably have limited operational quantities of some type of true-all-weather interceptor during 1953.

21. However, whether or not the USSR is attempting to develop extensive all-weather interception capabilities depends on the Soviet estimate as to how essential such capabilities are. This estimate assumes that the USSR, like the US, is placing great emphasis on the development of all-weather interception capabilities. The USSR may consider that all-weather interception is not essential to its air defenses, particulaly as the cloud cover over much of the USSR generally extends only to about 15,000 feet. It may have decided that infra-red or other systems will suffice. However, we have no evidence of the development of such systems.

22. AA Artillery. Aside from the large quantities of World War II 37 and 85 mm AA guns still in use by the Soviet forces, the USSR is producing at least two new weapons. It appears to have recently begun manufacture of a new AA gun, probably of 57mm calibre. Such a weapon would greatly increase Soviet capabilities for defense against highspeed, low-flying aircraft. Available intelligence indicates a high priority emphasis on the manufacturing schedule for this gun.

23. The USSR has also developed a new model AA gun, probably of 100mm caliber, which has been seen in substantial and increasing

numbers in 1951. We believe that these guns can provide continuously pointed fire to 35,000 feet and barrage fire to 40,000 feet, with an estimated rate of fire of 25 rounds per minute. However, we believe that they will not be capable of a high percentage of kills at these altitudes, even if controlled by the most modern fire control equipment. This gun is apparently in quantity production and should be available in substantial quantities in and around key areas by the end of 1952. There are some indications that the USSR may be developing a 120 or 122mm gun.

24. Fire Control. The SCR-584 gun-laying radars furnished the USSR under Lend-Lease are being augmented by a version of Soviet manufacture which is now appearing in service, particularly around Moscow. This radar, which is being used in connection with the above AA gun, will greatly increase the accuracy of Soviet antiaircraft fire. The USSR is also capable of producing both analog and digital computers as well as the electronic directors given it under Lend-Lease. Although there is little evidence that the USSR is using electronic directors, we believe that it is providing an improved director concurrently with the new AA guns and fire control radar.

25. Rockets. The USSR has the capability to develop and produce unguided AA rockets for use against high-speed, high-altitude aircraft. Of the German developments in this field

in which the USSR has shown interest, the TAIFUN is one of the few unguided rockets which may have been developed further by the Soviets. We have no clear indications as to how far this development has progressed, but we estimate that the USSR is now capable of having an unguided rocket in operational use with at least the following characteristics: supersonic speed, an operational ceiling of 45-50,000 feet, and small dispersion for rocket types.

26. AA Fuzes. The development of proximity fuzes for anti-aircraft ammunition may be a high priority Soviet requirement. Although we have no firm intelligence, we believe that the USSR could produce operational quantities of such fuzes for defense of key areas by 1953. Proximity fuzes could also be available for use in Soviet AA guided missiles. In addition, the USSR has manufactured experimental lots of electrical time fuzes, following German wartime developments. We believe that the USSR is capable of having these fuzes in use at the present time, although there is no evidence that they are in quantity production.

27. Guided Missiles. The difficulty of determining which direction the Soviet surface-to-air missile program has taken will not permit a firm estimate of specific missile systems undergoing development. The Soviet version of the SCR-584 radar could provide the USSR with a tracking capability suitable for operational missile guidance. The USSR also has the capability

to provide and will probably employ command guidance in the mid-course phase of missile flight. It is also reported to be developing terminal guidance equipment and is probably doing so. Based upon estimated Soviet capabilities in the field of infra-red and radar technology, we believe that infra-red or radar terminal guidance equipment could be available by 1954. However, there is no intelligence to confirm infra-red terminal guidance developments.

28. It is possible that the USSR could have available in moderate quantity by the end of 1952 ground-to-air guided missiles based on German World War II designs. Of these missiles, the WASSERFALL type had the best performance, and could be controllable through its maximum responsive slant range of about 40,000 yards.[11/] We believe that the USSR, in view of its demonstrated capabilities in related fields, could have an advanced type of supersonic missile, with increased range in operational use sometime during the period 1954-1956. Because of the lack of intelligence on the particular missile systems which could be employed by the USSR no sound prediction of accuracy can be made.

29. There is no intelligence on Soviet development of air-to-air guided missiles. However, in view of known Soviet

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11/ The D/I, USAF considers that available evidence on Soviet progress in missile and guidance development would limit estimated maximum slant range to 25,000 yards.

continuation of wartime German developments we estimate that the USSR is capable at the present time of having subsonic wire or radio-controlled missiles. We believe that by 1954 the USSR could have in operational use a supersonic missile possibly employing radar or infrared homing.

30. Countermeasures. Soviet jamming of foreign propaganda broadcasts has demonstrated Soviet capabilities for electronic jamming at these frequencies and indicates a keen appreciation of the value of jamming techniques. These broadcasts, using frequencies in the LF, MF, and HF bands, are jammed to uselessness in many parts of the USSR. The USSR exhibits excellent organization control over the jamming operations.

31. The USSR is capable at present of effective jamming and spoofing of LF, MF, and HF communications, although there is no evidence of the existence of significant quantities of VHF and UHF jamming equipment. However, Soviet capabilities in related electronic fields at these frequencies indicate that the USSR is capable of developing equipment for jamming of VHF and UHF frequencies at the present time.

32. There is little intelligence as to the existence of a Soviet program for jamming airborne micro-wave radar bombing, fire control, and navigational aids. The USSR acquired samples of US World War II equipment as well as German equipment

seven years ago, and is well aware of the significance of countermeasures, as indicated above. The possibility of Soviet jamming of Western airborne radar instrumentation is increased by the narrow frequency ranges employed by us. The USSR is reported to be working on CW magnetrons for jammer use in the 1, 3, 10, and 40-50 centimeter bands. It is capable of having intercept receivers operating in the UHF and SHF bands in operational use at present. The USSR will probably have by 1954 jamming equipment for operational use against any frequencies up to and including UHF and SHF bands, although it may have only limited quantities of UHF and SHF jammers.

33. Very little is known about Soviet work in electronic deception devices. Such devices should be attractive to the USSR and are likely to be encountered. The USSR has employed "Window" in training exercises.

ORGANIZATION, STRENGTH, AND COMBAT READINESS OF SOVIET AIR DEFENSES 12/

34. The USSR maintains a large and elaborate air defense system which not only includes the forces assigned to the air defense organization (PVO-Strany) but also has available to it those active air defense resources of the army, tactical air

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12/ See Appendix B for additional details.

forces, navy not otherwise committed, as well as the passive defense resources of the police and civilian organizations. The European Satellite and Communist Chinese air defenses add to and are integrated with the Soviet system.

35. The PVO-Strany. Air defense of the USSR is primarily the responsibility of a major component of the War Ministry, separate from the Army and Air Force, which is known as PVO-Strany (Anti-Air Defense of the Country) and is probably headed by a Deputy Minister. PVO-Strany headquarters in Moscow not only directs the employment of the numerous air defense forces which are assigned or attached directly to it, but also co-ordinates the use in air defense roles of other military and naval forces and the civil defense organization.

36. Following a series of reorganizations, the PVO-Strany is now organized into a number of Air Defense Regions, capable of independent operation if necessary, but normally subject to control from PVO headquarters in Moscow. The hub of the system is the Moscow Air Defense Region, composed of an inner sector and an outer zone which in turn is divided into sectors. Each sector is believed to have its own filter and control center, and to be capable of directing defense operations in its zone of responsibility. Ringing this hub are several other Air

Defense Regions: Volgda, Leningrad, Riga, Kaunas, Kiev, Kharkov, Ural-Sverdlovsk, and probably Odessa and Tiflis. Each region reports to central headquarters but controls its own operations through control centers at lower levels. Lateral communications at all levels tie these regions and their sectors together, insuring flexible control. Also reporting to PVO headquarters, and linked to the above regions by lateral communications, is the Baku Air Defense Region. Outside the European complex is the air defense organization of the Far East, which is operationally autonomous and apparently subject only to policy directives from Moscow.

37. The Early Warning System. The approaches to the most important areas of the USSR are believed to be well-covered by an early warning system which includes extensive radar, visual, and sonic detection networks, linked by radio and landline communications net.[13/] Over the past several years there has been a substantial increase in the Soviet early warning system. What the USSR lacks in quality of long range radar performance it has sought to compensate for by the quantity of radars deployed in depth. The density of deployment and the well-integrated organization within the Soviet early warning system largely compensates

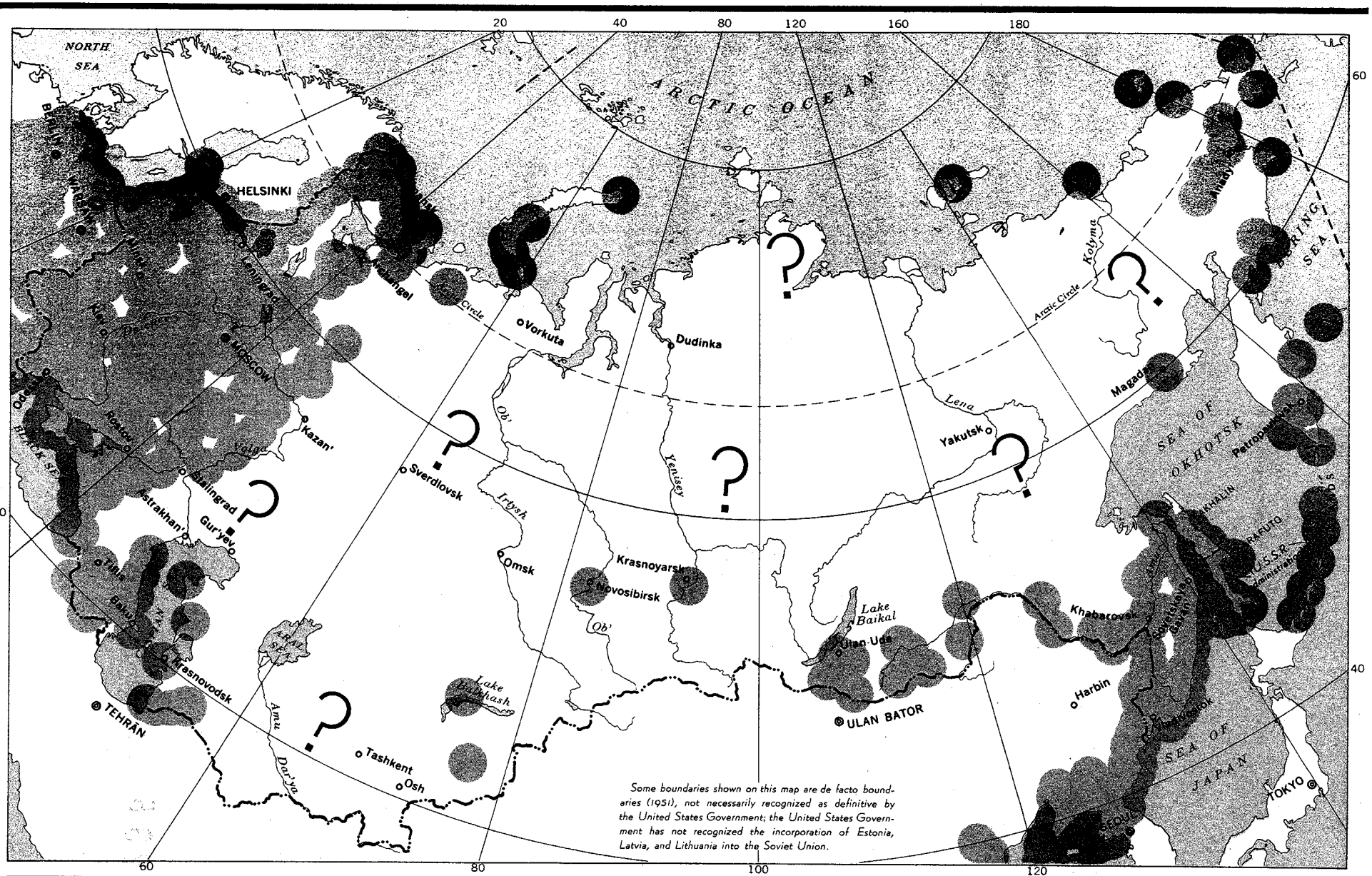
13/ See DI/USAF footnote to para. 3a.

for the technical deficiencies (by US standards) of the radars used (see map on next page).

38. The early warning and communications components of the Soviet air defense system are engaged in continuous training programs and we believe that they are in a high state of readiness in most important areas. Moreover, the USSR is already starting to employ much improved radar equipment.

39. Interceptor Forces. We believe that the effectiveness of Soviet fighter and interceptor forces is steadily increasing under the impetus of extensive re-equipment and training programs. The interceptors available for Soviet air defense include both those assigned to the PVO-Strany itself and those assigned to the tactical air forces, the Soviet Navy, and the Satellite and Chinese Communist air forces. As of 1 October 1952, the total T/O and E strength of forces potentially available for air defense of the USSR are estimated at about 12,850 aircraft, of which roughly 8,400 are jets. Some 2,800 of these interceptors (2,300 of them jets) are organized into Fighter Aviation of Air Defense (IA PVO) Air Armies, which are assigned to key areas, at present believed to be Moscow, Leningrad, Kharkov, Baku and possibly Chita. Although the scanty intelligence previously available appeared to indicate a relatively low state of training for Soviet interceptor forces, recent intelligence indicates considerable improvement in this respect.

TOP SECRET



Some boundaries shown on this map are de facto boundaries (1951), not necessarily recognized as definitive by the United States Government; the United States Government has not recognized the incorporation of Estonia, Latvia, and Lithuania into the Soviet Union.

UNION OF SOVIET SOCIALIST REPUBLICS

EARLY WARNING RADAR COVERAGE

1st QUARTER, 1952

Notes:

1. 150 mile diameter coverage assumes approximately a 75 mile radar range per station.
2. Indicated gaps are probably due to lack of intelligence, rather than lack of radar coverage.
3. On pheripheral areas, more than one source confirms most locations.

Scale 1:36,700,000

0 250 500 1000 1500 2000

Statute Miles

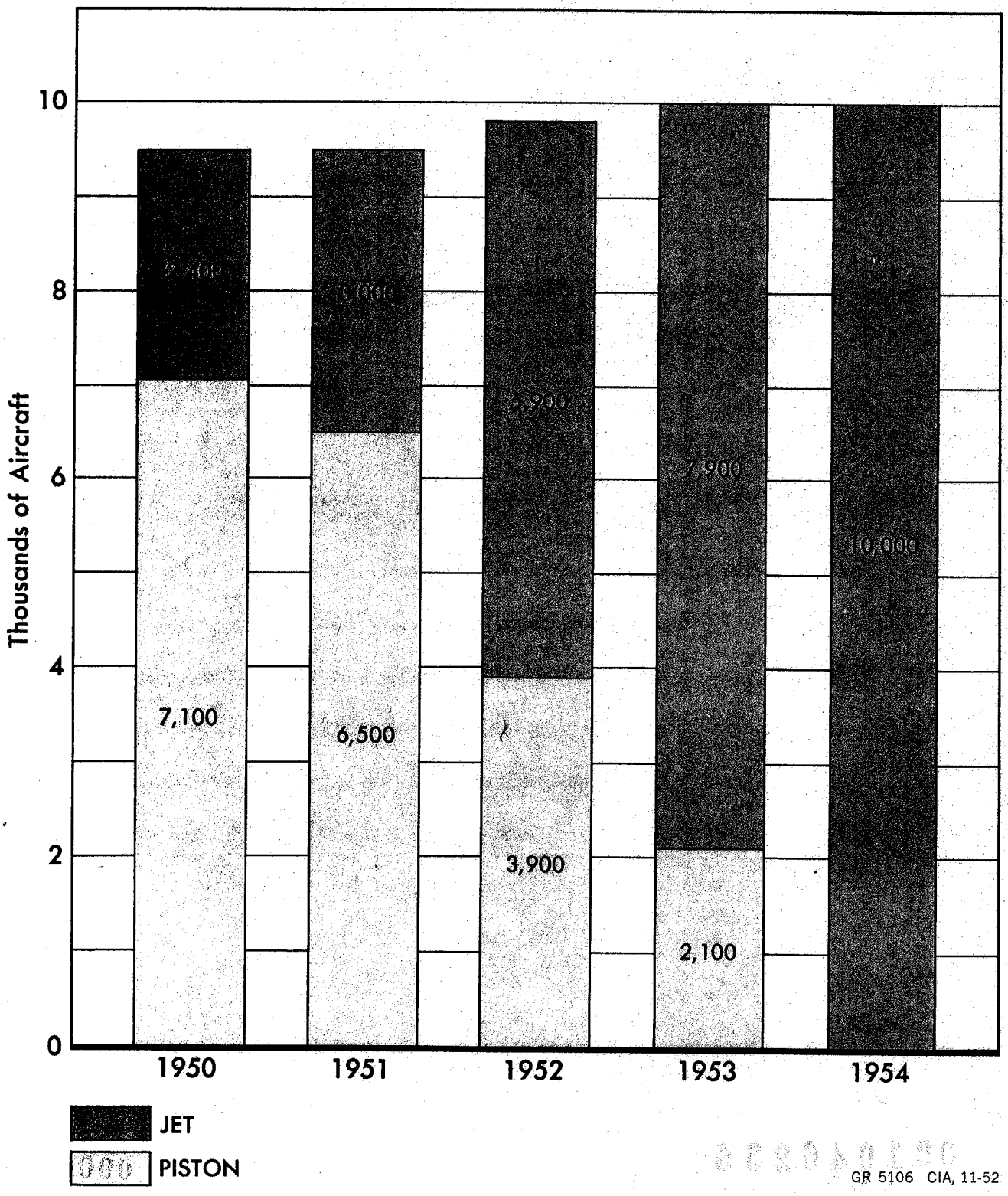
0 250 500 1000 1500 2000

40. Although the Soviet fighter interceptor forces as a whole probably will not increase substantially in size through 1954, we estimate that Soviet interception capabilities will considerably increase during this period by the conversion of all fighter and interceptor units to jet aircraft, the probable introduction of improved interceptors, improved GCI and AI equipment, and the continuation of present training programs. We estimate that by mid-1954 the IA PVO will consist of approximately 2,800-3,000 jet interceptors in operational units. The fighter units of Tactical Air Armies and Naval Aviation will also have been entirely jet-equipped, and we estimate that the Soviet air forces will have a total of some 10,000 jet fighters (including all-weather interceptors) in operational units in 1954.

41. Night and All-Weather Interceptor Forces. There is good evidence that the USSR is employing jet aircraft in a night intercept role. Such aircraft, even if not equipped with AI equipment, would still have certain night interception capabilities, depending upon the degree of visibility. The use of AI equipment would markedly improve Soviet capabilities in this field.

42. A serious deficiency in the present Soviet Air defense system appears to exist in its limited interception capabilities under conditions of poor visibility. Despite the lack of direct

ESTIMATED SOVIET AIR ORDER OF BATTLE
CONVERSION TO JET FIGHTERS



GR 5106 CIA, 11-52

evidence, we estimate that the USSR may now have small numbers of all-weather aircraft with some form of AI equipment in operational units around a few key Soviet areas.[14/] We estimate that by mid-1953 the USSR probably will have limited quantities of some type of true all-weather interceptor in operational units. By mid-1954 we estimate that Soviet fighter strength probably will include a few hundred such interceptors, the majority of which would be in the PVO forces.

43. Even when the USSR does obtain operational quantities of suitable all-weather interceptors, it will still have to overcome numerous difficulties before it can develop effective all-weather interception capabilities. If US experience is any guide, the maintenance of complicated AI equipment will in itself present serious problems. Moreover, extensive training programs and experience in all weather interception techniques will be required before any new all-weather equipment can be effectively used. However, present Soviet training programs stress GCI exercises and controlled cloud and night flying, not only for IA PVO interceptor regiments but for tactical and naval fighter units as well. The increasing availability of modern GCI radars should also enhance Soviet all-weather interception capabilities. We conclude that by mid-1954 Soviet all-weather interception capabilities will have increased considerably, owing to improved

14/ See DI/USAF footnote to paras. 3c., 18 and 19.

equipment and extensive training programs, but that various deficiencies will still exist.

44. Antiaircraft Artillery (AAA). The Soviet armed forces contain large numbers of AAA units, including both strategic AAA units assigned to the PVO and the extensive tactical AA artillery of the field forces and navy, which would be available in many cases for defense against strategic air attack. The USSR has available an estimated 29,000 37 mm. guns and at least 18,000 85mm. guns. These guns and ancillary equipment are being issued to the Satellite forces in increasing numbers and are gradually being replaced with newer weapons.

45. The USSR is engaged in a program to strengthen its AAA defenses and a marked increase in Soviet AAA capabilities has become apparent over the past year, owing largely to the introduction of improved heavy AA guns (estimated at 100 mm.), and new fire control equipment around key areas. Units employing unguided AA rockets or guided missiles may also be available, although we have no evidence to this effect. In addition the new medium AA gun (estimated at 57 mm.) is apparently now being issued to Soviet troops. Continued increases in AA strength and effectiveness are probable through 1954, as increased quantities of new weapons and fire control equipment become available.

46. Soviet Naval Air Defense Forces. The air defense forces of the Soviet Navy, which have primary responsibility for shore-based defense against air attack on most coastal areas, also contribute to Soviet air defense capabilities. The Navy has its own early warning radar and observer network, which is tied into the over-all air defense system and extends its coverage. The interception capabilities of the naval fighter forces (estimated T/O and E strength 1,850 aircraft, including 1,100 jets) are increasing with the conversion to jet fighters. Soviet coastal antiaircraft installations can provide surface fire in defense of targets lying in or adjacent to coastal areas, and could be assisted by Soviet naval vessels. There will probably be a steady increase in naval air defense strength through 1954.

47. Satellite and Chinese Communist Forces. The early warning nets of the European Satellites in the West and Communist China and North Korea in the East are linked with the Soviet systems and extend its coverage. Their interceptor and antiaircraft forces, which are gradually being re-equipped by the USSR, are an additional asset, despite their limited capabilities.

48. Over-all Combat Readiness. The Soviet air defenses are steadily improving as a result of continuous training programs and the introduction of new equipment. We believe that, in general, they are in an advanced state of readiness, except

for the following serious deficiencies: the lack of sufficient quantities of modern equipment to provide effective defenses for all important areas, limited interception capabilities under conditions of poor visibility, and the vulnerability of present Soviet radio communications. In addition we believe that the Soviet air defense system, or any of its components, is subject to saturation by sufficiently large scale air attacks.[15] However, these deficiencies are apparently being gradually overcome as new equipment, much of it probably already in production, is brought into widespread use and as present training programs reach fruition. Continued air defense drills and exercises, which are indicated as part of the over-all training program, should markedly improve the operational efficiency of the air defense system. Consequently we believe that Soviet air defense capabilities will improve substantially by 1954.

SOVIET ECONOMIC CAPABILITIES FOR AIR DEFENSE PRODUCTION[16]

49. Provided that the air defense program continues to be given sufficiently high priority within over-all Soviet economic plans, there appear to be no insoluble economic problems which

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15/ The DI/USAF believes that the serious deficiencies listed are of a nature and magnitude to prevent an estimate that the air defenses are in an "advanced state of readiness."

16/ See appendix C for additional details.

would prevent the continued improvement of the Soviet air defense system. However, we are unable to estimate the extent to which other competing economic and military demands would exert a limiting influence on any increase in the production of air defense material. Moreover, the USSR almost certainly faces numerous developmental and production problems in providing sufficient quantities of all types of air defense material.

50. The chief present weakness is believed to be in the electronics field. Nevertheless, despite the limited size of the present Soviet Bloc electronics industry, we believe that it is currently capable of supporting the extension, modernization, and maintenance of an early warning system, as well as microwave fire control and airborne equipment, for important strategic areas in the USSR. A plant expansion program is continuing, and no serious limitations in the availability of manpower and basic plant machinery are foreseen. The Soviet Bloc is at present partly dependent on Western sources for specialized production materials, but this dependence will probably decrease through 1954.

51. Extensive Soviet capabilities for the production of fighter aircraft are indicated by the estimated 1952 production of 5,000 jets, believed to be MIG-15's or variants thereof. The present Soviet airframe industry has the plant capacity, utilis-

ing present models, to produce an estimated 20,000 fighter aircraft annually, although it would require two years to achieve this rate. Such a production rate would require increased engine plant capacity, but there is some evidence that an expansion is underway. Basic raw materials required for airframes and engines are believed to be in adequate supply. The use of certain potentially scarce materials might be minimized by modifications in design.

52. The estimated rate of current production of AA guns of all types is from 2,500 to 4,000 annually, while plant capacity is estimated at 6,000 to 8,000 guns per year. The USSR appears to have adequate raw materials and plant capacity for the production of ammunition. There is evidence of substantial rocket production some of which may be AA types.

53. Soviet technological capabilities are considered to be adequate for support of air defense development and production programs, provided that these programs continue to be given a sufficiently high priority. We believe that the USSR faces no major handicaps in the shortage of technological skills needed to support a limited number of high priority programs, although technical personnel will continue to be at a premium.

APPENDIX A TO SIE-5

SOVIET AIR DEFENSE WEAPONS AND EQUIPMENT

1. Early Warning. The USSR has been placing chief dependence for its early warning radar on three types of equipment operating in the 70 mc. region, the RUS-2 (Redut), the P.2.M. (Pegmatit) and a set known as DUMBO. The greatest advantage of these sets is their simplicity. There is also in the early warning net a group of radars reported to be operating at frequencies in the 10 cm. band and thought to be similar to the American SCR-682. [redacted] [redacted] revealed the active use of American, British, German, and Japanese wartime radars or Soviet versions thereof in the early warning system of the Soviet bloc. This radar service may be augmented by such passive detection devices as radar receivers.

2. We estimate that the existing large numbers of lower frequency equipment will be retained as the principal early warning radar although as time elapses more sets providing greater range and accuracy will probably be added. There is reliable evidence that the USSR is already employing some new and improved radar sets similar to the US AN/CPS-6 (see para. 9).

Although this radar is primarily used for ground control intercept purposes, it is also usable for early warning. Even if this equipment does not perform as well as the AN/CPS-6, we believe that the Soviets have produced a radar which, if properly employed, is capable of much more effective long range search than was possible with previously known equipment. Moreover, in the early warning net in the European area radars have been identified with characteristics similar to the US TPS-3 radar, which have been tentatively identified as PRS-3.

3. Communications Nets. The Soviet ground-to-ground air defense communications system consists of both point-to-point radio circuits and land lines. On the basis of information available, it is known that special radio networks exist for this function utilizing frequencies between two and eight megacycles. Since there has been no opportunity to observe these networks under heavy raid conditions, no accurate estimate can be made of their capability for handling a large volume of traffic. In most cases observed the Soviet HF nets have tended to slow down and become less efficient when handling in excess of five raids, although we are unable to state whether or not this deficiency

rests in the communications net itself. However, the continuous training program will enhance the effectiveness of this system, provided sufficient circuits exist.

4. However, a serious deficiency of this system is that point-to-point radio circuits on frequencies below 30 mc. are vulnerable to long range jamming and are susceptible to unintentional disruption from man-made noise (electrical machinery, automotive ignition, etc.) as well as atmospheric noise and signal fading. Positive intelligence on the extent to which land lines back up radio circuits is lacking, but Soviet experience with the use of such frequencies, their known jamming proficiency, and their knowledge of Allied electronic countermeasures potential make it reasonable to assume that dependence on radio is being at least partially overcome by increased use of land lines. Moreover, the USSR is procuring from the Soviet Zone of Germany at least 750 sets of communications equipment operating at about 1200-1600 mc. in the UHF (300-3000 mc.) band and may intend to incorporate equipment of this type in its air defense networks. This would greatly reduce the vulnerability of such circuits to unintentional and deliberate interference as well as to intercept.

5. For ground-to-air communications the USSR has been depending upon equipment operating in the VF and HF portions of the radio spectrum. GCI operations depend upon ground-to-air communications which are the only known means a ground controller has for passing target information to his interceptors. The two basic types of MF and HF equipment used in Soviet aircraft are the RSI-6 series (3.5-5.0 mc.) normally carried in fighters and the RSB-BIS series (2.5-12 mc.) in bomber aircraft. The RSB-BIS ground equipment is frequently mounted in vehicles used as mobile communication stations by both the Soviet Air Force and Army. The ground equipment used by the Soviet Air Force is basically the same as that used in World War II and consists of the 11AK transmitter (2.5-7.5 mc.), the RAF transmitter (2.5-12.0mc.), and the type "US" receiver (175 kc-12 mc.). Radio communications equipment recently captured in Korea indicates a constant improvement in manufacturing techniques and component design. The latest models of this equipment are excellent.

6. However, these VF and HF ground-to-air circuits are susceptible to noise interference and jamming as are the point-to-point ground networks. In addition, aircraft receivers operating in these frequencies are subject to natural inter-

ference in the form of precipitation static. Furthermore, the lack of pre-tuned multi-channel transmitter in Soviet interceptors would create a difficult problem in the passing of control of interceptor aircraft from one station to another under jamming conditions. Therefore, the Soviet VHF and HF ground-to-air system is extremely vulnerable to a well-planned electronic attack which could completely disrupt any coordinated GCI operation.

7. A solution to this grave deficiency lies in the utilization of very high (VHF) or ultra high (UHF) frequency equipment. Until recently when VHF signals in ground-to-air communications were intercepted, the USSR was not known to have any alternate communications systems that could be utilized under all-weather conditions in the event of disruption of their VHF and HF ground-to-air circuits. However, the USSR is capable of developing and producing VHF or UHF equipment, and recent communications intercepts confirm the use of VHF equipment by transports, reconnaissance aircraft, and jet bombers. VHF equipment has also been identified in fighter aircraft in Korea.

8. GCI Radar. Soviet ground-control-interception (GCI) activity is indicated by

interceptions of Western aircraft. In the past the USSR has apparently placed most dependence upon the RUS 2 and the DUMBO radars, which we do not consider sufficiently accurate for GCI use because of their limited discrimination in range, height, and bearing. The 150 mc. radars may have served GCI functions in the Far East and 200 mc. radars similar to the US SCR 527/627 are in current GCI use in Europe. ECM data indicates that radars in the 2700-3000 megacycle range may also serve this function.

9. However, we now have conclusive evidence that radars of greater accuracy have appeared. Recent reports and photographs of new radars in several areas show equipment similar in appearance [redacted] to the US AN/CPS-6 radars in current operational use by the USAF Air Defense Command. If these radars have performance characteristics similar to the AN/CPS-6, they will provide the Soviets with a good GCI radar and should be capable of detecting bombers at a maximum reliable range of 130-170 nautical miles. They also should provide reliable coverage for interceptor control, without transponder beacons, to a maximum range of 65 nautical miles and an altitude coverage up to 40-42,000 feet. The use of transponder beacons in Soviet intereeptor

would increase range and altitude coverage for controlled interception.

10. Radio Navigation Facilities. The USSR places major reliance for aircraft navigation on radio direction finding. This equipment, in conjunction with ground radar, appears sufficiently accurate and reliable for air defense purposes. Ground direction finders installed in integrated chains are the primary aid to aircraft navigation. The PKV-45, a transportable set in the 1.5-16.8 mc. range, although simple in design, is equal or superior in performance to the US equipment of similar type.

11. The RPK-10 direction finder appears to be the principal airborne navigation set. It operates in the 270 kc.-740-kc. range, uses a fixed recessed iron core loop to eliminate drag, and is suitable for homing. Up-to-date samples obtained in Korea indicated that this equipment, currently manufactured, is excellent. An improved automatic direction finder (ARK-5) similar to the US AN/ARN-7 has been identified from a Soviet manual. By 1954 the USSR could have available substantial quantities of automatic radio compass equipment.

12. Low frequency beacons, both fixed and transportable, with rotatable beam patterns have been reported in use. These supplement standard broadcast stations, many of which are keyed periodically with a standard morse call sign to facilitate their use as beacons. The USSR has an operational radio altimeter (RV-2) which operates in 450-500 mc. range and is similar to the US AN/APN-1 altimeter. By 1954 this altimeter should be improved.

13. For blind approach and landing, the only known aids used by the Soviets other than ground direction finders are German Lorenz or British SBA (Standard Beam approach) systems of non-radar character (ILS-type). These consist of a localizer transmitter with horizontal sector identification in the form of dots and dashes. Distance from touchdown is established by two marker beacons and height information is obtained by use of an altimeter. Although there have been no indications that the Soviets are interested in radar blind landing systems similar to the US GCA system, they have the capability of developing such systems. We estimate that by 1954 the USSR probably will have substantial quantities of some type of blind landing system in operation.

14. Reports confirm that the USSR is experimentally operating a hyperbolic navigational system employing pulse transmit time techniques. This equipment will probably operate similarly to the US Loran or the British Gee system and will provide both long and short range navigational aid. Such a system should be in operation by 1954 and would improve Soviet navigation capabilities.

15. Interceptor Aircraft. Since World War II, the USSR has placed great emphasis on fighter aircraft in view of the necessity of providing adequate defenses against atomic attack on the USSR. At the present time the swept wing MIG-15 is the principal jet interceptor available for air defense. It compares favorably with the US F-86-E, both performance-wise and with respect to armament. The MIG-15 is capable of 580 knots at sea level and 525 knots at 40,000 feet, can climb to 40,000 feet in 6.1 minutes, has an estimated combat ceiling of 50,500 feet and a combat radius of 315 nautical miles. In accordance with the Soviet policy of installing relatively heavy armament in this type aircraft, the standard MIG-15 armament includes one 37 mm. and two 23 mm. cannon. The gun sight is believed to be similar to the US K-14, a later World War II type. The MIG-15's record

in combat against other fighters indicates that it may not possess fire control equipment on a par with its Western counterparts. However, it has exhibited pronounced effectiveness against the bomber types it has encountered, e.g. the B-29.

16. We estimate that by 1954 the USSR could increase the performance of its new interceptors by the use of after-burners and rocket boost. If the USSR is concentrating on such developments, the maximum performance characteristics which it could achieve by 1954 would be on the order of 650 knots at sea level and 800 knots at 30,000 feet for short periods, with climb to 40,000 feet in five minutes, a combat ceiling of above 60,000 feet, and a combat radius of 200 nautical miles. However, it is more likely that the maximum performance characteristics would be on the order of 610 knots at sea level and 560 knots at 30,000 feet, with climb to 40,000 feet in five minutes, a combat ceiling of 54,000 feet, and a combat radius of 350 miles. Armament for such aircraft would probably consist of 23 mm. or 37 mm. cannon in the nose, with ammunition for about six seconds of fire. On the other hand, unguided air-to-air rockets might be used. It is estimated that such a rocket would have an all-burnt velocity of about 2,000 feet per second and high explosive

warhead weighing 1.4 lbs. The fire control would probably consist of a gyro computing range-only radar sighting system. Radar and gyro information would probably be fed into an electro-mechanical computer.

17. The USSR now has 82 and 132 mm. RS series general-purpose aircraft rockets, with powder train time fuses, for use against air as well as ground targets, the type of head being dependent on the target. However, they were not designed for air-to-air use and cannot compete with current gun armament. The USSR has shown interest in the German air-to-air R-4M rocket, which had an operational range of 1,000 yards.

18. The German aircraft design group working under Soviet direction at Podberes'ye is known to have been working on a supersonic rocket-powered interceptor, and we estimate that a prototype probably will be test flown during 1953. It is expected that Soviet designs will be along the lines of the DFS-346 delta wing series, and the prototype is reportedly a delta wing type designed to attain a speed of Mach 1.5.

19. AI Equipment. See paragraph 18 of DISCUSSION.

20. Night Interceptors and All-Weather Interceptors. There is good evidence that the USSR is employing jet aircraft in a

night intercept role. Moreover, although we have no evidence as to the appearance of all-weather jet interceptors in operational units of the Soviet Air Force, the USSR has displayed several jet interceptor types which appear to be either designed for or adaptable to an all-weather role. Types 18 and 19, which were first exhibited at the 1949 Aviation Day Show and subsequently at the Tushino Air Show in 1951, had bulbous protrusions in the nose directly over the jet intake. The most logical explanation of these extensions is that they were built to house some form of AI equipment.

21. We believe that as an interim measure the USSR may be pursuing two possible alternatives: (1) employment of an interceptor such as the MIG-15 (the Type 19 may be an adaptation of the MIG-15) which has been modified to include AI equipment; (2) employment of a multiplace jet aircraft, such as the IL-28 or Type 35 light bombers or the Type 8 twin-jet straight-wing interceptor, to carry AI equipment and an operator in addition to the pilot. There is no affirmative evidence of production of the Type 19 or a similar interceptor, but such production is a possibility. On one occasion the USSR has employed an airborne radar in an unidentified, probably multi-engined aircraft that gave evidence of having the capability to search for,

track, maintain contact with and intercept a target aircraft. The IL-28, Type 35, and Type 8 could house World War II or smaller AI equipment, though the performance capabilities of the IL-28 and the Type 35 are such that they would not be effective against jet bombers. The Type 8 has probably been employed in Korea, but there is no indication that this has been in an all-weather role.

22. It is also within Soviet capabilities to develop a true all-weather jet interceptor, and we believe that the USSR will decide to concentrate on production of this rather than an interim type. It is conceivable that the USSR might employ a version of the twin jet, swept wing Type-17, which is capable of carrying both a pilot and radar operator, for this type of mission. The Type-17 was flown in the Tushino Air Show in July 1949, and appears to be the best Soviet design now known.

23. Antiaircraft Artillery. Soviet light antiaircraft guns were in general ballistically comparable in performance to those of other major powers by the end of World War II. By that time, the 37 mm. M-1939 was standard. It has since appeared in the Satellite armies. This gun resembles in design the well-known 40 mm. Bofors gun. Pieces which have been

captured in Korea are aimed by direct laying with a course and speed sight. A self-propelled version mounted on the chassis of the obsolete T-70 light tank is known as the SU-37. Ammunition and on-carriage sights have probably been improved since 1945.

24. By the end of World War II, the Soviet medium AA gun was the 85 mm. M-1939 with ballistic characteristics comparable to those of the 88 mm. Flak gun with which Germany entered the war. It is mounted on an efficient light-weight four-wheel carriage similar to the familiar Bofors design. The wheels are raised from the ground when the weapon is emplaced, but remain on the carriage during firing. Since the gun is hand-loaded, it has a relatively slow rate of fire. Although an improved M-1944 version was developed, as far as is known the M-1939 remained the standard medium AA gun until fairly recently. The M-1944 model has an improved tube assembly and recoil mechanism and an increased muzzle velocity. It is believed to use the same carriage as the M-1939.

25. [redacted] indicates that plant 106 at KHABAROVSK, and possibly others have recently begun manufacture of a new gun, reportedly of 57 mm. caliber and almost certainly designed for AA use. 57 mm. is the most probable

caliber, since it is one already standard in the Soviet weapons system. In addition, there are collateral reports of Soviet AAA units being equipped with a new 57 mm. AA gun. The appearance of an AA gun of approximately this caliber, to supplant or supplement the Soviet 37 mm. gun M-1939 as a weapon for countering low level air attacks, has been anticipated for some time. High priority emphasis on the manufacturing schedule of the new weapon is apparent. It is believed that such a gun would have a high rate of fire (130-150 rounds per minute), high traverse and elevation rates, a high muzzle velocity, possibly augmented by "muzzle-squeeze" and an effective ceiling of 15,000-18,000 feet. The gun may have liquid cooling to permit sustained high rates of fire. Employment of such a gun by the Soviets would greatly increase their capabilities for defense against air attacks in the low and medium altitude zones. No intelligence concerning other weapons or gun programs in this category are known. In the period under consideration it is estimated that emphasis will be placed on improvements of the 57 mm. gun and related equipment.

26. The U SR has also developed what is probably a new heavy AA gun which was reported in increasing numbers in 1951. Photographs of these guns emplaced in Moscow suggest German

design influence, indicating contributions by German specialists in the USSR. The gun probably incorporates automatic fuse-setting and loading and possibly utilizes remote-control laying. It is equipped with a mobile carriage. Scaled measurements from photographs give the gun an estimated caliber of 100 mm. and other reports, notably FW sources, tend to confirm the caliber estimate. We believe that this gun can provide continuously pointed fire to 35,000 feet and barrage fire to 40,000 feet, with a rate of fire of 25 rounds per minute. This estimate is in part supported [redacted] that AA service practice has been conducted in the USSR against targets towed at approximately 34,000 feet. The slant range for this practice would approximate the performance estimated above for a 100 mm. gun. This training requires a gun and fire control with performance superior to the 85 mm. M-1944 and the PUAZO-3 director. Photographs show a radar similar to the SCR-584 radar employed for fire control (see paragraph 31). However, we believe that this gun will not be capable of a high percentage of kills at these altitudes, even if controlled by the most modern fire control equipment. The USSR has undoubtedly standardized this new equipment and is systematically installing it in AA units in strategic areas, replacing the 85 mm. guns. The new gun is possibly also being furnished for fixed shipboard installation.

27. Unconfirmed reports of a 120 mm. gun have been received from a fairly reliable source, and such a gun of 120 or 122 mm. may have been developed. It could be expected to have an appreciably higher effective ceiling than the 100 mm. gun.

28. Naval Guns. Soviet naval dual-purpose antiaircraft guns are of modern design and manufacture and closely parallel Western European World War II equipment, except for rate of fire. As installed in current fleet units, these guns are not as numerous or as well located for sector defense as in comparable US or British units. However, modern Soviet fleet units are estimated to be capable of moderately effective antiaircraft fire against heavy planes and less effective fire against single engine, high speed aircraft.

29. Latest Soviet destroyers of the modified "O" class mount four 122 mm. dual-purpose guns, arranged in two twin mounts, one forward and one aft. The performance of this gun is unknown, but it may have characteristics similar to either the British 4.5 inch dual-purpose or the US 5 inch/38 caliber. Since this gun was first mentioned in 1946, it may be a postwar development. Other antiaircraft guns mounted on this type ship include 37 mm. and estimated 55 mm. guns. The 37 mm. gun is

believed to be of World War II vintage and common to many Soviet naval vessels. While the 55 mm. may be a separate postwar development, having been noted initially in 1947, it is probably a naval version of the reported new 57 mm. gun. This gun is well suited for use on shipboard, and [redacted] a new 57 mm. gun is being shipped from Krasnoyarsk to installations of the Ministry of Shipbuilding for probable installation on destroyers and possibly cruisers. The new 100 mm. gun has not as yet been identified on naval vessels; however, it must be anticipated as naval dual-purpose armament on ships and in coastal defenses.

30. Fire Control Radar. The USSR was provided with over 500 US, British, and Canadian radars under lend-lease during World War II; these have found widespread use in Soviet and Satellite countries. A large number of searchlight-control radars of British design were also supplied during the war, and similar sets have been observed fitted to Soviet naval vessels.

31. Intelligence indicates that the SCR-584 gun-laying radars furnished the Soviet Union under lend-lease are being augmented by a version of Soviet manufacture which is now

appearing in service, particularly around Moscow. This radar will provide excellent initial data at maximum ranges for a 100 mm. gun. Although the SCR-584 was developed during World War II, it is still employed as the mainstay of modern anti-aircraft fire control by Western nations. Soviet use of the SCR-584 as a basis for development appears to have been logical and time-saving. It operates in the 10 cm. band and provides automatic tracking of the target and automatic data transmission to the director. The total number of these radars reliably reported in the Moscow urban area exceeds the number of sets given the USSR under lend-lease more than 7 years ago, while normal attrition would have probably precluded complete serviceability of this number. Therefore, the USSR must be granted the capability to manufacture the SCR-584 type in quantity within the period through mid-1954. There is also an unconfirmed report of radar fire control for the reported 57 mm. gun. The Soviet tube industry is known to be in quantity production of magnetrons, klystrons, and detectors of the types required for fire control radar.

32. Radar controlled searchlights for illumination of attacking aircraft are being used by the Communists to aid night interceptor aircraft in Korea.

33. A new radar has appeared under radomes on the new Soviet cruisers. Although it is believed to be primarily for surface fire control, possible use for antiaircraft fire control cannot be discounted. There has been one report of the development of a shipboard version of the SCR-584 radar.

34. Directors. The only known Soviet fire control director in general use is the mechanical type designated the PUAZO-3. Radar data can be introduced into the PUAZO 3, although there is no direct evidence that the necessary accessories have been provided. However, the lend-lease SCR-584 radar was designed to work with electronic directors M-9 and M-10, and the USSR received many of these directors over seven years ago. Although there is no evidence to confirm or deny that the Soviets are using electronic directors with their fire control radar, the USSR has full knowledge of both analog and digital computers for general mathematical use and is capable of reproducing the electronic directors. It is likely that the USSR is providing an improved director concurrently with the new AA guns and fire control radar. On the other hand, the USSR may consider an improved mechanical director adequate for its purposes. The Kommandogerat 36 and 40 were captured from the Germans, and the latest German director, Kommandogerat 40F, about to go into production, was also available to the USSR.

35. The USSR also has the potential to duplicate the Naval War 56 GFS and has had access to German gyro developments (for level and cross level stabilization) superior to current US operational equipment. The USSR is capable of equipping fleet units with fire control systems equal to currently operational US systems by 1954.

36. Ground-to-Air Rockets.[1] The USSR employed unguided rockets as antiaircraft weapons during World War II when 45 mm. and 82 mm. rockets were used against low-level air attack from launchers having four and 48 rocket capacities. These rockets had a maximum ceiling of approximately 10,000 feet and were employed normally in a barrage type defense. No fire control system other than a ring sight was used.

37. Of the German developments in the AA field in which the USSR has shown an interest, the unguided rocket TAIFUN is one of the few which may have been further developed by the USSR.[2] Little positive intelligence

1/ Air-to-air rockets are discussed in paragraphs 16 and 17.

2/ German versions of this rocket included a liquid fueled and a solid fueled model, each of which had been flight tested before the end of hostilities. Two launchers were proposed by the Germans, one a 30 track launcher and the other a 60 track launcher, each being mounted on the 88 mm. Flak 36 gun carriage. Fire control for the missile was to be the standard German director FG-36 or FG-40 equipped with modified ballistic cams.

[redacted] of possible AA rocket manufacture is available. German technicians associated with TAIFUN were removed to the U.S. where an investigative program was undertaken. It is known that the Russians had access to the German developments and expressed considerable interest in their potential, but we have no clear indications as to whether or how far the Soviets have developed this rocket. We estimate that the Soviets could have reproduced German rockets designed to possess characteristics of supersonic speed, small dispersion, and an operational ceiling of 45,000 to 50,000 feet, and that the Soviets may have progressed beyond that point either on the basis of German developments or on the basis of purely Soviet developments deemed to be better. Fuel for these rockets would not be a limiting factor in their production or use.

38. AA Fuses. Pyrotechnic and mechanical time fuses are known to be in use by the Soviets. Electrical time fuses, a wartime German development, are known to have been exploited by the Soviets and manufactured in experimental lots during 1946-51. Such fuses were considered by the Germans to be cheaper and better than mechanical time fuses for AA use. We believe that the Soviets are capable of having these fuses in quantity for AA use at the

present time; however, we have no intelligence that they are in quantity production.

39. There is no evidence that the USSR did any work on proximity fuses before the defeat of Germany. However, Soviet interest in captured German experimental fuses is apparent in the fact that German scientists and technicians familar with problems peculiar to proximity fuses were taken to the USSR. Moreover, the Czechs were working on such a fuse for both AA and air-dropped projectiles in 1949. The detailed knowledge of US World War II proximity fuses which has become available to the USSR would further aid in any development of this device. There is evidence that the USSR is miniaturizing various components, such as resistors and capacitors, of the general type necessary in the design and manufacture of proximity fuses. Although the USSR has the capability to do so, there is no evidence of the development of sub-miniature vacuum tubes sufficiently sturdy to withstand the initial shock of firing. It is possible that the USSR has continued development of an electrostatic proximity fuse following the German wartime development.

40. Ammunition. Little information is available regarding Soviet developments in antiaircraft artillery ammunition. Known Soviet ammunition is of conventional high explosive, armor

piercing, and fragmentation types. Reports of shell burst observations from Korea indicate the possible development of incendiary-filled ammunition. The USSR has the capability to develop and produce hypervelocity projectiles in continuation of German World War II developments.

41. Surface-Launched AA Guided Missiles. Examination of available intelligence indicates that the overall Soviet guided missile program is based on German World War II developments. In view of the lack of current intelligence on surface-to-air missiles, estimates are based on assumed maximum exploitation of the German designs and lend-lease electronic equipment, and a continued Soviet development program. Aside from scattered reports of one or several of the German surface-to-air type guided missiles being observed, the best indications of the Soviet program are: (a) test of fuels which might be applied to these types; (b) indications of recent developments in control equipment at Leningrad by a German group working on surface-to-air types; (c) high priority exploitation of guidance systems for this type in the Soviet Zone of Germany shortly after World War II; (d) the reported building of 110 airborne radio control systems for test of WASSERFALL and SCHMETTERLING in 1948-1949; (e) a [redacted] statement that RHEINTOCHTER was tested in 1947; and (f) the existence of a WASSERFALL road convoy consisting of 11 trailer units reported to contain test equipment

apparently for pre-flight testing and training of personnel; (g) an SCR-584 radar reliably reported inside a guided missile plant in the suburbs of Moscow; and (h) a report of semi-active homing equipment development in the USSR.

42. The USSR has the capability to produce optical guidance and control systems for subsonic and supersonic missiles comparable to German 1945 types. It is unlikely, however, that this guidance system would be adopted. Soviet production of a version of the SCR-584 automatic tracking fire control radar gives them one which the US and UK have found particularly suited for guided missile development work. Modification of this radar, which is within Soviet capabilities, might make it suitable for test range tracking and even for operational guidance. As an indication of performance a modified SCR-584 is capable of tracking a medium bomber type aircraft up to approximately 100,000 yards. The use of a missile-borne beacon to permit tracking of a missile to 100,000 yards is also within Soviet capabilities. The USSR also has the capability to provide and will probably employ command guidance in the mid-course phase of missile flight. Some missile command receivers of the Strassburg type have been procured from the Soviet Zone of Germany. In addition, the USSR is capable of developing terminal guidance equipment and is probably doing so. In the light of estimated Soviet capabilities in the field of infrared and radar technology, the USSR could now have in progress

infrared and radar terminal guidance programs, although there is no intelligence to confirm such a development.

43. See paragraph 28 of DISCUSSION.

44. Air-to-Air Guided Missiles. See paragraph 29 of DISCUSSION.

45. Searchlights and Balloons. Soviet searchlights are considered good by US standards. They vary in diameter from 40 cm. to 300 cm. The 150 cm., patterned after the US Sperry 60 inch light, is predominantly an AA searchlight. Radar control is utilized for rapid centering on the target. The Soviet Army used barrage balloons with capacities of 10,360 and 11,826 cu. ft. during World War II. The ceiling of these balloons is between 10,000 to 13,000 feet respectively and when used in tandem, approximately 18,000 feet.

46. Countermeasures. See paragraphs 30-33 of DISCUSSION.

APPENDIX B TO SIE-5

ORGANIZATION, STRENGTH AND COMBAT READINESS OF THE SOVIET AIR DEFENSES

ORGANIZATION OF THE SOVIET AIR DEFENSE SYSTEM

1. The PVO Strany. As an indication of the importance attached by the USSR to the air defense of the Soviet homeland, this mission is believed to be assigned to a major component of the War Ministry, separate from the Army and Air Force, which is designated PVO Strany (Air Defense of the Country). The PVO Strany is probably under the ministerial control of a Deputy Minister of War for Air Defense. 1/ This post was apparently created in 1948. This official performs a dual role in the air defense system. As Deputy Minister of War for Air Defense he is believed to have ministerial responsibility for the over-all coordination of administrative, technical, and management matters in implementing air defense policies set by the Soviet General Staff and the

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1/ The Ministry of the Armed Forces (MVS) became the Ministry of War in February, 1950, when the Naval Forces became the separate Naval Ministry (VMM). The titles of all Ministers of the MV have not been determined since this change; therefore, it is necessary to describe the organization as it was know prior to the change. Since the reorganization of 1950, it is possible that the PVO Strany has been removed from the War Ministry and made an independent agency responsible for coordination and control of all activities relative to air defense, including those of the Navy. However, there is no intelligence to indicate whether this has in fact occurred.

Politburo or its successor institution, and he probably participates in the development of air defense policy. As Commander-in-Chief for Air Defense, he exercises over-all coordination of air defense field units including: (a) a high degree of supply and financial coordination; (b) technical training; (c) personnel assignment and administration; and (d) a degree of control over operational deployment of units. In addition, the headquarters of the Commander-in-Chief for Air Defense appears to exercise an operational control function over the air defense structure within the Soviet Union proper.

2. The mission of PVO Strany is the air defense of the entire Soviet Union, utilizing all existing military, police, and civil forces. [redacted] its functions appear to include: (a) detection of approaching hostile air forces; (b) alerting the central PVO authorities as well as all facilities in the immediate and adjacent areas; (c) initiation of counteraction by fighter aircraft and antiaircraft artillery; and (d) maintenance of surveillance over all flights of Soviet aircraft.

3. The Commander-in-Chief for Air Defense has at least two deputy CinCs, one for Fighter Aviation of Air Defense and one for Antiaircraft Artillery. Known services and directorates in the headquarters organization include beside the Chief Directorate of Air Defense, the Staff of PVO Strany, a Directorate of Communications, a Supply Directorate of PVO, and a Personnel Directorate.

 [redacted]

4. Regional Organization of the PVO. An exhaustive analysis of air defense communications nets has revealed the general outlines of the air defense system which has been reorganized in successive stages since 1948. It is divided into a number of Air Defense Regions; these are able to function independently, but normally are subject to coordination and control from the central PVO headquarters in Moscow. Each of the PVO regions has its own PVO headquarters, although the exact organizational structure of this headquarters is not known. Various air defense elements such as radar, ground observer posts, antiaircraft artillery, and fighter aviation, are assigned or attached to these headquarters as required by the size and importance of the area to be defended.

5. The hub of the system is the Moscow Air Defense Region, which is composed of an inner sector immediately surrounding the city, and an outer zone which is itself divided into sectors. The number of sectors in this outer zone is believed to have been recently increased from five to eight. Each sector reports to either of two control centers in Moscow, each of which controls four sectors. Each sector is believed to have a filter center and control center of its own, and to be capable of directing air defense operations within its area of responsibility.

6. Ringing the Moscow Air Defense Region are several other Air Defense Regions: Vologda, Leningrad, Riga, Kaunas, Kiev, Kharkov,

Ural-Sverdlovsk and probably Odessa and Tiflis. Each of these regions controls air defense operations in its assigned area, either through the regional control center or through subordinate sector control centers, of which each region has at least two. Lateral communication exists between regional headquarters, and between sector control centers.

7. Also reporting directly to central PVO headquarters and linked to the above regions by lateral communication, is the Baku Air Defense Region, which apparently controls air defense operations in an area ringing the Caspian Sea on the west, north, and east, extending probably as far east as Ashkhabad. The vital strategic importance of of the petroleum industry located within the region, plus its relatively exposed peripheral position, has led to a need for a strong, well-coordinated air defense system.

8. Outside the European complex is the Air Defense Organization of the Far East. This system operates directly under the Commander-in-Chief, Far East, who assigns zones of responsibility to the subordinate commands but exercises coordination and control from Khabarovsk. This Far East organization apparently operates autonomously, being subject only to policy directives on air defense matters from higher headquarters in Moscow.

9. Other Forces Available for Air Defense. Aside from the forces presently assigned or attached to the PVO regional headquarters, there are numerous other units and organizations which contribute to

Soviet air defense potential. These include: (a) the air defense components of the Soviet forces abroad, such as the Group of Soviet Forces in Germany; (b) the Satellite and Chinese Communist air defense forces; (c) the air defense components of the Soviet Navy; (d) the anti-aircraft artillery assigned to the Soviet Army; and (e) the Soviet tactical air forces. All of these forces, insofar as their air defense missions are concerned, are probably linked with the PVO Strany, though not subordinate to it. Antiaircraft units of the Soviet Army and fighter regiments of the tactical air forces may not only have local air defense missions in the area where they are deployed, but may be assigned or attached to the PVO regional headquarters should the need arise. Finally, the Soviet civil defense organization (MPVO), although under the MVD, is believed to come under the local operational control of the PVO-Strany during air attacks.

THE EARLY WARNING AND AIR DEFENSE CONTROL SYSTEM

10. At present the peripheral radar net around the borders of the Soviet Union is fairly complete, although gaps are believed to exist in some areas. Most important areas in the Soviet Far East and the area from Murmansk to Ashkhabad in the Western USSR are believed to be well-covered by an early warning (EW) network, which includes extensive radar, visual and sonic systems. We do not have sufficient intelligence to warrant a firm evaluation of the

warning system in the interior areas to the east and west of the Urals but we believe that coverage probably also exists in many of these areas. What the USSR lacks in quality of long range radar performance, it has sought to compensate for by the quantity of radars employed in depth. Moreover, from available evidence the USSR apparently appreciates that the organization for disseminating and acting upon early warning data is at least as important as the radar itself, and has taken steps to back its radar with a good reporting system.

11. The Army, Navy, Air Force, and MVD all have units to aid in the detection of hostile aircraft, which are incorporated in the national EW system. Air Force EW units are assigned areas of responsibility, and integrated into the sector or regional net in the area where they are stationed. Naval early warning forces are assigned areas adjacent to Naval bases and important sea approaches; Army units are deployed in areas adjacent to important army field forces and installations. In the interior of the USSR, the EW net is under the operational control of PVO Strany and its subordinate echelons.

12. There is evidence that the Soviet early warning system has been substantially extended since 1948.

[redacted] indicates that in 1949 and particularly in the last few months of that year the early warning facilities were materially increased. Furthermore, air warning nets are now in existence that are connected with major troop units, particularly in Germany, and with units of the forces of the Far East. Such nets were observed to pass traffic of the visual spotting type, much of it actual tracks rather than practice. The number of such nets was estimated in 1950 at over 200.

13. There has also been a steady growth in the air warning network for the Group of Soviet Occupation Forces Germany from autumn of 1949 through the spring of 1951. Nothing was known of this network before 1949 and probably none existed. This increase probably reflects a growing emphasis on the air defense of the Soviet Zone. There is no evidence that a final static level has yet been reached.

14. By July 1950 [redacted] indicated that air warning stations, both radar and visual spotter types, had been installed in increasing numbers along the periphery of the USSR, including some remote localities. By November 1951, a patterned build-up of communications facilities, particularly along the perimeter covered by the Tactical Air Forces of the Far Eastern Military District, suggested an overall strengthening of

air defense facilities. By April 1951 there were indications that at least four separate air warning nets were in existence in the Far Eastern Military District. A specific program also is believed to be well under way to make the EW capabilities of the Satellites more effective.

15. Visual Warning Network. Tied in with the electronic warning system is a supplemental visual-observer network known as the VNOS (Sluzhba Vozdushnogo Nablyudeniya Opoveshcheniya i Svyazi-Aerial Observation, Warning, and Communication Service). It consists of two services: Troops VNOS and VNOS Strany. Troops VNOS is organized primarily for the early sonic and visual detection of enemy aircraft to warn troop units against attack; it is manned by Army personnel and forms an integral part of field armies. Information collected is also forwarded to PVO Strany. VNOS Strany plays in the home territory a role similar to that of troops VNOS; its posts probably are manned mostly by Army personnel, although in many areas there are auxiliary posts manned by civilian members.

16. VNOS air warning regiments, battalions, and companies are integral units of PVO Corps, divisions, and brigades assigned to PVO Strany. The VNOS company consists of numbers of observation posts (military) and auxiliary observation units (civilian). The number of personnel assigned depends to some extent on the location

and air traffic expected to be encountered. The VNOS Company Post (collection center for a defined sector) usually has 10-12 observation posts from which it collects and filters early warning information. This information is in some cases consolidated with and follows the same channels as that received from electronic warning posts, although distinct VNOS reporting channels have also been identified. To date, 650 observation posts have been located in the USSR. The areas of most concentrated visual/sonic coverage are in the west from the Baltic to the Black Sea and in the Far East from Vladivostok to Nikolaevsk. Most posts in important coastal and land approaches have roughly a four to eight mile spread. The major posts usually have teams of four or five men. Auxiliary (civilian) posts are organized in regions where there are no military posts and are found in such locations as lighthouses, weather stations, forestry stations, etc. There is not much evidence as to the extent of VNOS coverage in the interior USSR, although it may be fairly extensive.

17. The SNIS (Slushba Nablyudeniya i Svyazi) is the Soviet Navy counterpart of the VNOS and is used in a similar manner. Naval coastal observation posts are organized with Navy personnel, and like naval radar stations, send EW information to a Naval Collection Center, where it is integrated into the regional defense network.

18. Satellite Early Warning Systems. The growing early warning net of the European Satellites is an extension of, and is directly tied in with the Soviet early warning system. While probably handicapped by insufficient electronic equipment and trained personnel, it supplements and further extends Soviet detection capabilities. For example, [redacted] that EW information from the Southern European Satellites is transmitted directly to the Soviet system. The Satellite radar net is supplemented by an extensive visual/sonic early warning network, which today forms the principal element of the Satellite early warning system. Similarly, Soviet early warning in the Far East is extended into China with a greater preponderance of radar than is now credited to the European Satellites. The present deployment of known radar in China shows complete coastal coverage as far south as Hainan with a few installations inland around important bases or cities. Much of this radar net is also supplemented by a visual/sonic net, the extent of which is not known.

19. Filter Center Facilities. Information from early warning radar and observer posts is collected at sector and regional filter centers. The radar organic to any fighter divisions stationed in the area also is tied into these centers, where there is believed to be a command element with operational control of the air defense forces in the sector or region. Each center coordinates and controls the air defense operations undertaken by its lower echelon organiza-

tion, each of which is assigned a definite territorial responsibility. Fighter intercept operations within this area are usually controlled by the fighter division or sometimes the corps, which are staffed to provide the Air Section in the filter center where fighter operations are coordinated with other air defense measures.

20. Although the actual equipment employed in Soviet filter centers is not known, the USSR was familiar with both Allied and German World War II systems and methods of filter control. The efficiency of Soviet filter center facilities seems high at present in dealing with small numbers of aircraft, although the evidence thus far obtained applies to conditions favorable to the Soviet defenses. We cannot estimate how efficient such facilities would be in dealing with large scale air attacks. [redacted] indicates that the normal time lag between the receipt of air warning information by a filter center and its re-broadcast (presumably after evaluation) is about one to two minutes. Since the normal time required to transmit an air warning message is about thirty seconds, any given air warning radio station can transmit radar detection reports on four targets during this interval. Flexibility of filter center operation appears to be emphasized, particularly in the Far East. The filter centers at several subordinate Far East headquarters, in addition to maintaining normal close coordination as regards all air warning activities, are known to have exchanged areas of responsibility in several large scale air warning exercises.

21. The effect of this system of control from unit up through sector to regional control points, has been to alter the Soviet air defense system from one of defended points as in World War II, to one of defended areas. This system is more in keeping with the high mobility (despite its limited range) of the principal interceptor weapon, the MIG-15, although the point system is still utilized where concentrated AA defenses are found.

22. The reporting component of the EW system is considered to be currently in a high state of readiness, especially in the Maritime and Sakhalin regions of the Far East and probably also in the Caucasus and around the periphery of European Russia. There are numerous reports of rapid and efficient communications between radar locations, filter centers, and control points. There have been frequent small scale EW drills largely on a sector basis, together with regularly scheduled major drills for the purpose of coordinating these defense sectors within the overall early warning system. The communication and reporting drills also include participation of the visual observer system, which evidence indicates as being in a good state of training and readiness in those areas where it has been observed. Some radar posts in the Far East area are known to be manned twenty-four hours a day. Some indications of round-the-clock manning have also been noted in the Soviet Zone of Germany and in European Russia.

SOVIET INTERCEPTOR FORCES

23. We believe that Soviet interception capabilities are steadily increasing under the impetus of extensive re-equipment of training programs. Almost half of the operational strength of the Soviet air forces is composed of fighters, and these forces are being rapidly re-equipped with jet aircraft. The fighters available for Soviet air defense include not only those assigned or attached to the PVO Strany but also those fighters assigned to the tactical air armies, the Soviet navy, and the Satellite and Chinese Communist air forces not otherwise committed. According to Soviet doctrine the PVO interceptor forces would be augmented by aircraft of these other forces as may be required. However, the ability of the control net to absorb additional fighters might prove a limiting factor. As of 1 October 1952 the estimated T/O and E fighter strength available for air defense of the USSR, including forces in Eastern Europe, Manchuria, and China was as follows:

	Piston	Jet	Total
IA PVO	500	2,300	2,800
Tactical Air Forces	2,200	2,900	5,100
Soviet Navy	750	1,100	1,850
Korea/Manchuria-China Area	240	1,400	1,640
European Satellite Air Forces	760	700	1,460
	4,450	8,400	12,850

24. The IA PVO. The operational interceptors at present under the control of PVO Strany are assigned to the Fighter Aviation of Air Defense (IA PVO) one of the chief subheadquarters of the PVO. These interceptors are organized into IA PVO Armies, which are assigned to key areas only, and whose headquarters are believed to be at Moscow, Leningrad, Kharkov, Baku, and possibly Chita. The state of training and combat readiness of the IA PVO is probably at least as high as that of other Soviet fighter units. We estimate that the approximate T/O and E strength of these armies is as follows: Actual operational strength as of 1 October 1952 is estimated to be approximately 85% of T/O and E strength.

Designation	Location	Piston	Jet	Total
19th Fighter Air Army	Moscow/ Voronezh, Gorki, Volga, Ural Belorussian Military District	100	550	650
Unidentified Fighter Air Army	Leningrad, Riga, Arkhangelsk White Sea, Baltic Military Districts	50	400	450
21st Fighter Air Army	Carpathian, Kiev, Odessa, Taurin, North Caucasus and part of Trans Caucasus Military Districts	150	700	850
7th Fighter Air Army	Baku Area	150	570	720
Unidentified Fighter Air Army	Central Siberian Area	50	80	130
TOTAL			2,300	2,800

25. A serious deficiency of the Soviet air defense system appears to exist in its limited interception capabilities under conditions of poor visibility. The training program currently stresses ground control interception, night, and instrument flying. The Soviet state of training, particularly in these respects, is not considered up to US standards, although emphasis has been placed on this type of flying since 1949. There is no evidence confirming or denying fighter control training against mass or saturation attacks. Air defense drills and exercises, which are increasing both in numbers and in scope, are probably improving the operating efficiency of the system, but the lack of sufficient quantities of AI equipment almost certainly imposes a severe handicap on Soviet all-weather training.

26. Tactical Air Forces. The air forces supporting the Soviet Army are organized into 14 tactical air armies and four Military District Air Forces. Three of these armies (the 4th, 24th, and 59th), and a part of another (the 5th), are stationed outside the borders of the USSR. The other eleven are deployed in Soviet border areas. Some military district air forces also have fighter units. Their present estimated T/O and E fighter strength is as follows:

Air Army	Military District	Piston Fighters	Jet Fighters	Total
1st	TAA Belorussia	200	120	320
4th	" Poland	50	200	250
5th	" Odessa, Rumania	100	180	280
6th	" Turkestan	250	--	250
11th	" Transcaucasus	150	120	270
9th	" Maritimes	50	330	380
10th	" Far East	350	520	870
12th	" Transbaikal	300	--	300
13th	" Leningrad	200	80	280
14th	" Carpathian	300	40	340
15th	" Baltic	--	230	230
17th	" Kiev	50	120	170
24th	" Sov Zone, Germany	--	660	660
59th	" Austria and Hungary	--	220	220
MD AIR FORCE TAURIC		100	80	180
MD AIR FORCE WHITE SEA		100	--	100
MD AIR FORCE MOSCOW		--	--	--
MD AIR FORCE WEST SIBERIA		--	--	--
		2200	2900	5100

27. Observation of the activities of the fighter elements of the tactical air armies shows that they devote a considerable proportion of their tactical training to ground controlled intercept problems. This tends to confirm other reports that the tactical air armies are responsible for intercepting hostile aircraft in their assigned territorial areas. The probable assignment of tactical air armies to the multiple missions of seeking air superiority, interdiction, ground support, and air defense would create a problem in case these air armies were withdrawn from their present areas in event of war. In this case we believe that as the tactical air army fighters moved forward, IA PVO fighters might move in and assume the fighter defense responsibility in the areas vacated. This would result in a thinning of air defenses unless additional IA PVO units were created, as would

be likely. Another possibility would be for the Tactical Air Armies concerned to be assigned additional fighter strength to provide both for ground support to the land armies and defense of their present territorial areas as well. In either event, some decline in Soviet interception capabilities might result in the early stage of a war. The fighter units which deployed forward in support of the ground forces would be assigned the mission of providing air defense in the area between the front lines and the forward limit of IA PVO responsibility, and their operations in those areas would be tied in with the PVO system in the USSR itself.

28. To date only a portion of the IA PVO, tactical air armies, and Fleet Air Force have been re-equipped with jet fighters and a significant interception deficiency exists in the presence of a large number of piston-engined aircraft in operational units. While there is every indication that all fighter units will be re-equipped with jet types, conversion training by units now re-equipping and units still equipped with piston-engined aircraft will require a transitional period of relatively low effectiveness for the units involved. We estimate that this re-equipment period will be completed in early 1954 and the transitional training period by the close of 1954, although the IA PVO forces, because of their high priority, may be re-equipped somewhat earlier.

29. Satellite Forces. The Satellite interceptor forces in Europe now consist mostly of piston-engined fighters, although all

except Albanian have been equipped with limited numbers of jet aircraft. Poland at present has the most effective air defense system. A new air defense organization, OPL (Oborena Przeciw Latnicsa) was established in 1950 along Soviet lines. Although there is little information concerning coordination between OPL and PVO, the presence of Soviet military personnel in command and staff positions of OPL, together with the recent assignment of jet aircraft and modern ground equipment, indicates that OPL may become a valuable adjunct to the over-all defense of the USSR. Present actual jet fighter strength (all in the OPL) is estimated at eighty planes. There is recent evidence that similar air defense organizations are also being established in Czechoslovakia and Hungary.

30. The intercept capability of Satellite fighter units is considered negligible against high flying bombers and probably only fair against medium and low flying bombers, with the degree of effectiveness directly related to the visibility. The main reliance for interception of hostile aircraft rests at present on the Soviet air force units stationed within these countries. However, Satellite interception capabilities will probably increase.

31. The China-Manchuria-Korea area contains a Communist jet interceptor force of considerable size, composed of Chinese Communist, Soviet and North Korean units. The air defense system appears to be organized along lines similar to that in the Soviet Union

itself and probably is being integrated into the over-all plans for defense of the Soviet Far East. Available evidence indicates that for purposes of command and control this area is divided geographically into air defense regions. As jet fighter strength has increased, the disposition of jet units has spread generally from Manchuria into China proper. Concentrations of jet fighters, augmented by piston-engined units, exist in southern Manchuria, the Peiping-Tientsin area, Shanghai, Hankow, and Canton. These forces could be used against air attacks launched across the foregoing areas against Siberia.

32. Airfields. Since the end of World War II the Soviets have pursued a development program of airfield improvement and construction which is constantly increasing in tempo. An airfield improvement program is a natural corollary to the re-equipment of units with higher-performance aircraft. In the past three years the Soviets have accelerated development of a string of airfields with permanent runways 6,000 feet or longer in the Western Satellites stretching south from the Baltic Sea toward the Black Sea, and since the beginning of 1951 there has been a marked increase in runways 8,000 feet or longer. The Soviets have also devoted increasing attention to jet airfields in the western part of the Soviet Union and have continued to improve airfields in the Moscow area. There has been a steady development of airfields in the Caucasus and extensive work on air bases in China. Air facilities along air routes from Central and

Eastern Soviet Union to and within China have also been developed. Steady development of air facilities in the Maritime provinces and on the Chukotski and Kamchatka peninsulas have been indicated. From the standpoint of defense, this airfield program provides a network of bases capable of supporting large-scale jet interceptor operations.

ANTIAIRCRAFT ARTILLERY

33. Soviet antiaircraft artillery (AAA) capabilities have markedly increased in the past few years, owing largely to the introduction of new model guns and fire control equipment. At present about one-third of the known Soviet AAA strength is disposed in the eastern and western peripheral areas of the USSR and is available to protect key areas from hostile attack.

34. Soviet AAA units consist of two distinct categories, strategic and tactical. Strategic antiaircraft artillery, with heavy, medium, and light guns, radar, searchlights, and barrage balloons, is an integral part of PVO Strany. It is organized into PVO brigades, divisions, and corps.

35. Tactical antiaircraft artillery units consist of independent divisions and the organic antiaircraft artillery within ground force units. The AAA division, with a strength of approximately 2,000, is the basic antiaircraft unit and is allotted to the various fronts, army groups, and armies as required. The exact composition of these divisions varies, some having two regiments of medium artillery and

two light AAA regiments, while others have one regiment of medium and three regiments of light weapons. Moreover, in the present Soviet Army all ground combat units of regimental size and larger have organic AA artillery, with light weapons predominating. The USSR has approximately 29,000 of the 37 mm. M-1939 AA guns, and we estimate that at least 18,000 85 mm. M-1939 and M-1944 guns are available.

36. The USSR is engaged in a program designed to strengthen existing AAA defenses through the introduction of the new estimated 57 mm. and 100 mm. guns and improved fire control equipment. These new weapons are probably now available in moderate quantities around the most important areas. In the Moscow area, for example, visual observation indicates that in the past year an obsolete and inadequate antiaircraft artillery system has been replaced by the emplacement of at least 216 new guns of the estimated 100 mm. caliber. It is estimated that an additional 122 new guns are available, which with the remaining 85 mm. guns makes Moscow the most heavily gun-defended city in the world. This heavily defended area has an outer perimeter with a radius of 10 to 12 miles centered at the Kremlin, which appears to encircle the city. Another ring of guns at a radius of five to nine miles consists of some 30 known batteries. While the new medium AA gun (est. 57 mm.) has probably now been issued to troops, available evidence does not permit an estimate as to how many may be operational at this time. Units employing AA rockets or guided missiles may also be available.

37. Increasing Satellite antiaircraft capabilities add to the depth of the eastern and western peripheral defenses of the USSR. Satellite AAA forces are being developed by the USSR to undertake a large share of the strategic defense of the lines of communication and to provide an outer belt of AAA for additional air defense protection.

MILITARY PASSIVE DEFENSE MEASURES

38. Reports and photo missions reveal active camouflage, dispersal of equipment, and use of underground installations in the Far East and in the European Satellites. However, observers from Moscow, Leningrad, and other strategic centers of the European Russian interior report a noticeable lack of passive defense precautions in these areas. The types of camouflage used by the USSR in World War II and in Korea are indicative of those which will be employed in the future. Skillful use of natural camouflage can be expected of Soviet military forces.

39. Airfields in Kwantung Province, Sakhalin, and the Far East generally employ earth revetments for aircraft, large dispersal areas, underground storage, and protected repair shops. The 24th Tactical Air Army in the Soviet Zone of Germany has prepared dispersed aircraft revetments and conducts frequent air alerts to provide realistic training. In Hungary and Bulgaria, it has been reported that underground wartime command posts and filter centers have been

renovated. Future military facilities will probably include subterranean construction, perhaps including aircraft hangars.

40. Passive defense indoctrination in most of the Soviet military forces in peacetime appears to be limited to that received through basic instruction and from field manuals. Defensive as well as offensive chemical warfare instruction is provided in short school courses for most Soviet officers and NCO's. There is no current evidence of instruction in troop units regarding biological warfare, but it is believed that there is a discernible trend toward the expansion of official military instruction to embrace defense against atomic and germ warfare.

SOVIET NAVAL AIR DEFENSES

41. The air defense preparations of the Soviet naval forces are consistent with the primarily defensive role of the bulk of the Soviet Navy. Operating close inshore around large port areas, Soviet fleet units with their early warning radar and antiaircraft batteries, are important components of the overall air defense system. All facilities of the various fleets, such as aircraft, radar, antiaircraft batteries, and communications systems are probably organized under a Chief of Staff for Air Defenses. Since each of the six Soviet fleets has its own air force, it can be assumed that each fleet is organized so as to fully utilize all its facilities for air defense in its respective area.

42. Shore-based defense against aerial attack on coastal areas is also a naval responsibility. The areas where the Navy apparently has primary air defense responsibility are the White Sea, the Baltic Sea, portions of the Black Sea, the Port Arthur area, and the Russian coast between the Korea-USSR border and 50 N. latitude. The areas of greatest concentration of naval air defenses in the Far East are Vladivostok and Port Arthur. Naval aircraft would also be available at Sovetskaya Gaven and in southern Sakhalin. In some cases when US aircraft have been intercepted, as in the Baltic, Black Sea, and Far East areas, a high degree of combat readiness has been demonstrated.

43. The estimated T/O and E strength of the naval fighter forces as of 1 October 1952 is approximately 1,850 aircraft, an estimated 1,100 of which are jets. The fighters of the various Fleet Air Forces were estimated to be distributed as follows:

	Piston	Jet	Total
4th (South) Baltic Fleet	100	120	220
8th (North) Baltic Fleet	100	80	180
Northern Sea & Fleet	150	80	230
Black Seas Fleet	100	200	300
5th Fleet	300	460	760
7th Fleet 3/	-	160	160
TOTAL	750	1,100	1,850

3/ Unknown numbers of piston-engined fighters are known to be still operating in the 7th Fleet.

The fighter intercept capability of these various fleet air forces has increased considerably during 1951 with the program of conversion from conventional to jet fighters. This program has been accelerated during 1952, and we estimate that fighter units of Naval Aviation will be entirely jet equipped by mid-1954.

44. Soviet naval air defenses include not only the facilities of naval vessels afloat and the naval air forces, but also a network of coastal radar stations, supplemented by the ship-based radars, and observation (VNOS and SNIS) posts equipped with sound-wave amplifiers, searchlights, and visual observation equipment. Since the Soviet Navy is also responsible for coast defense, it controls many shore-based AA batteries. Naval AA units equipped with 37 mm. and 85 mm. guns have been identified. We estimate that about one-third of the total number of Soviet naval personnel are, in one way or another, a part of the air defense system.

45. At present the Baltic area and the Far East area around Port Arthur and Vladivostok are the most heavily defended fleet areas. The relatively light defenses of the long Arctic and Northern Pacific Coast areas undoubtedly are a reflection of a confidence in natural obstacles, plus distance from the population and industrial centers of the USSR, to preserve these areas from severe enemy attack.

46. There will probably be a steady increase in naval PVO strength through 1954, reflecting the same type of increase in the Soviet Navy generally. It is not expected that the size of the fighter component will expand substantially but the conversion to jet fighters will continue. The creation of a separate Naval Ministry of 1950, the naval building program, the appointment of the wartime Naval Commissar KUZNETSOV as Naval Minister in 1951 all point to increasing emphasis on naval defenses.

APPENDIX C TO SIE-5

ECONOMIC CAPABILITIES OF THE USSR TO SUPPORT ITS AIR DEFENSE SYSTEM

1. Aircraft. The Soviet aircraft industry, which was apparently given a high priority post-World War II mission of developing a high-speed, high-altitude interceptor, was producing operational quantities of jet fighters by mid-1947, and by mid-1948 had produced the prototype of the MIG-15. Since the principal air-to-air defense weapon for the years 1952-54 will still be the interceptor-fighter, we estimate that the USSR will continue to allot a substantial portion of its aircraft production facilities to producing interceptors for the defense of the Soviet Bloc. Total production of jet fighters in 1952 is estimated at 5,000 aircraft, MIG-15's or variants thereof. Jet fighter production for 1953 is estimated at 5,500 aircraft, and 1954 production at 6,000 aircraft.

2. We estimate that at least eight final assembly plants, and possibly more, are presently producing MIG-15 fighters (at a rate of approximately 5,000 per year) and that additional factories are engaged in producing components for this fighter. In contrast only one plant (possibly two) is presently known to be producing medium bombers, while three plants are producing light jet bombers. In terms of airframe weight, jet fighters produced in 1951 amounted to an estimated total of 23,308,000 pounds while bombers of all types totaled 23,291,000 pounds. It is unlikely that aircraft

plant capacities will be increased materially between now and 1954. The present capacities would be first expanded to their maximum, should this be considered necessary by the USSR. Even allowing for the production of other aircraft, the present Soviet airframe industry has the plant capacity, utilizing present models, to produce an estimated 20,000 fighter aircraft per year, although it would require at least two years to reach this rate. The present aircraft engine industry would probably be unable to meet such a requirement, but there is some evidence that an expansion is under way.

3. Except for certain potentially scarce materials, the use of which can probably be minimized by modifications in design, the supply of raw materials for aircraft production is believed adequate; likewise, there are no serious limitations in the quantity or quality of technical personnel.

4. Electronics. At present, the capabilities of the Soviet Bloc electronics industry appear to be sufficient to support, extend, and over a period of time modernize an early warning system, as well as provide UHF and SHF fire control and airborne equipment for the Soviet air defense system. In addition to the Soviet electronics industry Hungary, East Germany, and Czechoslovakia also produce considerable electronic equipment. It is considered

that somewhat over half of the Soviet Bloc 1951 production was in radar - especially early-warning and improved fire-control and airborne types. Although the electronic industry has been operating at effective capacity, a small (perhaps 15%) increase in military output could be realized after a short time lag through the curtailment of civilian radio manufacturing.

5. Expansion of electronic plants has taken place through 1951 in the USSR and Satellites, and is expected to continue. It is estimated that the total electronics industry output of the Soviet Bloc can reach 150% of the 1951 rate by 1954. Firm evidence on many aspects of Soviet electronics production capabilities is lacking, but we believe that these capabilities are probably great enough to provide: (a) ground radar for early-warning, GCI and fire control; (b) AAA proximity fuzes; (c) missile guidance; and (d) airborne radar, in sufficient quantities to meet most critical air defense needs.

6. There are no serious economic limitations on Soviet capabilities for the manufacture of electronic air defense materiel in the fields of power or most types of basic plant machinery. However, the Soviet Bloc is at present partly dependent upon Western sources of supply for specialized critical production materials such as ductile tungsten and molybdenum fabrications, diamond dies, good mica, and thin capacitor paper. The USSR is

taking steps to reduce this dependence which will probably decrease through 1954.

7. Guns and Ammunition. During the peak productive years of World War II, about 25% of Soviet gun production capacity was utilized in the production of antiaircraft guns. In 1944, for example, the USSR is estimate to have produced 121,000 pieces of all calibers, of which 22,000 were AA guns. The estimated rate of current production of AA guns of all types is from 2,500 to 4,000 per year, including a current production of at least 500 of the new 100 mm. guns annually. The present capacity of Soviet weapons and munitions plants, without physical expansion and without limiting other production substantially, is estimated at 6,000 to 8,000 AA guns per year. It is estimated that capacity to produce AA guns of all calibers could be increased to at least 25,000 and possibly to 30,000 guns per year, although this would require an all-out effort. Any current limitation on the Soveit AA gun production and utilization is probably attributable to: (a) the relatively lower priority assigned to this program; and (b) present Soviet inability to provide adequate numbers of effective antiaircraft fire-control instruments. There is evidence to indicate that this latter limitation is being overcome.

8. The Soviet Bloc appears to have adequate raw materials and plant capacity for the production and maintenance of ammunition supplies. During the three years ending in July 1945, for example,

the USSR produced artillery shells at an estimated rate of 225 million per year. Based upon current production rates, plant capacity and stockpiles, Soviet ammunition production capabilities appear adequate for any contingency during the period of this estimate.

9. Although little is known about actual output figures, evidence indicates substantial existing Soviet production of rockets and rocket propellants and explosives, some of which may be of AA types. The USSR is capable of substantially increasing rocket production rates, including AA types.

10. There are no credible reports of the production of AA guided missiles. However, there is evidence that the Soviets have a development program based upon German World War II experience. If the Soviets develop satisfactory missiles, we believe that they will develop a significant production capacity for such missiles between now and 1954.

11. Technological Capabilities. Despite the growing pool of experienced Soviet personnel at the product engineering and supervisory level, technical personnel continue to be at a premium. It must thus be difficult for the USSR to meet the demands for technical personnel for new or expanded production programs. The resultant effect upon Soviet technological capabilities has been reduced, however, by utilizing foreign accomplishments and by

standardizing requirements and designs. Higher engineering and technical schools in the USSR have also been graduating well-trained students at a rate comparable to the US. In addition, many manufacturing enterprises have established extensive on-the-job training programs for junior engineers, technicians, and production supervisors.

12. It has been argued that while Soviet technological capabilities, in terms of trained manpower, may be adequate in the field of advanced basic research, these capabilities are limited in the field of reducing ideas to practice. However, this does not appear to be the case in those fields of endeavor receiving priority government attention. Moreover, in those industries requiring a high degree of technology, general simplicity in product design is evident. In view of known quantity manufacture of some very complex products, this Soviet tendency to avoid complexity is believed to be a result of policy decision, rather than lack of ability. In any case, the resultant effect is to considerably increase Soviet industrial capabilities for mass production. More recent evaluations of the products and methods typical of the Soviet engineering industries have provided frequent examples of excellent product design, efficient tooling and the use of good modern plant machinery. This trend, notable since 1947, is inconsistent with limited ability to reduce to practice. Therefore, we conclude that the USSR does not face a major handicap in the shortage of technological skills needed to support air defense development and production programs, provided

that the air defense program continues to be given a sufficiently high priority.

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