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JIC Assessment

The Soviet Threat to North America, 1959-71

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Note: This is the Canadian position paper for the joint
Canada/US CANUS 59 Threat Estimate



PA
Department of National Defence

JOINT INTELLIGENCE COMMITTEE

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29 Jan 59.

J.K. Starnes, Esq.,
Dept. of External Affairs.

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The Soviet Threat to North America 1959-71

1. Reference is made to the decision of the Committee at the 666th meeting (Item I) on the above subject.
2. Enclosed are copies of JIC 308/2 (59) dated 29 Jan 59 on this subject.
3. The enclosed paper will be considered at the meeting of the Committee on 4 Feb 59.


(I.A. McPhee)
Commander, RCN,
Acting Secretary.

Enc.

GPH/2-5459/cp

cc: CJS
CB NRC
JIS (5)

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JIC 308/2(59)
29 January 59

COPY NO. 21

THE SOVIET THREAT TO NORTH AMERICA
1959 - 1971

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JIG 308/2(59)

29 January 1959

THE SOVIET THREAT TO NORTH AMERICA
1959 - 1971

OBJECT

1. To assess the forms and scales of Soviet attack on North America in the event of war during the period from 1959 to 1971.

CONCLUSIONS

General

2. We consider it highly unlikely that the Soviet Union will specifically plan to attack North America in the absence of what it considers is a virtually certain and extremely critical threat to its vital interests.
3. If the Soviet Union does attack North America, it will do so as part of a global war, and its military objectives against North America will be to destroy or neutralize our capabilities for nuclear retaliation, and to destroy as rapidly as possible our determination to continue the war. Soviet strategy against North America will be some combination of: attacks by the most effective means against our nuclear capabilities, attacks against our industrial and population centres, and attacks against certain military installations and communications.
4. The Soviet planners must relate their strategically desirable objectives to what is tactically possible with the forces at their disposal. For example, the period during which the destruction of our nuclear retaliatory capability figures as their primary objective and the primary element in their strategy will depend upon Soviet capabilities to attack these forces effectively.

Forms and Scales of Attack from Aircraft and Missiles

5. We consider that the Soviet planners appreciate that their attack will be most effective if their main offensive weapons system for use against this continent changes from the manned bomber to the ballistic missile as soon as possible; and we consider that developing Soviet capabilities will allow this change to take place early in the period of this estimate.
6. The forms and scales of attack from aircraft and missiles may be considered in three phases as follows:
7. Phase I (from mid-1959 to about the end of 1960)
 - (a) The manned bomber will be the only weapons system that can deliver nuclear weapons on North America in any numbers, although a few relatively unreliable

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and inaccurate ICBMs and submarine-launched cruise-type missiles will probably be available in 1960.

Allowing for the requirements of all other campaigns and before any degradation, a maximum force of about 1375 bombers and tankers (100 BISONs and BEARs, 900 BADGERs, 375 BULLs) will be available for attack on North America in mid-1959.

- (b) The Soviet planners might appreciate that their objectives could best be accomplished by an attack with one-way and two-way refuelled and unrefuelled missions, executed as directly and as rapidly as tactical considerations permitted. If all 1375 available aircraft were employed under optimum conditions, about 560 could arrive in target areas, not considering combat losses. If no obsolete BULLs were employed, about 320 aircraft could arrive in target areas, not considering combat losses. If only BEARs, BISONs and the one-third of the BADGER force that is trained in air-refuelling were employed, about 150 aircraft could reach target areas under optimum conditions, not considering combat losses. Numbers reaching target areas would be further reduced if the force received only short notice of impending operations or if weather conditions were adverse.
- (c) Such ICBMs and submarine-launched cruise-type missiles as are available may be directed against area targets in North America.
- (d) The threat to Alaska will be from light bombers, missiles and possibly a small number of BADGERs.

8.

Phase II (from about the end of 1960 to 1963-1964)

- (a) This phase will be one of transition during which the missile threat will sharply increase. By 1964 the ICBM will have replaced the manned bomber as the primary weapons delivery vehicle against North America, and will be effective against all but very small and hard targets, such as hard ICBM sites.
- (b) Current types of aircraft will be phasing out, although over 1000 BADGERs may still be available in 1964. Some 200 supersonic recce/bomber aircraft may be available by the end of the period. As ICBMs with improving characteristics become available in increasing numbers, the roles of aircraft will be progressively confined to reconnaissance, raid-assessment and attack on special targets.
- (c) If the ICBM programme does not meet requirements, larger numbers of supersonic aircraft may be produced as weapons carriers, and heavy bombers may continue in service.

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(d) Some Soviet submarines may be positioned to supplement the ICBM attack with missiles launched from directions not covered by our ballistic missile warning and defence systems.

(d) The threat to Alaska will be largely from missiles.

9. Phase III (from about 1964 to 1971)

(a) During this phase the characteristics of Soviet ICBMs should improve until by about 1968 they are highly reliable and have good accuracy with a large warhead yield, and North American retaliatory capability might by 1967 or later be largely based in hard sites.

(b) Satellites with increasing capabilities for reconnaissance will become available, while by the end of the period supersonic nuclear-powered aircraft and boost-glide aircraft should be available.

(c) We cannot estimate scales of attack for this phase.

Other Forms and Scales of Attack

10. We consider it generally unlikely that the Soviet Union would attempt airborne operations on any scale against North America at least in the initial stages of a nuclear war. The possibilities remain however that small parties might be landed to acquire intelligence or to assist the aircraft and missile attack; and that small groups of airborne troops equipped with man-pack nuclear weapons (when these are available) could attack a few targets considered unprofitable for aircraft and missiles. We consider that the threat of amphibious operations against North America is insignificant, and limited to the landing of small groups from submarines.

11. Soviet submarines, other than those equipped for missile-launching, could carry out operations of the following kinds in the ocean areas adjacent to North America: torpedo attacks on naval and merchant shipping; "killer" operations against Western submarines in the transit areas near North American submarine bases; minelaying on coastal convoy routes and in approaches to ports and harbours. The estimated scales of these operations during the period of this estimate are given in paragraph 116.

12. Sabotage and subversion both by known and anonymous native communists and sympathisers and by trained and infiltrated Soviet nationals are probable after the outbreak of war. The scale of these operations would, however, be limited by countermeasures and by the effects of the nuclear exchange itself. Espionage will be carried out by trained and integrated illegal residents, but the scope of the operations would be limited by the disruption of the networks caused by the nuclear exchange.

Probability of Warning

13. Under most circumstances we may receive evidence of preparations for hostilities on the part of the Soviet Union which would, if sufficiently urgent and extensive, indicate a degree of risk of global war. Whether or not we receive this evidence of preparations for hostilities depends largely upon the Soviet requirement to employ numbers of medium bombers which need forward bases for effective attack on North America. This estimate indicates that by 1963 or 1964 the Soviet Union will have phased out aircraft as weapons carriers. Before these dates some 7 to 10 days' warning in advance of that provided by early-warning systems may be obtained from the deployment of strategic bombers to forward bases, and a few hours' warning may be obtained from Soviet activities with first generation ICBMs and IRBMs. After 1964, it is probable that little or no warning will be obtained.

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PART I - GENERAL CONSIDERATIONS

Circumstances under which War involving Attacks on North America may Commence

14. Although limited war may take place during the period of this estimate, North America is only likely to suffer direct attack during a major war between the United States and the Soviet Union and their respective allies. Such direct attacks will be effective only if large-yield nuclear weapons are employed. We believe that the Soviet Union would attack North America only in the face of what it considered was a virtually certain and extremely critical threat to its vital interests. We consider it highly unlikely that the Soviet Union would specifically plan to attack North America in the absence of such an apparent threat.

15. The most likely circumstances under which such an apparent threat could arise would be during a period of mounting tensions or from an extension of local hostilities. Under either of these circumstances, the Soviet Union might become convinced that the Western Powers intended to launch an attack upon it, and thus feel compelled to forestall this attack.

Soviet Objectives and Strategy

16. The primary Soviet objectives in this major war will probably be to secure the Soviet Union as far as possible against Western nuclear attack, and to destroy as rapidly as possible the determination of the Western Powers to continue the war. Other objectives will include the destruction of Western forces in the Eurasian land mass, the Mediterranean area and the island chain of the Far East; and eventually the establishment and consolidation of Soviet control over some of these areas. These objectives will remain true throughout the period of this estimate, but Soviet capabilities to achieve them will vary with the nature of the target systems and the nature of available weapons systems.

17. Soviet world-wide military strategy must therefore include some combination of the following:

- (a) attacks by the most effective means against Western nuclear capabilities throughout the world;
- (b) attacks against industrial and population centres in North America and elsewhere;
- (c) attacks against Western forces-in-being in Eurasia, the Mediterranean area and the island chain of the Far East; and attacks against Western military installations and communications throughout the world;
- (d) eventually, operations to establish and consolidate Soviet control over some of these areas.
- (e) military and civil defensive measures within the Soviet Union and throughout the Soviet bloc.

18. Soviet military objectives against North America will therefore be to destroy or neutralize North American capabilities for nuclear retaliation, and to destroy as rapidly as possible North American determination to continue the war. Soviet strategy against North America will include some combination of:

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- (a) attacks by the most effective means against North American retaliatory capabilities; and
- (b) attacks against industrial and population centres in North America; and against other North American military installations and communications.

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PART II - THREAT FROM AIRCRAFT,
MISSILES AND SPACE VEHICLES

Introduction

19. The form of the threat to North America from aircraft, missiles and space vehicles will depend largely upon the types of weapons systems available to the Soviet Union at any given date, and on the Soviet estimate of the relative effectiveness of these weapons systems against the different kinds of targets to be attacked. We therefore first consider the characteristics of the targets which the Soviet Union might consider would have to be attacked in pursuance of its objectives, and then consider the weapons systems that are likely to be available and their relative effectiveness for the different tasks.

20. The general characteristics of the weapons systems now available to the Soviet Union are reasonably well known, and the general nature of the systems that are likely to become available during the next decade are fairly clear, although there always remains the possibility of an unexpected technological breakthrough. The dates by which the specified performance characteristics of these new weapons systems will be achieved are however subject to great uncertainty, and the scale of the threat at any given date in the future is almost impossible to estimate with precision.

Target Systems

21. The target systems that will be attacked by the Soviet Union will change with the changing capabilities of both sides, and with the development of new weapons.

22. The target systems in North America that the Soviet Union will attack will be selected from the following:

- (a) nuclear retaliatory facilities, including SAC aircraft bases, other airfields that could be used by SAC, missile launching sites, naval forces with nuclear retaliatory capabilities, US national nuclear weapons storage sites;
- (b) other military installations, headquarters, forces and communications, especially those concerned with the air defence environment and those which if destroyed would prevent the effective deployment of North American military forces;
- (c) industrial and political centres.

23. Outside North America, target systems will be selected from: SAC and RAF Bomber Command aircraft bases and other airfields that could be used by SAC and the RAF throughout the world, missile-launching sites, naval forces with nuclear capabilities, nuclear weapons storage sites, military installations, headquarters, forces and communications; and industrial and population centres at least in the United Kingdom. It is assumed that orbiting satellites will be attacked during the most appropriate parts of their orbits, and not necessarily over North America.

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24. Appendix "A" gives data on North American targets. The following points should be noted in connection with this Appendix:

- (a) Available data does not permit precise determination of the numbers of aircraft bases and launching sites, especially beyond 1962. We assume however that after this date the number of "hard" ICBM sites will grow rapidly and that the number of SAC aircraft bases will not increase. We cannot estimate with any confidence how many other airfields which have runways suitable for SAC aircraft might be included in any Soviet target list or with what priority.
- (b) Undoubtedly the US nuclear retaliatory capability based on the air and missile-launching elements of the US Navy (surface vessels and submarines) will be included in any target system. However, we cannot determine the numbers of such vessels that will be in the North American area at any given time.
- (c) The degree and distribution of destruction of industrial and population centres required so to stun, demoralize and incapacitate the North American people that prosecution of the war is no longer endurable or possible is not known. However, there are certain levels of destruction at which the Soviet planners, weighing their capabilities against attack requirements, may consider that a point of rapidly diminishing returns has been reached. We consider that this point of diminishing returns may have been reached in an attack on the leading 54 US metropolitan areas and six Canadian metropolitan areas plus the two national capitals. (This would bring under attack about 42% of total US population and 24% of total Canadian population, and about 61% of gross US industry and 41% of gross Canadian industry.) We would emphasise that at such times as the Soviet planners appreciate that their capabilities give them a reasonable chance of destroying a large part of North American retaliatory capability, the attack on urban areas will be subordinate to the attack on these capabilities. Under these conditions the number of urban targets the Soviet Union may attack will depend on how much of their strike force is available at any given date after the requirements of the primary mission have been filled.

25. Appendix "B" gives data on targets outside the continental US and Canada. Nuclear retaliatory forces and facilities will be amongst the primary targets, and the considerations mentioned in paragraph 24 above apply also to these areas. Certain Soviet shorter-range weapons will be useful against some of these targets, while the long-range weapons will almost certainly be allotted to attack on North America. In between, however, are certain weapons systems which the Soviet planners must divide between the demands of North America and those of other areas. This Appendix provides a basis for the division. No data are available concerning the numbers of US and UK missile sites outside North America, and numbers of such sites are not included in the table.

26. Appendix "C" shows the overpressures estimated to be required for the destruction of these targets and the calculated numbers of weapons of different characteristics required to be detonated in the area of the target in order to give 90% assurance of the destruction of the target.

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Aircraft

Availability and Characteristics

27. Aircraft now available that could be employed by the Soviet Union for attacks on North America are BADGER, BISON, BEAR and BULL. It is estimated that on 1 January 1959 the strategic bomber force of the Soviet Union totalled 1860 aircraft (1350 BADGERS, 50 BISONs, 35 BEARs and 425 BULLs). Except for some 200 BADGERS in Naval Aviation and 100 BADGERS in Frontal Aviation, these aircraft belong to the Soviet Long Range Air Force. There are no aircraft specifically designed as tankers, although BADGER and BISON aircraft can be modified to serve as tankers to refuel their bomber counterparts. Large numbers of jet light bombers are also available in the Soviet Air Forces for attacks on targets within range, including targets in Alaska.

28. BADGER production is continuing at two major plants, although at a decreasing rate, and with signs that production may be phasing out. BADGER operational strength is still increasing and is expected to reach a peak of 1400 aircraft by mid-1959. After this date it is believed that BADGER production, if it continues at all, will not be sufficient to do more than replace wastage. It is believed that between mid-1959 and 1965 the size of the BADGER force will decrease through wastage to about 1000 aircraft.

29. BISON production was suspended during the first part of 1958, but although output has now been resumed (at a rate of about three aircraft per month), it is believed that production will cease permanently in the near future. There is still insufficient evidence to state categorically that BEAR production has ceased. Limited production may be continuing although output is insufficient to increase BEAR strength significantly. The general rate of growth of the heavy bomber force is so slow that we consider it doubtful if total BISON and BEAR strength will ever exceed 100 aircraft.

30. The BULL component of the Long Range Air Force is wasting rapidly and probably all of these aircraft will have been phased out of service by 1961.

31. It is known that the Soviet Union has been interested for many years in supersonic gas turbines. Recently a new aircraft, the BOUNDER, was seen at Moscow/Fili and an aircraft which is possibly a further type of new advanced aircraft was sighted at Kazan. At present we consider that these are experimental models or prototypes of an aircraft with supersonic-dash characteristics and possibly designed to carry air-to-surface missiles and decoys. Such an aircraft might not be produced in numbers for operational use, and the extent of series production of any supersonic or supersonic-dash aircraft will be generally dependent upon the success of the Soviet ICBM programme. We estimate that a split-mission (subsonic cruise and supersonic-dash) aircraft will be introduced into the Long Range Air Force about mid-1960, and that in later years up to 200 of them will go into service, primarily in a recce/bomber role. In any case, the development of supersonic aircraft is likely to continue both to provide knowledge of supersonic aerodynamics and thermodynamics and to provide an insurance in case of the failure of the ICBM programme to achieve required characteristics by certain dates.

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32. We estimate that, if the Soviet Union has attached sufficient importance to the development of a nuclear-powered aircraft, it could have a subsonic prototype by about 1960. In our opinion, such an aircraft would not have a military operational capability for several years after the development of the prototype. A supersonic military nuclear-powered aircraft could be developed late in the period of this estimate.

33. The table below shows the estimated composition of the Soviet strategic bomber force during the period 1959 to 1971.

Estimated Soviet Strategic Aircraft Strength

MID-	BULL	BADGER	BISON AND BEAR	NEW SPLIT-MISSION RECCE/BOMBER
1959	375	1400	} Not over 100	-
1960	175	1350		10
1961		1300	} Phase out	80
1962		1350		160
1963		1200		200
1964		1100		200
1965		1000		200
1966		(wastage		.
1967		continues)		(2)
1968		(1)		
1969				
1970				
1971				

Notes: (1) By 1965 there may be no requirement for BADGER operations against North America. Remaining BADGER aircraft would then be maintained for use against medium-range targets and as a reserve force.

(2) There will be a continuing requirement for reconnaissance, but by this date the vehicle likely to be used becomes uncertain. Supersonic nuclear-powered aircraft may be coming into service, and other advanced means of reconnaissance may be in operation.

34. The maps at Appendix "D" illustrate the range/radius capabilities against North America of the four Soviet strategic bombers now in service if operated from forward bases. These maps show:

- (a) that the BADGER, the major component of the present force, can be effectively employed from the Tiksi and Murmansk base areas only on refuelled one-way missions;
- (b) that the BISON has a limited capability against North America, even if refuelled;
- (c) that the BEAR does not suffer from the range limitations of other current Soviet bombers. In the case of this aircraft several flight routes which would avoid heavily defended areas are shown.
- (d) that the BULL has a limited one-way capability against North America.

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35. Appendix "E" shows in tabular form the main characteristics of the aircraft mentioned above. The use of aircraft as missile launching platforms is considered in paragraphs 56 to 58; and aircraft-type missile decoys are considered in paragraphs 80 to 81.

Maintenance and Training

36. Operational training in the Soviet Long Range Air Force has continued to progress steadily since the beginning of the BADGER re-equipment programme in 1954. Training has become progressively more advanced and has emphasized deployment from home bases, high altitude (above 30,000 feet) bombing and navigation to out-of-area locations both by day and by night. During the past two years the Long Range Air Force has been training in the techniques of air-refuelling, and it is believed that about one-third of the force has now attained operational proficiency in this field. There is evidence that flights into the Soviet Arctic, where only minimal ground navigation aids are available, is included in this training. In general we consider that the proficiency of Long Range Air Force crews is such that they can, in training but under adverse conditions, navigate to an assigned target and bomb with the accuracies shown in the table below. Under combat conditions these figures would suffer degradation.

ALTITUDE feet	CEFs in feet		
	VISUAL BOMBING	BLIND BOMBING WITH RADAR	
		Well-defined targets	Poorly-defined targets
40000	1100	2500	3500
35000	900	1500	3000
30000	700	1000	2500
20000	500	800	1500

37. Soviet capabilities to carry out maintenance of aircraft and equipment in the Long Range Air Force appear to be comparable with those of similarly-equipped Western air forces, although there are significant differences in approach to the maintenance problem between the Soviet Union and the West. The average Soviet technician may be somewhat less well qualified than his Western counterpart, but Soviet equipment is generally designed for simple maintenance. The Soviet Air Force does not appear to consider essential the elaborate maintenance facilities demanded by Western air forces; for example, most maintenance is done in the open even in cold weather. Further, the Soviet Air Force may accept reduced safety factors in order to maintain higher serviceability rates. However, we consider that the Long Range Air Force is able to maintain a serviceability rate of about 70% during peace-time operations, and that this could be raised to 90% after a ten-day standdown. Similar figures are likely to apply even after the introduction of more complex aircraft and equipment.

Air Facilities

38. The areas of the Soviet bloc from which an aircraft attack on North America is most likely to be launched are: the Kola-White Sea area, the Chukotsk area, the central Arctic coast, the Arctic archipelagoes and the Kamchatka area. Other parts of the bloc, such as the home base areas of the Long Range Air Force, the Leningrad area and East Germany and Poland possess excellent airfield complexes with logistic and climatic advantages, but they are further from the targets, and their use might well prejudice surprise. In general, we believe that staging bases in the Soviet Arctic would be necessary, at least for the initial attack. These northern airfields, except for those in the Kola-White Sea area, lack sophisticated refuelling and maintenance facilities and are largely dependent upon seasonal water

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transport. Stockpiling during the short navigation seasons on the Northern Sea Route and the northward-flowing rivers would be necessary. The Northern Sea Route is open to navigation only about two or three months a year, and the Chukotsk ports are open only from May to November. On the other hand, one 10,000 ton tanker, unloading at ports close to airfields on the Arctic coast, could supply sufficient POL for 290 BADGER sorties. Air transport is also available, although it is likely that this would be largely employed on airlift of personnel and emergency stores. Weather conditions at Soviet northern staging bases would complicate the coordination of the launching of a large-scale attack from widely separated base areas, and, in addition, the occurrence of fog or blowing snow or extreme wind chill at any of these bases would increase the operational degradation of a force staging through the bases affected.

39. In general, we estimate that the Soviet Union has adequate air facilities in forward areas to enable it to launch aircraft against North America in the numbers envisaged in this estimate, and at the same time provide the necessary bases for PVO and other elements. Assuming stockpiling, we believe that the Soviet Union can solve the problems associated with supplying these bases. It is in fact probable that many of the necessary supplies are permanently stockpiled at selected bases.

40. The table at Appendix "F" summarizes Soviet airfield capabilities in selected forward areas of the Soviet bloc.

Low-Level Attacks

41. The BEAR is the only aircraft now available that could reasonably be used for low-level missions against North America. However, the requirement for available BEARs to supplement the limited BISON force in high altitude attacks on targets at extreme ranges suggests that the employment of BEARs for low-level missions is unlikely. A nuclear-powered bomber may in time pose a low-level threat to North America, although it is possible that the development of this aircraft as a weapons carrier will be overtaken by the development of the ICBM.

Coordination of Air Attacks

42. The Soviet Union may attempt to coordinate its air attacks on North America and elsewhere so as to permit simultaneous arrival of aircraft at the limits of early warning radar, or perhaps under some circumstances at the limits of the contiguous radar ground environment. Simultaneous arrival of all attacks would be exceedingly difficult or impossible to achieve because of the different distances on different flight routes between the staging bases and the radar limits; the different speeds of the attack aircraft (especially if BULL aircraft were used); and the different weather conditions which would be encountered by attacks launched from widely separated base areas and following widely separated flight routes.

Force Degradation

43. Certain planning factors may be used to estimate the numbers of bombers which could arrive over North American target areas, not considering combat losses. These factors, which are based on intelligence concerning Soviet maintenance, base logistic support and operational proficiency, and on United States experience with comparable aircraft, are as follows:

- (a) 90% of aircraft at home bases would be in commission after a ten day standdown;

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- (b) 85% of these aircraft in commission at home bases could be launched from staging bases (this allowance is for attrition en route to and while at staging bases);
- (c) 85% of the bombers launched from staging bases on unrefuelled missions could arrive in target areas, not considering combat losses;
- (d) 80% of the bombers launched from staging bases on refuelled missions could arrive in target areas, not considering combat losses.

44. Thus, in the case of unrefuelled missions, about 65% of aircraft available at home bases would arrive over target areas, not considering combat losses. For refuelled missions, the figure is about 61%. It should be carefully noted that these estimates of force degradation in an attack on North America represent the optimum capability of the Long Range Air Force. They presume that the Long Range Air Force is efficient, that it has had adequate notice of impending operations and that weather is not an adverse factor.

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45. Missile systems that could be employed against North America include: intercontinental ballistic missiles; medium-and intermediate-range ballistic missiles (against Alaska only); air-to-surface missiles; and submarine-launched missiles. The following table lists certain data on missiles that we estimate may be available to the Soviet Union in the period 1959 to 1971. Further technical data on these missiles are given in Appendices "G" and "H".

Missile	Max. Range nm	Year Into Service (1)	CEP nm	Warhead Yield	Reliability % (2)
<u>Missiles Under Development or In Existence</u>					
ICBM	5000	1960 possibly 1959	5 3 by 62-63 2 by 65	1 MT	60
IRBM	1000- 1100	1959	1.5	200 - 700 KT	70
MRBM	700	1956	1.0	200 - 700 KT	70
ASM	55	1956	150' against ships	HE or 5-10 KT	-
<u>Missiles that could be Developed - on Basis of Estimated Requirements</u>					
ICBM	5000- 7000	1965	2-3 .5-1 by 68	1-5 MT	70
IRBM	1800	1962-4	1.5 .5 by 65-7	1-5 MT	85 90 by 65-7
Sub- launched cruise- type	200	1956-57	-	200- 100 KT	-
IRBM sub- launched	1000	1962-4	3 1 by 65-7	1-5 MT	60 initially
ASM	100	1960	1; $\frac{1}{4}$ with homing against suitably defined targets such as ships	1-5 MT	85
ASM	5500	1962-4	2 at 500nm (3)	1-5 MT	80

NOTES: (1) Year Into Service: year in which at least one series-produced weapon becomes available to trained unit with completed launch facilities. In the case of the ICBM, the missile could be a prototype.

(2) Reliability: percentage of missiles functioning according to specifications from launch to detonation in target area. For submarine-and air-launched types launch is moment at which missile leaves carrier.

(3) Includes navigational error of carrier.

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46. It should be noted that for only the first four of these missiles do we have sufficient evidence to justify a reasonably firm estimate that they are either in service or under development and due to come into service. However, it is reasonable to suppose that some types of missiles of which we have no knowledge may now be in service or under development, and that the Soviet Union will initiate the development of new and more advanced systems, if only to diversify its strategic armament and to explore all avenues of weapons development. Data concerning those missiles of which we have no firm evidence are based on estimates of Soviet requirements, of general Soviet technical and scientific progress in relevant fields and of probable Western progress in similar fields. The credibility of the estimates is limited by the intuitive nature of estimates of requirements, by our lack of knowledge of Soviet technical and scientific competence in certain fields, and by our lack of authoritative information concerning certain Western programmes. Thus the information given in the tables above and in Appendices "C" and "H" on those missiles for which we have no firm evidence should be treated with considerable caution.

47. Estimates of probable inventories of Soviet missiles present similar difficulties. Two of the most important factors on which estimates of production of Soviet equipment are normally based are factory output and sightings of hardware, and very little is known about either of these factors in the case of missiles. However, in very general terms, we believe that the Soviet Union could have available sufficient missiles of any of the types listed to meet requirements within one to three years after the introduction into service of the first series-produced missile of that type. The actual numbers produced will depend upon the Soviet planners' view of their requirements for each type; the numbers may vary from a few hundred to several thousand.

Intercontinental Ballistic Missiles

48. The performance of the first-generation Soviet ICBM with a range of 5000 nm, which we believe will become operational in 1960 or possibly in 1959, can be expected to be improved. By 1962-1963 its CEP will probably be reduced from 5 nm to 3 nm as guidance errors become less, and further improvement to about 2 nm is possible by about 1965. An increase in range, by installation of a warhead of lower weight or by improvement of the propulsion system, is also possible.

49. However, the Soviet Union is considered to have a requirement for a second-generation ICBM having a fast reaction time and a CEP approaching 0.5 nm. This missile should have a range of at least 4000 nm and be capable of launch from highly-protected sites or from mobile launchers. Fast-reaction ICBMs will require solid fuel engines or storable liquid propellants and recent advances in the United States indicate that large solid propellant engines having accurate control of thrust termination and vectoring can be developed. A promising degree of success has also been obtained in experimental tests with storable liquid propellants. There is no evidence of Soviet work on large solid propellant rocket engines, but if Soviet development is under way, and if Soviet advances are comparable to those which we expect in the United States, large engines may be developed by the Soviet Union in the early 1960's. While information on Soviet work on storable liquid propellants is also lacking, the Soviet Union has considerable experience with liquid propellants generally, and they could certainly develop such engines.

50. Suitable solid-fuelled or storable liquid engines for the second generation ICBM could become available by 1962-1963, and the missile itself could become available by about 1965 and have a maximum range of 5000-7000 nm. Initially, this missile could have a CEP of 2-3 nm, or possibly better if storable liquid fuel were used. Towards the end of the period, perhaps even as early as 1968, the accuracy of the missile could possibly be improved to

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give a CEP of 0.5-1.0 nm. Reduction in the weight of warheads by that time could also give a greater range capability and thus provide a wider choice of re-entry trajectories, unless the weight saved was used to carry decoys.

51. No information is available about possible launching sites for ICBMs, but it is presumed that adequate launching sites for the numbers of missiles produced will be available. Launching site complexes will probably be located in areas having adequate communications and logistic facilities and located within about 5000 nm of important targets in North America. If the Soviet planners are confident of their ability to conceal the precise locations of their launching sites from Western intelligence, there would probably be no necessity for them to construct hardened or mobile sites.

52. The use of these missiles will undoubtedly be against North America. Even in the early stages they would be effective weapons against SAC bases, soft ICBM sites and area targets, although a large inventory would be required to attack a reasonable proportion of all targets of this type.¹ Until the accuracy of these missiles with a warhead in the megaton range is somewhat better than 0.5 nm, and their reliability is high, they are unlikely to be used against hard ICBM sites, unless the Soviet planners appreciate that the secondary effects of a large-scale attack will seriously reduce the scale of retaliation from hard sites. Possibly towards the very end of the period of this estimate the ICBM will have improved sufficiently for it to be used directly against hard sites.

53. Decoys. Soviet ICBM nose cones can be expected to be accompanied by decoys to confuse and saturate active defence systems. Second generation ICBM warheads will probably be of small radar cross-section, and may be accompanied by large numbers of decoys of similar radar cross-sections.

54. Soviet Anti-Missile Defence. There is evidence which suggests Soviet interest in anti-missile defence as early as 1953, and it can be assumed that preliminary studies of the problem were carried out in the period 1953 to 1955. It seems likely that the Soviet Union would aim first for active systems employing anti-missile missiles and that other systems, if feasible, would follow later. Although comparison with the United States programme is not necessarily valid, it may be noted that the Nike/Zeus system feasibility studies were carried out in 1953 and that the earliest operational date that has been predicted is 1963. It can be estimated, therefore, on the premise that work began in the Soviet Union in 1953, that an anti-missile defence system could reach limited operational status some time in the period 1963-1965. It is probable that the cost effectiveness of such a system would limit its use to point defence. The anti-missile system that the Soviet Union may develop would have a capability against reconnaissance satellites (see paragraph 85), and it is probable that the missile could be used in this role before 1963, as satellite orbits can be established with good accuracy.

¹ Note that out of 100 ICBMs with the characteristics we estimate for the initial models, 25 would probably be out of commission at any one time for maintenance and modification. Pre-launch reliability will probably not be greater than 85%. Post-launch reliability is estimated at 60% for initial models. Thus only about 40 ICBMs out of the inventory of 100 could be expected to arrive in designated target areas. (See also Appendix "C").

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Medium and Intermediate Range Ballistic Missiles

55. We estimate that a ballistic missile with a range of 700 nm has been available since 1956, and that an IRBM with a range of 1000-1100 nm will be available in 1959. Further, certain targets on the periphery of the Soviet Union require a missile with a range of 1600-1800 nm if they are to be attacked from Soviet territory, and we estimate that such a ballistic missile could be available by 1962-1964. The main use of these missiles would be against peripheral targets including those in Alaska, and their initial estimated accuracies and warhead yields suggest that they are unlikely to be reasonable weapons for use against targets other than SAC bases, soft ICBM sites and area targets, unless the Soviet planners are prepared to employ large numbers of missile or to depend upon secondary effects. However, the eventual characteristics of the 1600-1800 nm IRBM might allow it to become a reasonably effective weapon against hardened point targets at all these medium and intermediate ranges.

Air-Launched Missiles

56. It is known that jet medium bombers have been used as carriers for air-to-surface missiles, and we estimate that a subsonic cruise-type missile with a range of 55 nm and designed primarily for anti-ship use is now operationally available for use by BADGERS. Further, information on Soviet propulsion, airframe and control and guidance design has demonstrated Soviet capabilities to provide component parts for more advanced air-to-surface systems. We estimate that a supersonic missile with a range of 100 nm could be available by 1960, and that a supersonic missile with a ram-jet engine and a range of 500 nm could be available by 1962-1964. The extended range of the 500 nm missile would probably dictate the employment of a purely inertial guidance system, which may well be the main factor in determining availability. However, Soviet gyroscopic development appears to be fairly advanced and we do not think that guidance problems associated with the development of a 500 nm air-launched missile would be beyond Soviet capabilities. The Soviet Union may also consider the development of an air-launched ballistic missile. A design study for a system of this kind with a range of 1000 nm is under way for the USAF; this is believed to be a feasible and practicable weapons system involving only hardware now developed or equipment under development.

57. The 100 nm missile would probably be designed for launching from current types of medium and heavy bombers; we would expect the 500 nm missile to be designed primarily for employment with a supersonic aircraft, although present strategic bombers should also be capable of launching it.

58. We would not expect the currently available 55 nm air-to-surface missile to be used against North America, as its warhead yield is limited to the kiloton range and it appears to be primarily an anti-ship weapon. The more advanced missiles will however be capable of carrying megaton warheads, and a proportion of the inventory will no doubt be allocated to the attack on North America.

Submarine-Launched Missiles

59. Soviet authorities have expressed interest in the naval applications of guided missiles and have made statements implying capabilities in this field. Activity related to the possible development of submarine-launched cruise-type missiles may have taken place as early as 1948 (when V-1 type missiles were reported to have been fired from the decks of submarines) and since that time continuing reports have contributed to intelligence on the subject. However, no positive evidence exists to indicate that the Soviet Union has completed the development of any cruise-type missile, or that any large-scale programme of converting submarines for launching such missiles has been undertaken. No reliable evidence is available which would indicate Soviet development of naval ballistic missiles; nor have we knowledge of the

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development of solid-fuel missiles for any but the shortest ranges. Nevertheless, we consider that the Soviet Union is capable of developing both cruise-type and ballistic submarine-launched missile systems.

60. Although we estimate that the Soviet planners have a requirement for submarine-launched missile systems, we do not know when any particular programme may have commenced, and we therefore cannot estimate with any accuracy when capabilities in this field could have been acquired by the Soviet navy. There is some evidence which suggests that the Soviet navy may already have a capability with cruise-type missiles, but the scanty nature of this evidence leads us to believe that the missile or missiles developed for this purpose would not have ranges of more than 200 nm; that the system could not have become operational before 1956 or 1957; and that a large-scale programme of submarine conversions was probably not undertaken by the Soviet Union.

61. A Soviet requirement is considered to exist for the development of a submarine-launched ballistic missile with a maximum range of 1000 nm and a warhead yield of up to 5 MT, and we estimate that a carrier submarine for such a missile could be available by mid-1961. In general, the problem of design and development of the submarine-launched ballistic missile is more intricate than that of the land-launched missile, particularly as large solid-propellant engines are believed to be a requirement for the former. There were indications that Soviet development of small solid propellant engines was at least on a par with that of the West after the Second World War, but United States progress with the Polaris project implies some major advances in casting, thrust termination and control and burning; and it is not known if the Soviet Union has made similar advances. However, we estimate that, had the Soviet Union embarked on the project early in its missile programme, it could be expected to have an operational capability with a submarine-launched ballistic missile in the period 1962-1964. This missile would have inertial guidance, a maximum range of 1000 nm, and a CEP of 3 nm. (This CEP excludes inaccuracies due to navigational errors of the carrier, which are likely to be of the order of 0.5 nm.) By 1965-1967, the accuracy of the missile could probably be improved to give a CEP approaching 1.0 nm.

62. We have no data on which to estimate numerically the numbers of Soviet submarines that may have already been converted for missile-launching or that may be so converted in the future, and no data on which to estimate the numbers of submarines that may be built specifically for missile-launching. However, as we have suggested in paragraph 60 above, we consider that a small-scale programme of conversions for topside stowage and launching of cruise-type missiles may have been started in 1956 or 1957. We estimate that perhaps 20 such conversions could have been completed within six months of the decision to do so but we cannot estimate either when the programme may have started or how many conversions may have been planned. It is probable that the Soviet Union is also developing new types of missile-launching submarines designed for internal missile stowage and possibly including ballistic missile-launching types. We estimate that the submarine-launched ballistic missile, if it becomes operationally available, will do so about 1962-1964, and we would presume that the development of the platform will be related to the availability of the missile. Submarines converted for topside stowage of cruise-type missiles could probably only carry two such missiles. Ballistic missile launching submarines may be capable of carrying 12 missiles each and of launching them when submerged.

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Availability and Allocation
of Nuclear Weapons

63. The table at Appendix "I" gives estimates of the numbers of nuclear weapons that may be available to the Soviet Union between 1960 and 1963. It is emphasized that this data is extremely tentative, particularly for the years after 1960. Useful estimates cannot be made for years after 1963, and it must be assumed that by this date, if not before, availability will be at least equal to requirements. Appendix "H" also gives tentative estimates of the weights of nuclear weapons of various yields at various dates.

64. A number of assumptions were made in calculating the numbers of weapons likely to be available to the Soviet Union. The main assumption is that we are able to continue to divide nuclear weapons into two broad categories: the all-fission (or boosted fission) type with a yield range of 1 KT or less to 100-200 KT; and the fission-fusion type with a yield range of 0.5 to 10-20 MT. We assume that on the average the fission-fusion type will require three times as much fissile material as the all-fission or boosted fission type. This proportion may become less as high-yield weapons are made "cleaner", but the possible decrease in requirements for fissile material which may result will be more or less offset by the increasing requirements of Soviet nuclear power and propulsion programmes. It is estimated that these requirements, which now represent perhaps 5% of available stockpile of material, may represent about 15% of the stockpile in 1971.

65. Estimates of the weights of nuclear weapons are highly speculative after 1960. It should be noted that in any nuclear weapon the containing material, the conventional explosives, the timing mechanisms, etc. make up the bulk of the weight, regardless of the yield of the weapon. Thus all-fission weapons, even if boosted, will remain relatively heavy and will not reflect the drastic reductions in weight that are suggested for high-yield weapons. The only possible exceptions to this rule are the very low yield "pipsqueaks" which may come into service after 1960, but which make a highly inefficient use of fissile material.

66. It is impossible to determine with any accuracy how the Soviet planners may divide their available nuclear weapons between their various forces with nuclear capabilities, but it is improbable that there will be any shortage of weapons, except possibly during the first two or three years of the period of this estimate. Until about 1960-1961 there may be some competition for available fissile material between the demands of small-yield weapons for tactical use and for air defence and the demands of large-yield weapons for use against retaliatory forces and area targets. If this competition arises, we presume that the Soviet planners would be prepared to restrict the availability of weapons for tactical use in the interests of air defence and attacks on retaliatory bases; we presume that the Soviet planners are arranging their production schedules with this factor in mind. In any case, our information on this subject is so conjectural that we cannot use it as a basis for any estimate that shortage of nuclear weapons will be a limiting factor in the Soviet attack on North America at any time during the period of this estimate.

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Biological, Chemical and Radiological Weapons

Biological Weapons

67. Very little is known about the achievements of Soviet BW research in recent years, but we believe that the Soviet Union has an active programme encompassing anti-personnel, anti-crop and possibly anti-livestock agents. Current research appears to be directed towards the stabilization of aerosols, and studies in different routes of infection and virology. We estimate that the Soviet Union is now capable of employing bacterial agents on a large scale against men and animals, and that it will have a similar capability with virus in about 1965. We believe that substantial progress will be made in the modification of the immunogenic properties of bacteria and in the adaptation of the viruses of animal diseases to human hosts. Extremely virulent organisms of this type could be developed during the early part of the period of this estimate; by about 1968 these could be available for filling into munitions. No estimates are available of the amounts of BW material likely to be available to the Soviet Union at any given date or of the lethality of individual agents. Delivery of BW agents could be accomplished by aircraft spray, aircraft bombs, missiles or by clandestine means.

68. We do not consider that the Soviet planners would appreciate that BW agents were suitable weapons for the attack on Western retaliatory capabilities, because of the delay between the attack and the appearance of its effects and because physical installations would not be destroyed. There is a somewhat greater chance that BW agents might be used to attack population and industrial targets, either in areas which the Soviet planners did not wish to devastate or in support of an attack with nuclear weapons. It is also possible that, if the conclusion of the initial nuclear exchange left the Soviet Union with delivery capabilities but no nuclear weapons (an unlikely eventuality), the Soviet planners might turn to the use of BW agents as a last resort.

Chemical Weapons

69. The Soviet Union is able to produce G-agents and it is probable that it is now, or shortly will be, in a position to produce V-agents in operationally significant quantities. We do not believe that major increases in toxicity could be obtained by further development of agents now known to exist; other types of chemical substances which act by a route different from those now available are known to be highly toxic, but it is unlikely that any of these will be developed into useful CW agents during the period of this estimate unless a breakthrough should occur. No estimates are available of the amounts of CW material available to the Soviet Union. The Soviet Union is thought to be capable of delivering CW agents by aircraft or ground spray, aircraft bombs, artillery shells and missiles. CW weapons would not be suitable for the attack on Western retaliatory capabilities because they would not destroy physical installations and because of the ease with which such targets could be protected from their effects. There is some chance that CW agents might be used to attack population and industrial centres, either in areas which the Soviet Union did not wish to devastate or in support of a nuclear attack.

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Radiological Weapons

70. With the growth in the number of nuclear reactors, considerable quantities of radioactive waste materials are becoming available. We doubt, however, whether the inherent difficulties associated with radiological weapons will be overcome by 1971, and we do not think that this type of warfare will occur except as a by-product of the use of dirty nuclear weapons.

Electronic Warfare and Decoys

71. Little information is available on Soviet electronic countermeasures (ECM) facilities. However, the Soviet Union does not at present lag behind the West in this field and the assumption is therefore generally valid that future operational performance of Soviet equipment will at least equal present forecasts of the state of the art in the West for given dates. The following paragraphs briefly estimate the state of the art in the present and foreseeable future, in relation to possible forms of attack.

Large Raids by Aircraft

72. The effective average jamming power which Soviet bombers could radiate uniformly over all vulnerable frequency bands of the present North American air defence environment (comprising ground-to-air communications, "L" and "S" band ground radars and "X" band fire control systems) may amount to about three to four watts per Mc. per bomber, increasing after 1963 to about 10 to 20 watts if no frequency diversity radars are introduced by this time. The carrying of the necessary equipment would impose no significant performance penalty on bomb-carrying aircraft, and its use would deny range information to ground radars not provided with passive location systems and probably unlock airborne intercept, fire control and missile seeker radars. Jamming power densities could be increased to 50 watts per Mc per bomber or more in selected parts of the frequency spectrum.

73. Special ECM aircraft or decoy drones may be used to increase confusion and conceal weapons carriers.

74. The use of chaff by all aircraft is indicated. However, it may well be reserved for penetration of the main defence zone, where it would be valuable against interceptors in addition to ground radars. For this purpose chaff-sowing drones appear likely. Fast-blooming chaff may be very effective for unlocking lock-follow radars, and delayed-opening chaff will add substantially to the confusion of ground radars.

75. The introduction of radar absorbing material (RAM) for the camouflage of aircraft is likely by 1963, and the relative efficiency of ECM will therefore be correspondingly decreased. Aircraft of a size comparable to the BISON would require of the order of 4000 lbs of RAM although it is believed that aerodynamic characteristics would be relatively unaffected. The penalty of this added weight would be a reduction in the radius of action of an aircraft comparable to the BISON by less than 100 nm.

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Sneak Raids by Aircraft

76. Active ECM is unlikely until aircraft are fairly close to their targets. Measures designed to confuse specific weapons systems will then be used. In particular chaff from drones and infra-red countermeasures appear likely.

ICBM Attack without Active Defences

77. The radar cross-sections of the nose-cones of ICBMs may be reduced from 0.1 to 0.01 square metres by shaping alone; by the use of RAM this figure may be further reduced to 0.001 square metres before re-entry. This latter figure will render the ballistic missile early warning system (BMEWS) as presently conceived completely ineffective.

78. In order to confuse the prediction of missile trajectories by BMEWS the final stage of the rocket case may be disintegrated. Ground-based jamming of BMEWS is not very likely, but attempts could be made to achieve long-range jamming effects by illuminating clouds of chaff released near the apogee of the ICBM's trajectory or by means of "smoke-puff" techniques. Airborne jamming from ranges of the order of 300 miles is feasible, but missile jammers are unlikely.

ICBM Attack against Active Defence

79. Due to improvements in ICBM payload and reduction in warhead weight, which may begin to be introduced by about 1962 or 1963, it is likely that a large number of decoys will be carried by each missile. These might well be released near apogee with relative speeds up to 50 ft per second, and will provide a sphere of five mile radius at the target containing 20 or more sophisticated decoys. Chaff, which would probably also be present during the latter part of the trajectory, would burn up on re-entry, but the main decoys, which would have aerodynamic and radar characteristics closely similar to those of the warhead, would accompany the warhead through re-entry. Currently conceived radars would be unable to sort these decoys and the defence would be faced with the problem of attacking all the objects.

Aircraft-Type Decoy Missile

80. The decoy missile is a small, inexpensive vehicle that is designed to fly at the same altitude and speed as the attacking aircraft, and provide a radar echo identical to that of the aircraft. If the Soviet programme should be similar to that of the United States, the decoys would be carried internally by the bomber. The B-47 can carry four decoys and the B-52 eight. If both decoys and weapons are carried the number of decoys would be reduced by a half, and the aircraft would suffer a significant performance penalty.

81. Decoy characteristics can be readily defined since their size is limited by the storage space available, and their performance and radar characteristics must be similar to those of the weapons carriers they are to simulate. Their design and manufacture could be readily carried out by the Soviet Union.

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Space Vehicles

82. The Soviet Union has a serious interest in astronautics and all indications point to an ultimate intention to achieve manned space flight. In particular, in April 1955, the Soviet Union announced the establishment of the Interagency Commission for Interplanetary Travel. The Commission was assigned the problem of creating an artificial earth satellite, which was to be a first step towards interplanetary travel. This task was accomplished in October 1957 when the first satellite was launched successfully.

83. The Soviet Union will probably proceed by means of a series of logical steps, the first of which has been the launching of scientific satellites. There is no direct information on the steps likely to be taken or the dates by which they might be attempted. However, on the basis of the programme that will probably be undertaken in the West and in the light of certain articles that have appeared in Soviet scientific literature, these steps may consist of the following:

Unmanned: Advanced Satellites:

- heavier, with more sophisticated equipment and oriented;
- high perigee and apogee
- recoverable, capsule type.

Lunar Vehicles:

- instrumented probes
- instrumented recoverable probes
- instrumented lunar landing

Mars and Venus Vehicles

- instrumented probes

Manned: High Altitude Rockets

Satellites

- capsule type
- glide type

Lunar Vehicles

- circumlunar

84. Soviet accomplishments and activities in related areas, such as rocket technology, celestial mechanics, electronics and space medicine, indicate a capability to undertake these steps. Many of them, particularly unmanned advanced satellites and lunar vehicles, could probably be accomplished in 1959. However, before safe and reliable space flight is attained, much information on conditions in space must be acquired and many technical and physiological problems must be solved. The launching of a manned satellite with recovery from orbit might be accomplished by 1962. Manned circumlunar flight might be accomplished towards 1970.

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Possible Military Applications

85. The military implications of the Soviet space programme are not yet clear, but one type of space vehicle, the earth satellite, is known to have military potential. Some of the more practical military applications that have been proposed for earth satellites are: reconnaissance, i.e., to provide meteorological information, intelligence on the larger military targets (such as large ships, large troop concentrations and large facilities at airfields), survey and mapping information, detection of ballistic missile launchings; and monitoring of radio transmissions; relaying of communication; provision of a platform for ECM activities; and the detection of nuclear explosions. Soviet literature has in particular indicated an interest in the use of satellites to provide meteorological data and as communications relays. We estimate that if the Soviet Union so wished it could develop an unmanned military satellite with some capability for the applications listed above by 1960-1962. A completely effective system to detect ballistic missile launchings could probably not be available until 1963-1965.

86. Manned satellites, which the Soviet Union can be expected to develop as a step towards interplanetary flight, could also be used in the roles outlined above, and would have considerably greater capabilities than the unmanned types.

Forms and Scales of Aircraft and Missile Attack

87. In general, we consider that the Soviet planners appreciate that their attack will be most effective if their main offensive weapons system for use against North America changes from the manned bomber to the ballistic missile as soon as possible; we consider also that developing Soviet capabilities will allow this change to take place early in the period of this estimate.

88. A consideration of all factors leads us to outline the forms and scales of attack by aircraft and missiles in three phases as follows.

Phase I

89. During the period from mid-1959 to about the end of 1960, the manned bomber will be the only Soviet weapons system that can deliver nuclear weapons on North America in any numbers, although a few relatively unreliable and inaccurate ICBMs and submarine-launched cruise-type missiles will probably be available in 1960. However, in addition to the attack on North America, Soviet strategic aircraft must during this period be employed to attack peripheral nuclear retaliatory bases, naval forces with nuclear retaliatory capabilities, certain other military targets, and population and industrial centres at least in the United Kingdom. Certain aircraft (light bombers) will necessarily be limited by their ranges to attacks on targets outside North America, but including Alaska. It is reasonable to assume on the other hand that the entire heavy bomber force will be used in the attack on North America. The Soviet planners must, however, divide the BADGER and BULL force between the demands of the attack on North America and those of the attack on other areas. We are of course unable to determine how the Soviet planners may make this allocation, but Appendix "B" suggests, with certain assumptions, that there are a minimum of 40 targets outside North America to which Long Range Air Force BADGERS and BULLS may be assigned. On the basis of five aircraft per target, it thus appears that a minimum of 200 of these aircraft (for purposes of further calculation we assume that these will all be BADGERS) may be allotted to these operations on two-way unrefuelled missions.

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90. We thus estimate that the maximum force available for use against North America in mid-1959 will consist of about 100 heavy bombers (say 40 BEARs and 60 BISONs), about 900 BADGERs and about 375 BULLs, before allowance is made for any degradation. We concede that BADGER and BULL aircraft are by no means entirely suited to the task of attacking North America, but under the circumstances in which we envisage that war would commence (see paras. 14 and 15) we believe that the Soviet planners would probably be prepared to sacrifice a number of these aircraft on one-way missions in an attempt to reduce the scale of Western retaliation.

91. The Soviet planners might appreciate that their objectives can best be accomplished by an attack with two-way and one-way refuelled and unrefuelled missions against nuclear retaliatory bases, and also against as many urban areas and other targets as their capabilities allow, executed as directly and as quickly as tactical considerations permit. Non-combat degradation and the requirement for tankers would reduce the number of aircraft that could arrive over target areas. If all 1375 aircraft were employed under optimum conditions, the number of aircraft that could arrive in target areas would be about 560, not considering combat losses. If the attack force on North America consisted of BEARs, BISONs and BADGERs only, and BULLs were not employed either against North America or peripheral targets, the number of aircraft that could arrive over target areas under optimum conditions would be about 320, not considering combat losses. If only BEARs, BISONs and the one-third of the BADGER force that is thought to be trained in air refuelling (see para. 36) were employed, the number of aircraft that could arrive over target areas under optimum conditions would be about 150, not considering combat losses. These numbers of aircraft over target areas would be further reduced if the Long Range Air Force were not given adequate notice of the impending operations, or if weather conditions were adverse.

92. Such ICBMs and submarine-launched cruise-type missiles as are available in 1960 may be directed against area targets in North America.

93. The threat to Alaska during this phase will be from light bombers, medium and intermediate range missiles and possibly a small number of BADGERs. It should be noted that BADGERs have been allocated for this purpose, and that this requirement (if it exists) will not further degrade the numbers of these aircraft available for attack on the United States and Canada.

Phase II

94. The period from about the end of 1960 to 1963-1964 will be one of transition during which the missile threat will sharply increase. It is probable that by 1964 at the latest the Soviet planners will have at their disposal ICBMs that are as effective as the manned bomber against all but very small and very hard targets such as hard ICBM sites, and in sufficient numbers to bring under attack all the targets listed for this date in Appendix "A". By 1964 therefore we estimate that the ICBM will have replaced the manned bomber as the primary vehicle of weapons delivery against North America. The protected launching sites in North America of solid-fuelled rapid-reaction missiles will present the Soviet planners with a dilemma. ICBMs will be ineffective against them, unless reliance is placed upon secondary effects to reduce the scale and speed of reaction, while manned bombers which possess the necessary accuracy will also be ineffective because of the relatively lengthy warning that can be obtained of their approach.

95. During this period BISON and BEAR aircraft will be phasing out, and the numbers of available BADGERs will be reducing, although more than 1000 of the latter may still be available even in 1964. Supersonic

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recce/bomber aircraft will have become available and some 200 may be in order of battle of the Long Range Air Force by the end of the period. As ICBMs become available with improving characteristics and in increasing numbers they will progressively assume the task of weapons delivery against North America, while the roles of aircraft will be progressively confined to those of reconnaissance, raid assessment and attack on special targets. If for any reason the ICBM programme does not meet requirements, larger numbers of supersonic aircraft may be produced as weapons carriers, while BISON and BEAR aircraft may be continued in service.

96. Soviet submarines are maintained on patrol in waters relatively close to North America in peace-time. A number of these submarines, apparently operating in their normal peace-time roles, could be positioned to supplement the ICBM attack by launching missiles from directions not covered by our ballistic missile warning and defence systems.

97. The threat to Alaska, by 1963-1964, will be largely from missiles.

Phase III

98. The period from about 1964 to 1971 will be distinguished by two main developments: second-generation ICBMs should become available to the Soviet Union by about mid-1965, and the characteristics of these missiles should steadily improve until by 1968 they are highly reliable and have a small CEP with a large warhead yield; and North American retaliatory capability might by about 1967 or later be largely based in numbers of hard sites. Although we do not think that even by the end of the period of this estimate the characteristics of ICBMs will be adequate to give a high probability of the destruction of a hard ICBM site with one shot, we nevertheless consider that growing inventories will induce the Soviet planners to direct their ICBMs against these targets as well as against area and soft targets.

99. During this phase, also, satellites with increasing capabilities for reconnaissance will become available; and by the end of the period supersonic nuclear-powered aircraft and boost-glide aircraft should be available.

100. Under these conditions, we cannot estimate scales of attack.

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PART III - OTHER THREATS

Threat from Amphibious and Airborne Forces

Airborne Capabilities

101. The Soviet Union has about nine airborne divisions and ample reserves with parachute training. There is slight evidence that the Soviet Army may be planning to increase the number of airborne units, but we think that in general emphasis will be on increasing the effectiveness of existing forces. Nevertheless the Soviet airborne training system is capable of expansion to meet increased requirements. Airborne troops receive continuous training, but so far paratroops have only been observed in exercises operating immediately ahead of deployed divisions. No full-scale airborne exercise has been reported in which airborne troops were employed in isolated locations and supplied by air continuously.

102. At present Soviet Aviation of Airborne Forces is not equipped with any medium or long-range transports with front or rear loading doors and capable of carrying heavy equipment. About one-fifth of the Airborne Forces aircraft are helicopters and this proportion appears to be increasing, which may reflect the short-range close-support nature of the force. Air transport capacity could theoretically be increased by the use of transport aircraft of the Civil Air Fleet, but under the conditions of the kind of war we envisage we would expect these aircraft to be very largely employed on the maintenance of emergency communications. Present Soviet lack of adequate numbers and types of equipments for airborne operations could of course readily be rectified during the next twelve years.

Amphibious Capabilities

103 Any Soviet division could of course be transported by sea if sufficient shipping were available. However, Soviet amphibious exercises so far observed have been on a small scale and have usually employed specially trained marines. There have been no indications that the Soviet Army is organizing or training units for long sea-crossings and assault landings.

Weapons and Equipment

104. Soviet ground forces possess an adequate range of modern weapons and equipment, which is undergoing continual improvement. Weapons capable of firing nuclear shells and able to be transported by helicopter already exist, and there are indications that surface-to-surface missiles of various ranges are now going into service although it is most unlikely that any of these could be transported by air. It is possible that during the later years of the period of this estimate Soviet ground forces may have available fractional KT man-pack nuclear weapons, in addition to an improved range of light field rocket equipment.

Forms and Scales of Attack

105. Successful airborne operations within the limited ranges of available aircraft against Alaska, the Aleutians and Northern Canada could deny bases and other installations to us, while enabling the Soviet Union to make use of them. However, the denial of bases for our operations could be more effectively and economically achieved by bombing or missile attack, and we do not think that the Soviet planners will place any reliance on the use of bases in North America in the conduct of their operations against this continent. Small ground parties could facilitate the operations of Soviet aircraft by installing navigational aids in the

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North, and could reduce the effectiveness of the North American early warning system by attacks on small and isolated air defence installations. However, we do not think that the Soviet planners would be prepared to rely on operations of this kind for the conduct of their air offensive against North America.

106. It has been argued that airborne attacks, on even a small scale, would create public alarm and result in demands for defensive measures which would cause maldesployment of North American forces. We consider, however, that in the context of a nuclear exchange advantages of this nature would appear marginal to the Soviet planners and that they would be inadequate by themselves to justify the mounting of such operations.

107. On balance we consider that it is generally unlikely that the Soviet Union would attempt airborne operations against North America at least in the early stages of a nuclear war. The possibilities remain, however, that small parties might be landed with radio and electronic equipment to acquire intelligence or to assist the aircraft and missile attack; and that small numbers of airborne troops equipped with man-pack nuclear weapons (when these are available) could attack a few targets which were considered unprofitable for aircraft or missiles.

108. Amphibious operations from surface ships employing a maximum of 4000-6000 troops in the initial assault against the Aleutians or the coast of Alaska north of Bristol Bay are within Soviet capabilities. However, such landings would be very vulnerable to nuclear counter-attack and we do not think the Soviet planners will consider them justified. Small groups could be landed from submarines on the coasts of Canada and the United States. This threat is considered insignificant, unless perhaps the troops were equipped with man-pack nuclear weapons.

Threat from Naval Forces (other than that
posed by Missile-Carrying Submarines)

109. Although the Soviet Union possesses a large and modern surface force, which is undergoing constant improvement in weapons and techniques, we consider that the only Soviet naval forces which may be capable of reaching North American waters¹ during the period of this estimate are aircraft of Naval Aviation and submarines. The employment of submarines as missile-launching platforms is considered in Part II, and this section deals only with the minelaying and torpedo threat posed by these boats.

Naval Aviation

110. Although Soviet Naval Aviation at present includes jet and piston medium bombers, it is limited by lack of aircraft carriers to operations within the ranges of land-based aircraft. We think the main mission of these aircraft will be to assist in locating and attacking Western naval forces with nuclear retaliatory capabilities. Some of these forces will of course be in North American waters, but we consider that the aircraft of Naval Aviation will be allotted to operations at shorter ranges, and that operations of this nature against North America will be primarily the preserve of the Long Range Air Force, which is better equipped and trained for the task.

¹ North American Waters are these areas of the Atlantic and Pacific Oceans from which missile-launching submarines can attack targets in North America.

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Submarines

111. At present, the Soviet Union has a total of over 300 modern long-range submarines in its Fleets. These submarines are dispersed among four main fleet areas, which are virtually independent of each other. Only those submarines based in the Northern and Pacific Fleet areas can be considered an immediate threat to the North American continent during the initial stages of a war. However, there are alternative bases for submarines of the Baltic Fleet in the Northern Fleet area, and it is possible that those long-range submarines of the Baltic Fleet which were not required for defensive purposes would be moved to the Northern Fleet area before hostilities in a way which would not prejudice surprise. A greater threat to North America could thus be developed in the early stages of a war and without gaining control of the exits from the Baltic Sea.

112. At least one new class of submarine is in production in the Baltic and it is probable that submarine construction is also being carried out in the Far East. Sightings of certain of the new types suggest that they are conventionally powered, but other types, possibly with nuclear propulsion, are thought to be in production also. It is estimated, however, that the number of operational submarines in the Soviet Navy has reached its maximum and that new construction is intended to replace the older existing classes.

113. In addition to posing a serious threat as a weapon of attrition against Western sea lines of communication throughout the world, Soviet submarines, other than those equipped for missile-launching, are capable of carrying out the following operations in the ocean areas adjacent to North America:

- (a) torpedo attacks on naval forces and merchant shipping;
- (b) "killer" operations against Western submarines in the transit areas near North American submarine bases;
- (c) minelaying on coastal convoy routes and in approaches to ports and harbours, either as specific missions or as part of other anti-shiping operations.

Submarine Weapons

114. In addition to conventional torpedoes of the types used in the Second World War, the Soviet Union is believed to have a torpedo with hydrogen peroxide propulsion, a range of 16000 yards at 48 knots or 10000 yards at 55 knots, and equipped for passive homing or pattern running. It is thought that improvements in the immediate future will increase the range of this torpedo to more than 20000 yards, and that by 1960 an 1100 lb warhead, possibly nuclear, could be carried. An active homing torpedo may come into service at the beginning of the period of this estimate.

115. The Soviet Union has stockpiled bottom mines actuated by magnetic induction. The most probable advances in mines will be new or improved firing mechanisms, such as influence, magnetic, acoustic and pressure devices or any combination of these. While it will be possible to fit mines with nuclear charges, it is considered that this will only be done in exceptional circumstances since it might be an uneconomical use of fissile material.

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116. It is estimated that with no warning of war the Soviet Union could have 75% of its submarines, other than missile-launching submarines, available for operations. An estimate of the numbers of these submarines available for torpedo and minelaying operations in North American waters appears in the table below. These submarines would have left their home bases but would not necessarily be in a position to commence operations immediately in North American waters.

Date	Area	Torpedo Attacks		Minelaying
		Anti-Ship	Anti-Submarine	
1959	East Coast	9	2	2
	West Coast	9	1	2
1963	East Coast	11	3	2
	West Coast	12	2	2
1968	East Coast	11	3	2
	West Coast	12	2	2

117. The mining threat in North American waters is estimated to be in the approaches to ports and harbours, and in focal areas of shipping. Minelaying could commence immediately upon the outbreak of hostilities and continue, but we do not think that mines would be laid before the war because of the chance of prejudicing surprise. Submarines can be expected to lay both moored and ground mines with various types and combinations of influence firing mechanisms. The number of minelaying submarines to be employed in North American waters will be generally as shown in the table above, but from time to time concentrated minelaying operations employing a considerable number of submarines may be expected. It is also expected that submarines employed on missile and mining missions will carry a limited number of torpedoes for targets of opportunity.

Sabotage, Subversion and EspionageSabotage

118. There is no evidence to indicate that Communist Parties in North America are organizing sabotage groups. However, known and anonymous native communists and fellow travellers could take part in sabotage attacks planned and coordinated by trained Soviet nationals who had infiltrated the United States and Canada, and who would themselves be capable of sabotage. Native communists and communist sympathisers could also commit undirected acts of sabotage against targets of opportunity. The physical means of conventional sabotage, such as fire, explosives or abrasives could readily be procured from local sources. BW agents and their disseminating devices could be procured locally or smuggled into the country.

119. The main targets of any organized attempts at sabotage in North America would probably be sources of electric power, transportation systems and communications networks, sabotage of which would hamper or put out of action defence industries and installations. Sabotage by communists or sympathisers acting on their own initiative could be directed against a wide range of targets of opportunity.

120. Because of the danger of prejudicing surprise, sabotage is unlikely to be carried out before the outbreak of hostilities. However, during and after the initial attack, sabotage committed both by trained Soviet

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saboteurs and by native communists and sympathisers acting spontaneously or under guidance is probable, although the scale of such operations would be reduced both by the effects of the attack itself and by counter-measures.

Subversion

121. Known and anonymous communists and sympathisers, with access to communications media including underground press and radio could attempt in wartime: to undermine the confidence of the people in government policies, institutions and leaders; to exploit by rumours and other means the confusion that would exist amongst the population, especially that part of it subject to attack or evacuation; to impede vital industries and facilities through strikes and slowdowns; and to reduce the efficiency of the armed forces by adversely affecting morale.

122. Although communists using underground facilities might be active from the time the first public warning of war was issued, their usefulness for subversion would be curtailed both by countermeasures and by the effects of the nuclear attack. Subversion, including the circulation of clandestine propaganda sheets, would probably increase after the initial stages of the war, especially if it appeared that the tide of war was turning even temporarily against the West.

Espionage

123. "Legal residencies" operating under cover of Soviet diplomatic establishments in North America would be neutralized at the outbreak of war and their functions assumed by highly trained, completely-integrated "illegal residents". The latter will each have built up espionage networks designed to operate during an emergency, and will possess the radio equipment necessary for efficient clandestine communication with the Centre in the Soviet Union. The networks would attempt to ascertain the degree of success achieved by Soviet attacks on North America, and to furnish the Soviet Government with data on North American capabilities, potential and intentions.

124. In spite of the efforts of Western counter-intelligence the Soviet Union will retain a capability to conduct espionage operations in North America. The scope of these operations would be limited however by the disruption of the networks caused by the nuclear exchange itself.

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PART IV: PROBABILITY OF WARNING

125. We consider that there is no chance of receiving direct knowledge of the Soviet policy decisions to go to war or to attack North America, nor of the operational plan of attack. Warning other than that derived from North American and European radar defences must be the result of a judgement of probabilities based upon necessarily incomplete evidence. It is therefore unlikely ever to be definite and unequivocal. Neither will intelligence be able to give clear warning of the moment of attack. Such warning can only be provided by early-warning systems.

126. However, under most circumstances we may receive some evidence of preparations for hostilities on the part of the Soviet Union. Although we will rarely be able to make a firm judgement as to whether these preparations are for defence, for a show of force or for offensive action, they would, if sufficiently extensive or urgent, at least indicate a degree of risk of war.

127. The main Soviet activity from which we are likely to receive intelligence warning of attack on North America is the deployment of Soviet bombers to forward bases. While Soviet capabilities largely depend upon aircraft which require these bases for effective attack on North America we may receive some intelligence warning. As suitable missiles become operational, we shall lose our most likely source of warning.

128. The following is a summary of our views on the likelihood of warning in advance of radar warning, in terms of the phases indicated in paragraphs 88 to 100 above for aircraft and missile attack. It is assumed that the Soviet Union does not agree to any international arrangement which would provide substantially more intelligence on Soviet capabilities and intentions than is available at present and that no radically new sources of intelligence become available to us. (In the following sub-paragraphs the word "warning" means warning in advance of that provided by early-warning systems.)

(a) Phase I (mid-1959 to about the end of 1960):

- under some circumstances some 7-10 days intelligence warning would probably be provided by large-scale strategic bomber deployments to forward bases in the Arctic prior to attack;
- lesser amounts of intelligence warning may possibly be obtained from air defence, and possibly civil defence, preparations but the receipt of warning from this source could not be relied upon;
- intelligence warning deriving from other Soviet military or para-military activities would probably not be available.

(b) Phase II (1960 to 1963/1964):

- under some circumstances intelligence warning received from strategic bomber deployments prior to attacks would be about a week in 1960, and may continue to be available until 1963. Warning could be nil by the end of the period, particularly if the ICBM becomes the major weapons delivery vehicle;

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- Soviet activities associated with first generation ICBMs and IRBMs may or may not provide intelligence warning. If available, warning is unlikely to exceed several hours;
- intelligence warning is not likely to be received from other military or para-military activities.

(c) Phase III (1964 to 1971):

- it is probable that little or no intelligence warning will be available in this period.

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Appendix "A"
to JIC 308 (59)

Numbers of
Targets in North America
(excluding Alaska)

Mid-	SAC Bases	Soft ICBM Sites	Hard ICBM Sites	Weapons Storage Sites	SAGE, HQs, etc.	Area Targets
1959	52	3	-	6	4	62
1960	60	15	-	6	5	62
1961	68	30	-	6	7	62
1962	75	45	-	6	8	62
1963	75	45	30	6	9	62
1964	75	45	100	6	10	62
1965	75	45	300	6	10	62
1966	75	45	700	6	10	62
1967	60		1300	6	10	62
1968	45		1800	6	10	62
1969	30		1800	6	10	62
1970	30		1800	6	10	62
1971	30		1800	6	10	62

Naval Forces with Nuclear Capabilities: no estimate of numbers in
North American waters is possible.

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Appendix "B"
to JIC 308 (59)

Numbers of Targets Outside North
America (including Alaska) and
Distances from Soviet Airfields

Target	Distance from Nearest LRAF Home Base Area nm	Distance from Nearest Suitable Airfield in Soviet Union or European Satellites nm.
<u>SAC and RAF Bomber Command Bases</u>		
Alaska (2)	-	680
Spain (3)	1770	1170
Morocco (4)	1780	1470
Libya (1)	1290	810
UK (23)	1010	500
Guam (1)	2000	2000
<u>Other Airfields that could be used by SAC or RAF Bomber Command</u>		
Iceland (1)	1300	-
Cyprus (1)	-	570
Turkey (1)	-	400
S. Arabia (1)	1250	830
Azores (2)	2400	-
Okinawa (1)	1000	1000
Philippines	1800	1800
All Other Targets in UK (missile sites, urban areas, military installations, etc.)	1010	500
All Targets in France (tactical airfields, military installations, etc.)	1140	650
Almost All Targets in Italy	920	600
All Targets in Japan	690	690
Naval Forces with Nuclear Capabilities	Fleeting Targets	

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Appendix "C"
to JIC 308 (59)

Numbers of Weapons Required "Over Target" to give
90% Assurance that a Single Target is Destroyed or
Rendered Unusable. (1)

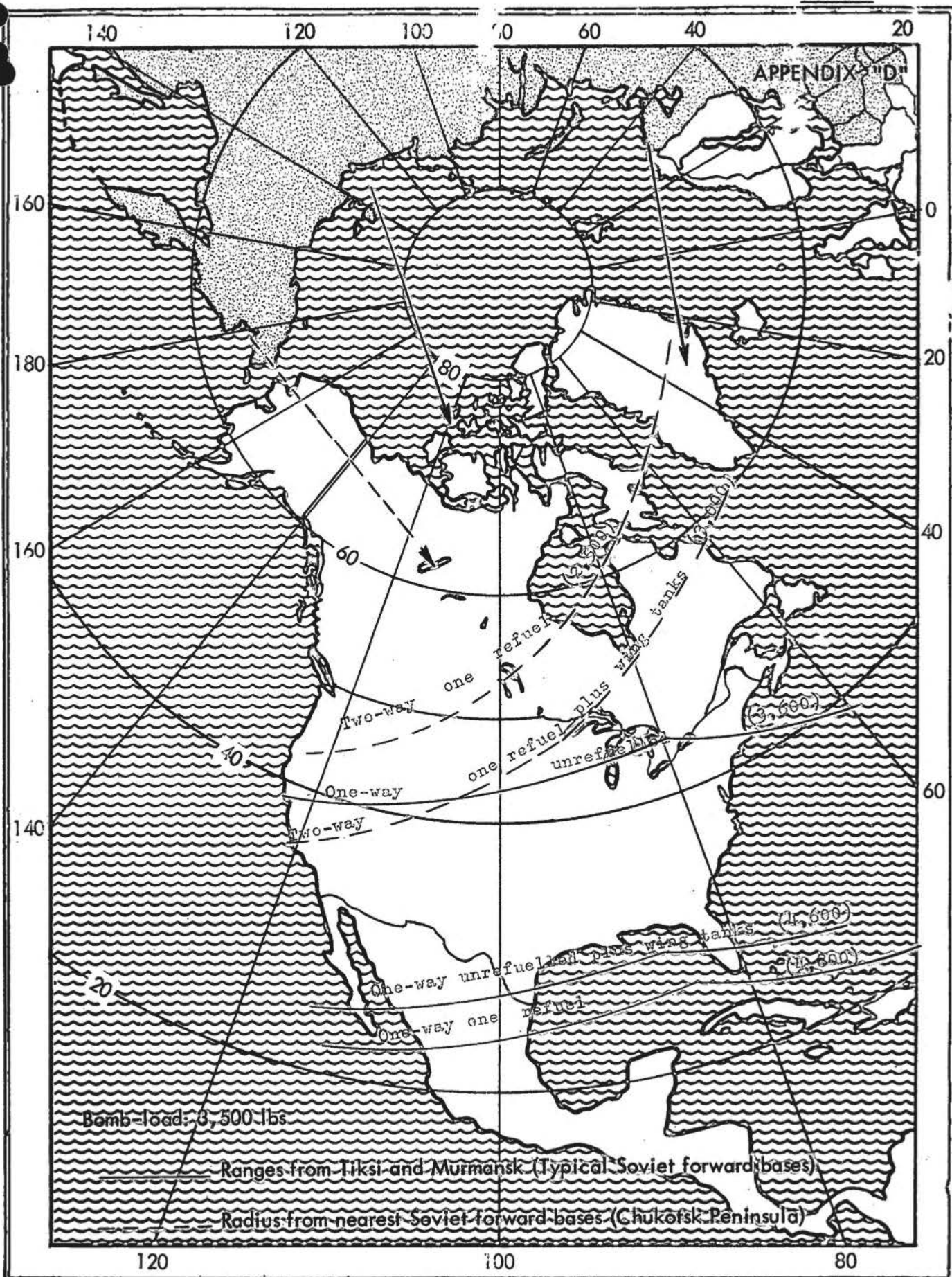
Weapon		SAC Bases (2)	Soft ICBM Sites (3)	Hard ICBM sites, weapons storage sites, SAGE installations, protected headquarters, etc. (4)		
Yield MT	CEP nm			A	B	C
0.5	0.5	1	1	5	20	10
	1.0	1	1	17	77	37
	2.0	3	1	66	308	148
	5.0	19	3	411	1920	924
1.0	0.5	1	1	3	13	8
	1.0	1	1	11	49	29
	2.0	2	1	41	196	116
	5.0	11	3	257	1210	718
2.0	0.5	1	1	2	8	6
	1.0	1	1	7	31	21
	2.0	2	1	26	121	81
	5.0	8	2	160	760	509
5.0	0.5	1	1	1	5	4
	1.0	1	1	4	17	13
	2.0	1	1	15	68	52
	5.0	4	1	89	412	314
10.0	0.5	1	1	1	3	3
	1.0	1	1	3	11	9
	2.0	1	1	10	42	35
	5.0	3	1	58	262	216

NOTES

1. No allowance for degradation due to unreliability or attrition. No bias in Mean Point of Impact. Cumulative damage effects ignored. Burst at optimum height for each target and yield. (See also footnote to paragraph 52)
2. SAC Bases: Figures based on 8 psi which is peak overpressure required to render above-ground installations unusable at hardened bases. 2-3 psi peak overpressure is sufficient to destroy aircraft on the ground, and the figures for this case are the same as for soft ICBM sites.
3. Soft ICBM Sites: Figures based on 2-3 psi peak overpressure.
4. Hard ICBM Sites, etc. Some doubt exists as to precise requirements for destruction of underground installations such as hard ICBM sites. Figures in Columns A, B and C are based on the following:
 - A. 100 psi overpressure
 - B. $2\frac{1}{2}$ X crater radius of ground burst
 - C. $2\frac{1}{2}$ X crater radius of burst 50 feet underground.
5. Area Targets are not amenable to this form of analysis. Some area targets will require more than one weapon for complete destruction but this is because of area of target rather than inadequacy of the weapon.

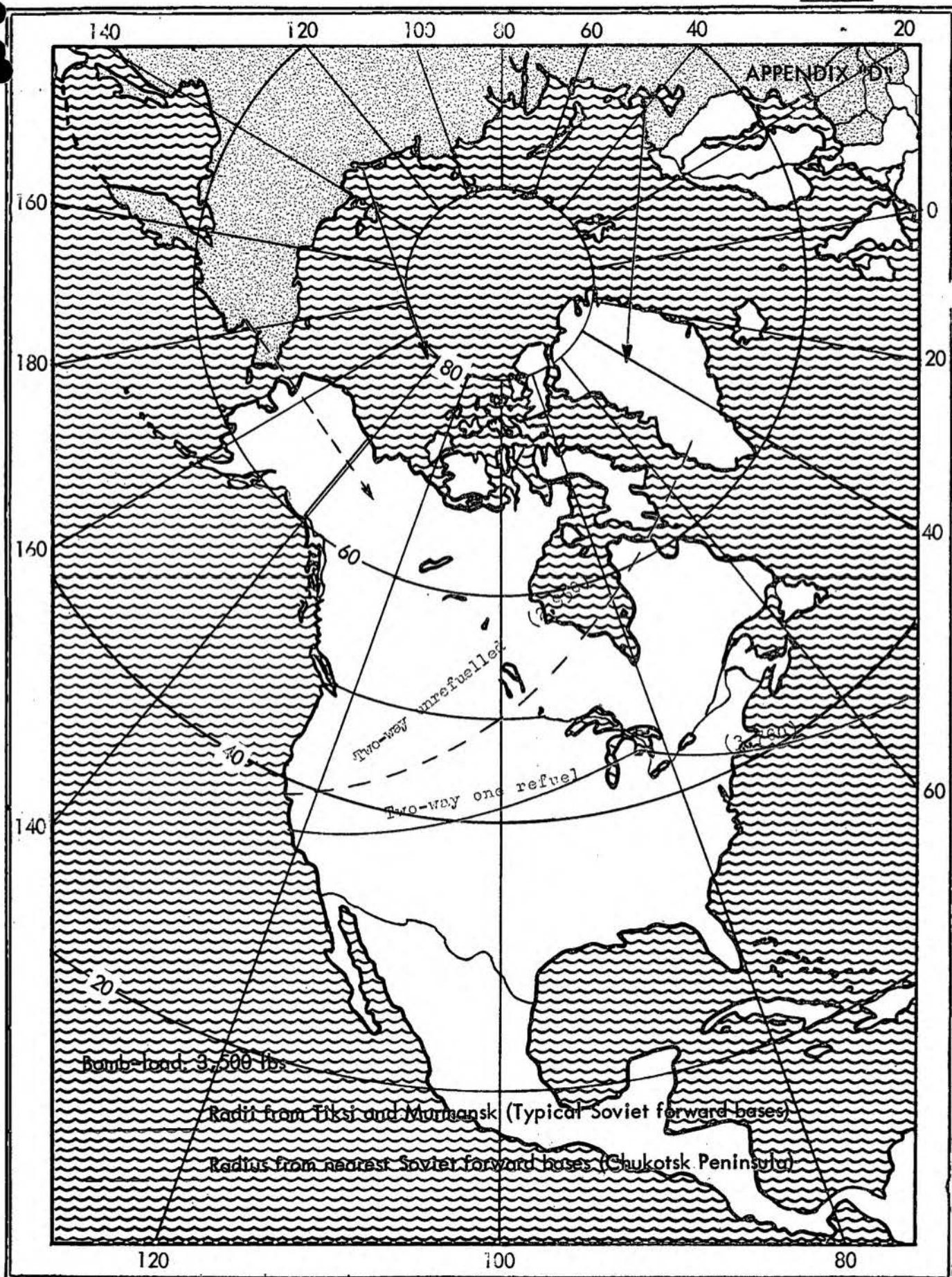
MAP 1 - OPTIMUM BADGER RADIUS AND RANGE CAPABILITIES AS APPLIED TO NORTH AMERICAN MISSIONS

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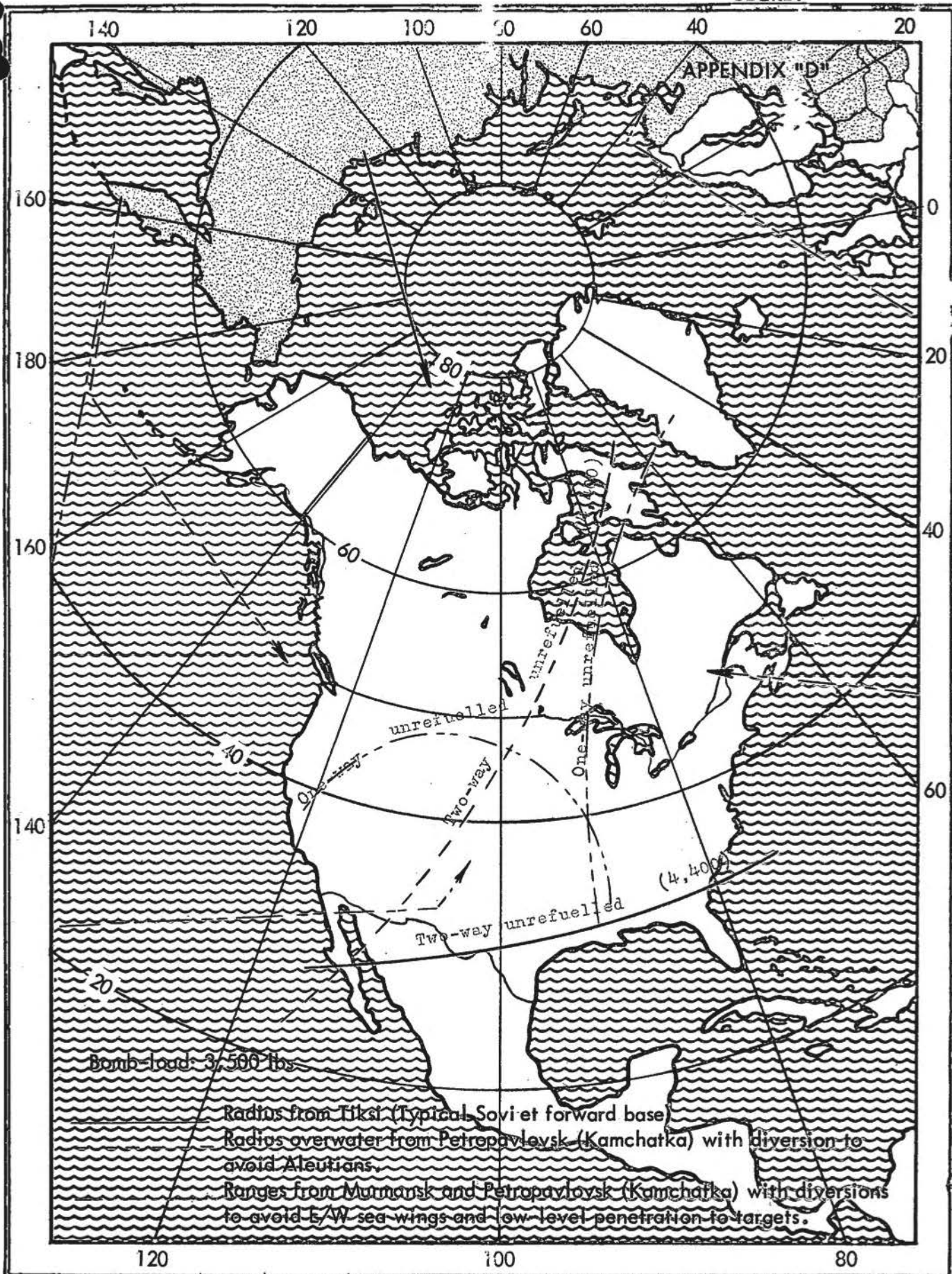
MAP 2 - OPTIMUM BISON RADIUS CAPABILITIES AS APPLIED TO NORTH AMERICAN MISSION

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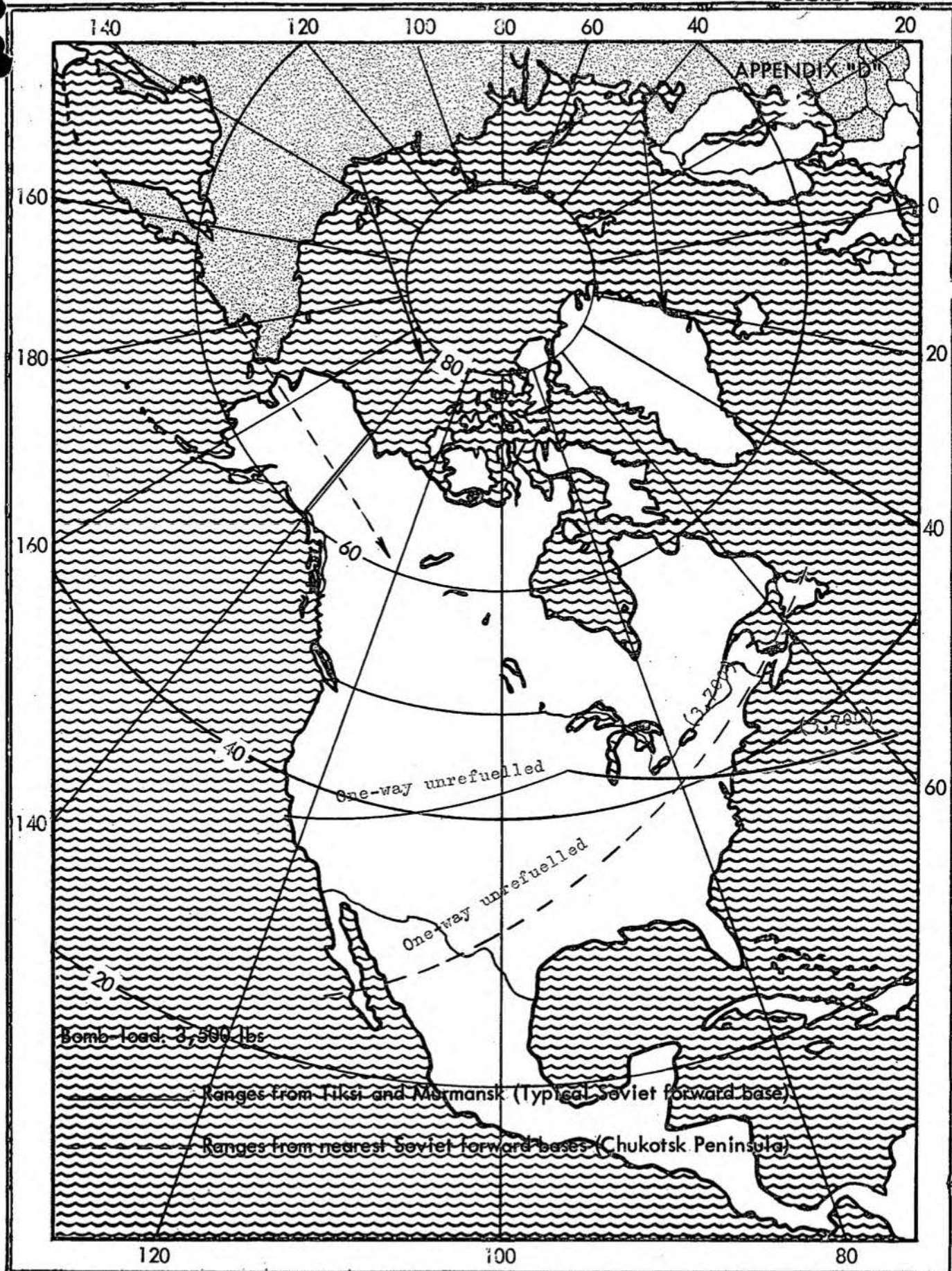
MAP 3 - OPTIMUM BEAR RADIUS AND RANGE CAPABILITIES AS APPLIES TO NORTH AMERICAN MISSIONS

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MAP 4 - OPTIMUM BULL RANGE CAPABILITY AS APPLIED TO
NORTH AMERICAN MISSIONS

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Soviet Strategic Bomber Performance

Appendix "E"
to JIC 308 (59)

SUBSONIC AIRCRAFT	BOMBLLOAD	COMBAT RADIUS/RANGE(1)		TARGET ALTITUDE(1)		SPEED	
		without refuel	with one inflight refuel(3)	one-way mission	two-way mission	average cruise	combat
	lbs	nm	nm	ft	ft	kts	kts
BISON	10000 3500	2800/5500 2950/5800	3650/7400 3700/7800	51400 51400	40900 41300	450 450	480 480
BEAR	10000 3500	4200/8100 4400/8700	5700/ - 5950/ -	50300 50300	41900 42300	405 405	450 440
BADGER	10000 3500	1600/3100(4) 1800/3600(4)	2300/4200(4) 2500/4800(4)	48000 48000	40800 41400	465 465	490 490
BULL	10000 3500	1800/3300 2050/3700	2400/4500 2750/5000	10000(5) 10000(5)	10000(5) 10000(5)	10000 ft	30000 ft
						285 280	350 345

- (1) On a low-level mission, the range of a gas turbine aircraft from the point of descent to low altitude will be reduced to about one-third of the normal range from this point.
- (2) The limits of accuracy of the altitudes shown are approximately plus or minus 1000 ft.
- (3) Refuelling estimates are based on the use of compatible tankers which will provide about 35% increase in radius/range.
- (4) Although no confirmed sightings have been made of external wing tanks on BADGERS, two 1200 Imperial gallon tanks would increase the radius/range by about 500/1000 nm.
- (5) Maximum altitude over target can be between 30000 ft and 40000 ft depending on weight. The figure of 10000 ft is the economical cruise altitude and has been assumed in the calculation of the radius/range figure quoted.

SUPERSONIC AIRCRAFT	RADIUS AND SPEED	Weapon Launch Altitude (if used as Weapons Carrier)
Supersonic-Dash Aircraft	4000 nm with two refuels at Mach 0.95 with 200 nm supersonic dash near target	60000 ft
Supersonic Cruise Aircraft	4000 nm with two refuels at Mach 2.0 (maximum speed Mach 2.5)	64000 ft (end of cruise altitude 72000 ft)

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Appendix ^{WgW}
to JIC 308, (59)

Soviet Airfield Capabilities
in Selected Forward Areas

Area	No. of Airfields suitable for heavy bomber staging	No. of Airfields suitable at least for medium bomber staging
Kola - White Sea	3, of which 1 suitable for sustained HB operations	12
Chukotsk	3, of which 1 suitable for sustained HB operations	2
Central Arctic Coast	3	4
Arctic Archipelagoes	2 (10 months of year only)	2
Kamchatka	1	1
Leningrad (within 200 nm of city)	3	17
North European Satellites	2	84 (of which about 20 have runways over 8000' long)

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APPENDIX "G" to
JIC 308 (59)

Technical Characteristics of Missiles¹
(Read in conjunction with Para. 45)

Missile	Max. Range nm	Speed	Radar Profile	Flight Profile
<u>Missiles Under Development or In Existence</u>				
ICBM	5000	Mach 0.6 (terminal)	0.1 m ² - 0.01 m ²	ballistic
IRBM	1000-1100	-	0.1 m ² - 0.3 m ²	ballistic
MRBM	700	-	0.1 m ² - 0.3 m ²	ballistic
ASM	55	Mach 0.9	-	low-angle descent
<u>Missiles that could be Developed - on Basis of Estimated Requirements</u>				
ICBM	5000-7000	Mach 3-6 (terminal)	0.01 m ² - 0.001 m ²	ballistic
IRBM	1800	-	0.05 m ² - 0.1 m ²	ballistic
Sub-Launched Cruise-type	200	Mach 0.9	about 1.0 m ²	cruise
IRBM Sub-launched	1000	-	less than 0.1 m ²	ballistic
ASM	100	Mach 2.5	-	-
ASM	≥500	Mach 2.5	-	cruise altitude: 80000 feet high-angle descent

¹ For re-entry angles and times of flight of ballistic missiles, see Appendix "H"

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APPENDIX "H" to
JIC 308 (59)

Re-entry Angles and Times of Flight of Ballistic Missiles

Missile (Maximum Range)	Burning Time at Full Range (slightly less at half range) mins	Full-Range		Half-Range ⁽¹⁾	
		Re-entry angle degrees	Time of Flight launch to re-entry ⁽²⁾ mins	Re-entry angles degrees	Times of Flight launch to re-entry ⁽²⁾ mins
ICBM (5000nm)	4.0-5.0	24	35	11 - 58	31 (average)
IRBM (1000-1100 nm)	2.5	41	13	28 - 60	9.5 - 20
MRBM (700 nm)	2.0	42	12	30 - 56	7 - 12
ICBM (7000 nm)	3.0	15.5	42	15 - 55	40 - 60
IRBM (1800 nm)	3.0	37.5	19	13 - 67	11 - 34
Sub-Launched IRBM (1000nm)	1.5	41	13	28 - 60	8.5 - 19

- (1) Ballistic missiles when fired to less than full range could employ either optimum trajectories or trajectory variations using the same cut-off velocity as for full range. In general, the minimum range of all missiles is about half of the full range.
- (2) Add about 1 minute in each case to obtain time of flight from launch to impact.

Soviet Nuclear Weapons: 1958-1971

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 Appendix 1
 to JIC 308 (59)

Year End	Estimated Numbers of Available Weapons			Yield ranges Available	Estimated Weight Ranges lbs
	If all fissile material is used for weapons of 1 KT to 200KT	If all fissile material is used for weapons of 0.5 MT to 10 MT	If all fissile material is used for low and high yield weapons (other divisions are possible) low/high		
1958	3000	1000	1000/700	1-15 KT 20-200 KT 0.5-5 MT 5-10 MT	500-1500 1000-2000 1500-3000 3000-5000
1959	4000	1300	2000/700	1-15 KT 20-200 KT	400-1000 800-1500
1960	5500	1900	2000/1200	0.5-5 MT 5-10 MT	1000-2500 2500-4000
1961	8000	2700	3000/1700	0.1-15 KT 20-200 KT	80-800 500-1000
1962	10000	3400	4000/2000	0.5-5 MT	1000-2000
1963	12000	4000	4500/2700	5-10 MT	2000-3000
1964-1967	See Paragraph 63			0.1-15 KT 20-200 KT 0.5-5 MT 5-20 MT	50-600 400-1000 500-1000 1000-2000
1967-1970				0.01-15 KT 20-200 KT 0.5-5 MT 5-20 MT 20 MT	30-500 200-800 300-800 800-1500 1500-2000