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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON 25, D.C.

SEP 19 1962

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Results of Special Vulnerability Analysis

You may recall that the Department of Defense and the Atomic Energy Commission are currently conducting jointly a study of the long-term ecological effects of nuclear war. A portion of this study effort involved an evaluation of the number of deaths in the USSR predicted as a result of a variation of weight of nuclear attack, type of target system and burst geometry. The results of this portion of the over-all study are quite interesting in the effect of weapon design on the resultant fatality estimate.

This analysis, the results of which are outlined in the attached tabulated data and curves, was based on the following considerations:

a. Two target systems were defined: one was restricted to important military targets such as air fields, missile facilities, nuclear weapon storage sites, submarine bases, command centers and depots; the second system included the first as well as the industrial base of the USSR.

b. The nuclear attack level was varied by programming approximately 1000, 3000 and 10,000 MT against the combined (military and industrial) target system. The levels directed against the military system were of lesser total yield.

c. Attack programs were constrained to either all air burst or all surface burst for the purpose of this analysis.

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ATOMIC ENERGY ACT, 1954
AS AMENDED

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e. Specific delivery systems were not selected but a 3000 ft. circular error probable (CEP) was utilized for purposes of probability calculations.

f. Realistic shielding factors were employed.

Results: A tabular presentation of fatal casualties estimated for the various considered cases, is at Tab A. Graphs indicating the fatality estimate as a function [redacted] are at Tab B. The distribution of various levels of attack throughout the USSR are shown on the charts at Tab C. The following data, extracted from the Tab A presentation, indicate the effect of a variation in [redacted] on the mortality estimate for the given attack level.

a. Surface Burst/Military-Industrial Target System

Total MT Yield	[redacted]	Fatalities (Millions)	Percentage Reduction from [redacted] Case
10,000		170	
		165	3%
		140	18%
		129	24%
		120	30%
3,014		116	
		107	8%
		77	34%
		69	40%
		63	45%

971	[redacted]	79	
		70	11%
		49	38%
		43	45%
		39	50%

b. Air Burst/Military-Industrial Target System

Total MT Yield	Fatalities (Millions)	Percentage Reduction from [redacted] Surface Burst Case
10,000	62	65%
3,014	50	57%
971	41	48%

c. Surface Burst/Military Target System

Total MT Yield	[redacted]	Fatalities (Millions)	Percentage Reduction from [redacted] Case
6,037		108	
		100	7%
		71	35%
		60	45%
		52	52%
1,869		59	
		51	14%
		29	51%
		24	59%
		20	66%
586		34	
		28	18%
		14	59%
		11	68%
		8	77%

FOIA(b)(3) - 42 USC 2162(a) - RD DOE EO13526 6.2(a)

d. Air Burst/Military Target System

Total MT Yield	Fatalities (Millions)	Percentage Reduction from Surface Burst Case
6,037	19	82%
1,869	12	80%
586	9	74%

Conclusions: I believe there are certain conclusions that can be drawn from this preliminary analysis.

a. For a given weight of attack in the surface burst cases, the estimated USSR fatalities decrease markedly with

b. Attacks employing all surface-burst normal weapons against a broad target array cause 50% (10,000 MT attack) to 100% (971 MT attack) more fatalities than similar attacks employing surface-burst clean weapons.

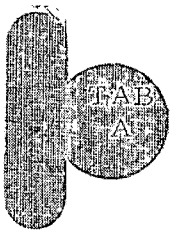
c. Air-bursting of weapons is the most sparing of the population, although at about 1000 MT weight of attack, fatalities are about the same from (a) an air burst-combined targets array, (b) a clean weapon-surface burst-combined targets array, or (c) a normal weapon-surface burst attack against military targets only. For lower weights of attack, clean surface bursts will cause somewhat fewer casualties than the same air burst technique.

e. The targeting philosophy is as important as weapon type in affecting population. Attacks employing all clean or all normal weapons, as well as attacks employing all air bursts or all surface bursts, are not the most efficient and are thus not realistic. Optimum targeting involves a mixture of air and surface bursts; accordingly,

fatal casualties for an actual attack should be an interpolation between the air burst and surface burst curves according to the optimum air/surface burst weapon mix.

Gerald W. Johnson
Assistant to the Secretary
of Defense (Atomic Energy)

3 Inclosures
1. Tab A - Effects upon Total Population in the USSR
2. Tab B - Effects on Population in the USSR - Attack on Military Targets Only and Combined Attack on Military and Industrial Targets
3. Tab C - 10,000 MT on Combined Targets and 6000 MT on Military Targets



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EFFECTS UPON TOTAL POPULATION

IN THE USSR

	AIR BURST		SURFACE BURST																	
	ALL WEAPON TYPES																			
	Combined mill. %	Military mill. %																		
LOW ATTACK	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT
DEAD	41 20	9 4	76 37	32 16	39 19	9 4	43 21	11 5	43 21	11 5	48 23	14 7	52 25	17 8	69 33	28 14	79 38	34 16		
(Blast)	41 20	9 4	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3		
(Fallout)	0 0	0 0	43 21	25 13	6 3	2 1	10 5	4 2	10 5	4 2	15 7	7 4	19 9	10 5	36 17	21 11	46 22	27 13		
CASUALTIES	11 5	4 2	23 10	16 8	15 8	9 5	18 9	11 6	17 9	10 6	19 9	12 6	22 11	14 7	25 12	15 7	23 11	16 8		
(Blast)	11 5	4 2	3 2	1 1	3 2	1 1	3 2	1 1	3 2	1 1	3 2	1 1	3 2	1 1	3 2	1 1	3 2	1 1		
(Fallout)	0 0	0 0	19 8	15 7	10 5	7 3	13 6	9 4	12 6	8 4	14 6	10 5	17 8	12 6	20 10	14 6	19 9	15 7		
(Both)	0 0	0 0	1 0	0 0	2 1	1 1	2 1	1 1	2 1	1 1	2 1	1 0	2 1	1 0	2 1	0 0	1 0	0 0		
WELL (≥300r)	158 75 -	197 94 -	110 53 18 9	159 76 13 6	150 73 0 0	188 91 0 0	144 70 -	184 89 -	145 70 -	184 89 -	141 68 -	180 87 -	132 64 -	176 85 -	116 55 -	163 79 -	107 51 -	157 76 -		
MEDIUM ATTACK	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT
DEAD	50 24	12 6	114 54	56 27	63 31	20 10	73 35	26 13	69 33	12	77 37	29 14	87 42	36 17	107 52	51 24	117 57	59 26		
(Blast)	50 24	12 6	45 22	10 5	45 22	10 5	45 22	10 5	45 22	5	45 22	10 5	45 22	10 5	45 22	10 5	45 22	10 5		
(Fallout)	0 0	0 0	69 32	46 22	18 9	10 5	28 13	16 8	24 11	7	32 15	19 9	42 20	26 12	62 30	41 19	72 35	49 23		
CASUALTIES	6 3	3 1	23 11	22 11	21 10	16 8	24 12	19 9	23 11	8	24 12	18 9	25 12	19 9	24 12	21 10	23 11	20 10		
(Blast)	6 3	3 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1		
(Fallout)	0 0	0 0	21 10	21 10	19 9	14 7	22 11	17 8	21 10	7	22 11	17 8	23 11	18 8	22 11	19 9	21 10	19 9		
(Both)	0 0	0 0	1 0	0 0	1 0	1 0	1 0	1 0	1 0	0	1 0	0 0	1 0	0 0	1 0	1 0	1 0	0 0		
WELL (≥300r)	154 73 -	195 93 -	72 35 19 9	126 62 19 9	122 59 1 0	171 82 1 0	109 53 -	162 78 -	115 56 -	1 80	106 51 -	159 77 -	96 46 -	152 74 -	78 36 -	136 66 -	70 32 -	128 62 -		
HIGH ATTACK	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	60 MT	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	6037 MT		
DEAD	62 30	19 9	169 82	105 51	119 57	53 26	136 66	67 32	129 60	29	140 67	71 34	151 74	81 39	165 79	99 48	171 82	108 52		
(Blast)	62 30	19 9	60 29	16 8	60 29	16 8	60 29	16 8	60 29	8	60 29	16 8	60 29	16 8	60 29	16 8	60 29	16 8		
(Fallout)	0 0	0 0	109 53	89 43	59 28	37 18	76 37	51 24	69 31	21	80 38	55 26	91 45	65 31	105 50	83 40	111 53	92 44		
CASUALTIES	4 2	6 3	10 5	21 10	29 14	24 12	23 11	25 12	25 12	12	22 10	24 11	18 9	24 12	13 7	22 11	11 6	21 11		
(Blast)	4 2	6 3	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1		
(Fallout)	0 0	0 0	9 4	20 9	27 13	22 11	21 10	23 11	23 11	11	20 9	22 10	17 8	22 11	12 6	20 10	10 5	20 10		
(Both)	0 0	0 0	0 0	0 0	1 0	1 0	1 0	1 0	1 0	0	1 0	1 0	0 0	1 0	0 0	1 0	0 0	0 0		
WELL (≥300r)	144 68 0 0	185 88 0 0	29 13 4 2	81 39 20 10	62 29 3 2	128 62 2 1	50 23 -	115 56 -	57 28 -	1 59	49 23 -	115 55 -	32 17 -	102 49 -	31 14 -	86 41 -	27 12 -	78 37 -		

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TABLE A-1

EFFECTS UPON TOTAL POPULATION

IN THE USSR

[redacted]

LOW ATTACK	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT	971 MT	586 MT
DEAD	41 20	9 4	76 37	32 16	39 19	9 4	43 21	11 5	43 21	11 5	48 23	14 7	52 25	17 8	69 33	28 14	79 38	34 16
(Blast)	41 20	9 4	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3	33 16	7 3
(Fallout)	0 0	0 0	43 21	25 13	6 3	2 1	10 5	4 2	10 5	4 2	15 7	7 4	19 9	10 5	36 17	21 11	46 22	27 13
CASUALTIES	11 5	4 2	22 10	16 8	22 10	10 5	23 10	12 6	21 10	11 5	21 10	13 6	24 12	15 7	25 12	15 7	23 11	16 8
(Blast)	11 5	4 2	3 2	1 1	8 3	2 1	7 3	2 1	7 3	2 1	5 3	2 1	3 3	2 1	3 2	1 1	3 2	1 1
(Fallout)	0 0	0 0	19 8	15 7	10 5	7 3	13 6	9 4	12 6	8 3	14 6	10 5	17 8	12 6	20 9	14 6	19 9	15 7
(Both)	0 0	0 0	1 0	0 0	4 2	1 1	3 1	1 1	[illegible] 1	1 1	2 1	1 0	2 1	1 0	2 1	0 0	1 0	0 0
WELL	158 75	197 94	110 53	159 76	150 71	188 91	144 69	184 89	[illegible] 69	184 90	141 67	180 87	132 63	176 85	116 55	163 79	107 51	157 76
(@300r)	-	-	18 9	13 6	0 0	0 0	-	-		-	-	-	-	-	-	-	-	-
MEDIUM ATTACK	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	[illegible] MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT	3014 MT	1869 MT
DEAD	50 24	12 6	114 54	56 27	63 31	20 10	73 35	26 13	[illegible] 33	24 12	77 37	29 14	87 42	36 17	108 52	51 24	117 57	59 28
(Blast)	50 24	12 6	45 22	10 5	45 22	10 5	45 22	10 5	[illegible] 22	10 5	45 22	10 5	45 22	10 5	45 22	10 5	45 22	10 5
(Fallout)	0 0	0 0	69 32	46 22	18 9	10 5	28 13	16 8	[illegible] 11	14 7	32 15	19 9	42 20	26 12	63 30	41 19	72 35	49 23
CASUALTIES	6 3	3 1	23 11	22 11	25 11	17 8	27 13	20 9	[illegible] 11	17 8	26 13	19 9	27 13	19 9	25 12	20 10	23 11	21 10
(Blast)	6 3	3 1	1 1	1 1	4 2	2 1	4 2	2 1	[illegible] 1	1 1	3 2	1 1	3 2	1 1	2 1	1 1	1 1	1 1
(Fallout)	0 0	0 0	21 10	21 10	19 9	14 7	22 11	17 8	[illegible] 10	15 7	22 11	17 8	23 11	18 8	22 11	19 9	21 10	19 9
(Both)	0 0	0 0	1 0	0 0	2 0	1 0	1 0	1 0	[illegible] 0	1 0	1 0	1 0	1 0	1 0	1 0	0 0	1 0	1 0
[illegible]	154 73	195 93	72 35	126 62	122 58	171 82	109 52	162 78	[illegible] 56	166 80	106 50	159 77	96 45	152 74	77 36	136 66	70 32	128 62
(@300r)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
HIGH ATTACK	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	6037 MT	10000 MT	6037 MT	[illegible] MT	6037 MT	10000 MT	6037 MT	10000 MT	3067 MT	10000 MT	6037 MT	10000 MT	6037 MT
	62 30	19 9	168 82	105 51	118 57	53 26	135 66	67 32	[illegible] 60	60 29	139 67	71 33	150 74	81 39	164 79	99 48	170 82	108 52
last)	62 30	19 9	59 29	16 8	59 29	16 8	59 29	16 8	[illegible] 29	16 8	59 29	16 8	59 29	16 8	59 29	16 8	59 29	16 8
allout)	0 0	0 0	109 53	89 43	59 28	37 18	76 37	51 24	[illegible] 31	44 21	80 38	55 26	91 45	65 31	105 50	83 40	111 53	92 44
UALTIES	4 2	6 3	10 5	21 10	30 14	25 12	23 11	26 12	[illegible] 12	25 12	22 10	25 12	20 9	24 12	13 7	22 11	11 6	21 11
Blast)	4 2	6 3	1 1	1 1	2 1	2 1	1 1	3 1	[illegible] 1	2 1	1 1	2 1	2 1	1 1	1 1	1 1	1 1	1 1
Fallout)	0 0	0 0	9 4	20 9	27 13	22 11	21 10	23 11	[illegible] 11	22 11	20 9	22 11	17 8	22 11	12 6	20 10	10 5	20 10
(Both)	0 0	0 0	0 0	0 0	1 0	1 0	1 0	1 0	[illegible] 0	1 0	1 0	1 0	1 0	1 0	0 0	1 0	0 0	0 0
LL	144 68	165 86	29 13	81 40	62 29	128 62	50 23	115 56	[illegible] 28	122 59	49 23	115 55	32 17	102 49	31 14	86 41	27 12	78 37
(@300r)	0 0	0 0	4 2	20 10	3 2	2 1	-	-		-	-	-	-	-	-	-	-	-

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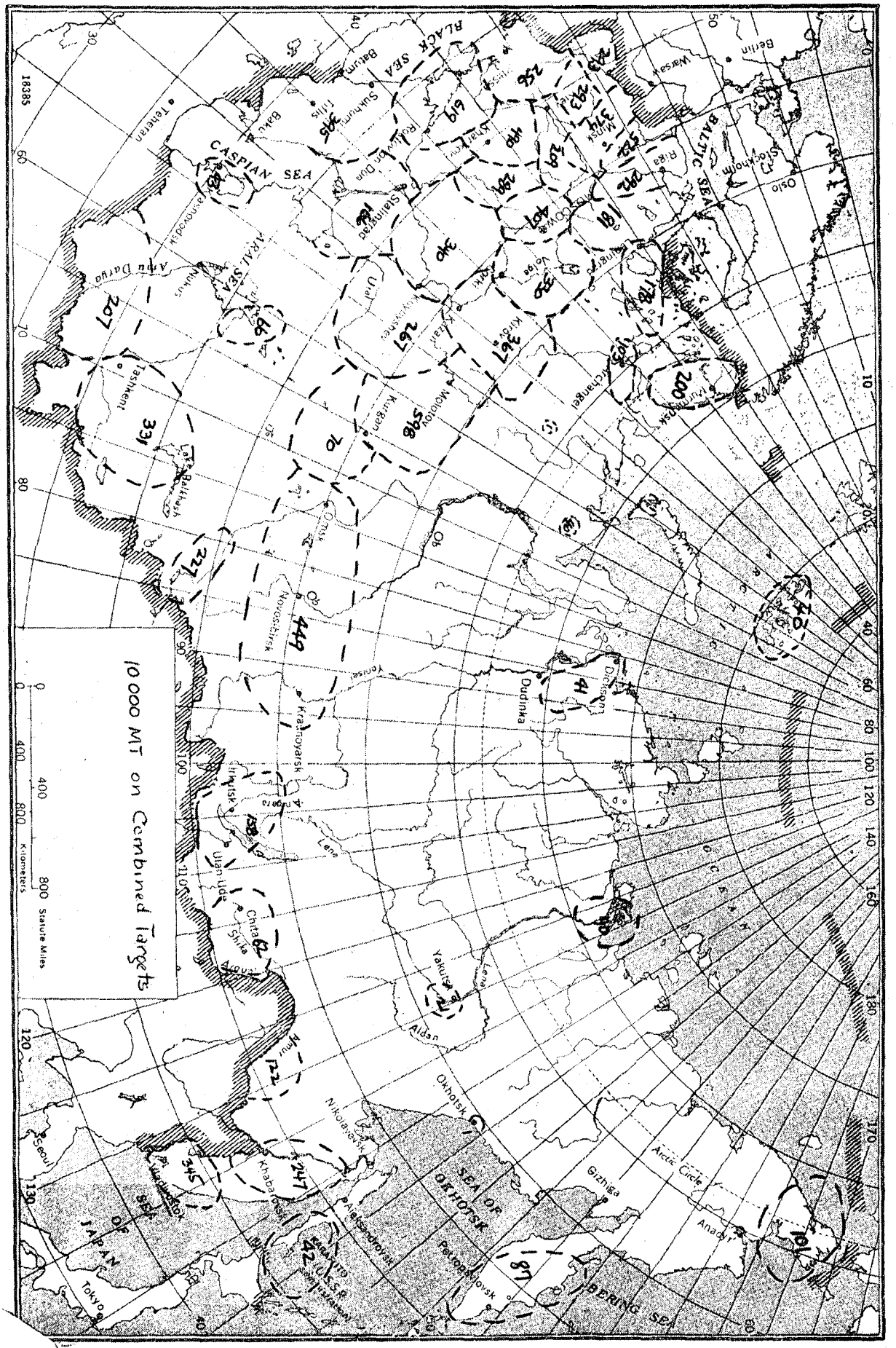

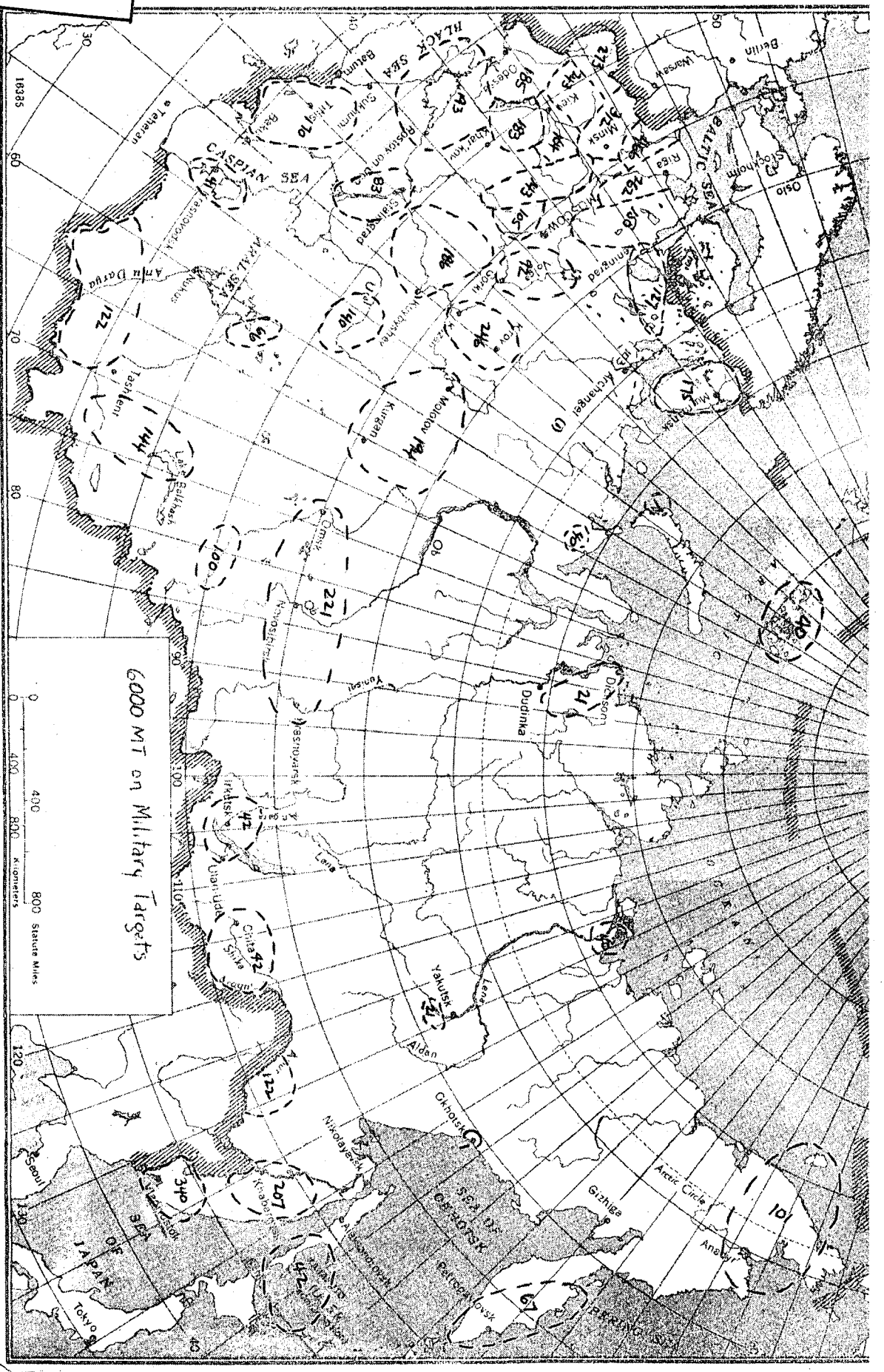

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