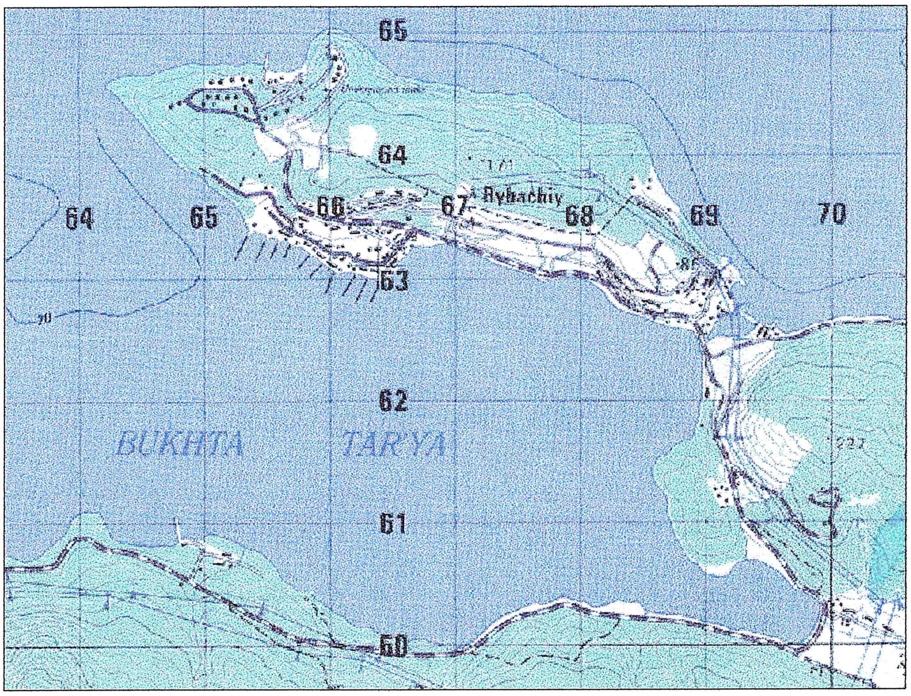
pages for NRDC SIOP

Near the city of Petropavlovsk-Kamchatskiy.

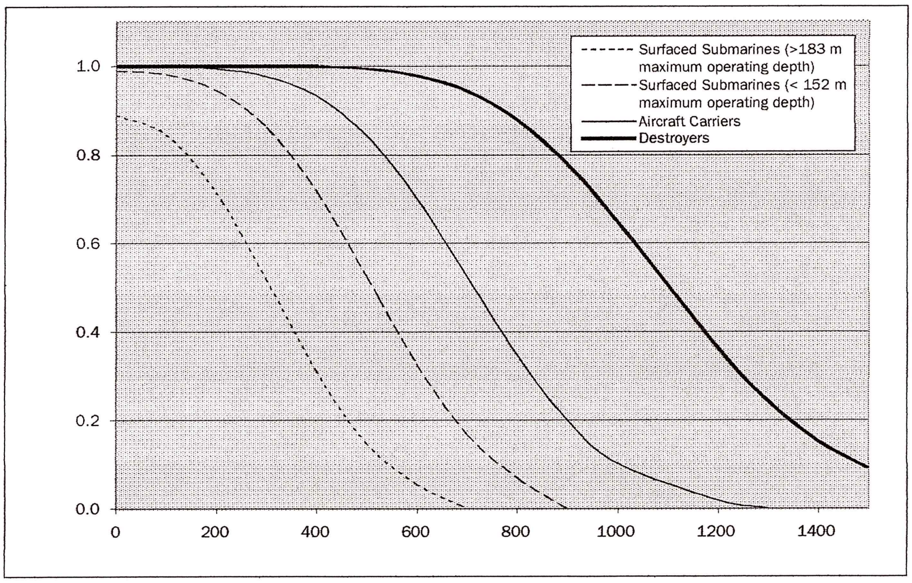


Warhead Requirements and Aimpoints

Since long-range Russian SSBN patrols are now infrequent, for MAO-NF we assume that many, most, or possibly all, of the moored submarines are at some stage of alert and are thus potential stationary firing platforms. We also explore the possibility that Russian SSBNs might disperse to other naval bases.

Vulnerability numbers for naval targets are provided in Table 4.7, showing three levels of damage (A, B and C) for three characteristics (seaworthiness, mobility and

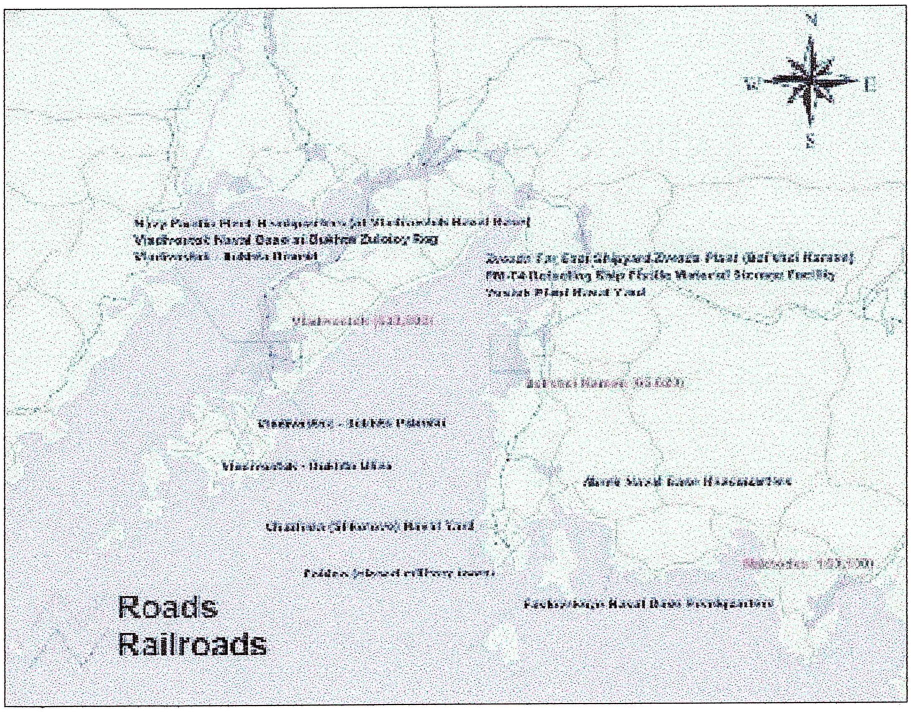
A CEP of 183 meters was used for these calculations.



Severomorsk-Polyarnyy complex, ships and submarines are based at the ports of Gremikha, which is approximately 200 km eastwards from the Kola Inlet, and the Litsa Guba/Bolshaya Litsa Complex, which has four bases—three on the eastern side of the fjord: a nuclear submarine maintenance area, a base for nuclear attack submarines and a base for Typhoon and other SSBNs—and another submarine maintenance facility on the western side, and westward in the port of Pechenga. There are reportedly several tunnel facilities (in Sayda Bay) for submarine repair and missile reloading.

Pacific Fleet

The main Russian Navy Pacific Fleet facilities in the Far East are shown in Figures 4.34 and 4.35. The two largest cities potentially affected by MAO-NF in the Russian Far East are Vladivostok and Petropavlovsk-Kamchatskiy. Vladivostok is a port city of 700,000 on the Sea of Japan at the eastern end of the Trans-Siberian Railway (a seven-day rail journey from Moscow) and about 70 kilometers from China. Vladivostok ceased to be a closed city in 1992. Approximately 35 kilometers east of Vladivostok is the large submarine disassembly plant Zvezda, and 40-60 kilometers southeast of Vladivostok are several main naval facilities, including Chazma Naval Yard and Abrek Bay Naval Headquarters. Approximately 2,300 kilometers northeast of Vladivostok, on Russia's Kamchatka Peninsula, lies the city of Petropavlovsk-Kamchatskiy (1989 population 268,700) and the Rybachiy Naval Base, home to the Pacific Fleet's remaining SSBNs (see Figure 4.35). Both the city and the naval base are situated along Avachinskaya Bay near the southern end of the Peninsula. Rybachiy Naval Base and the city of Petropavlovsk-Kamchatskiy are separated by about 20 kilometers.



These sites are located at and near the city of Vladivostok. Population data comes from the 1989 Soviet Census.

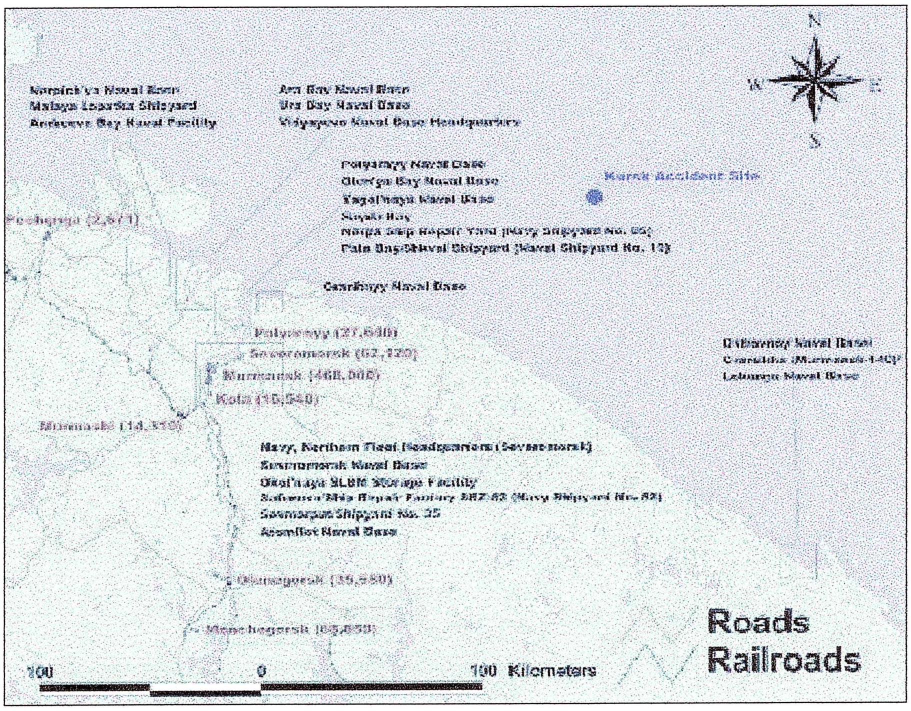
On October 13, 2000, the Russian Navy command decided to disband one of three submarine combined units of the Pacific Fleet's Maritime Territory Flotilla for lack of funds. The unit of some two-dozen submarines was based at the military town of Fokino, about two hours from Vladivostok. Reportedly only a few submarines will be deployed to other locations, and the rest will be dismantled at the nearby Zvezda plant.[51]

Today, the principal Russian naval targets for U.S. strategic nuclear weapons are likely to be the SSBN basing areas of the Northern Fleet and the Pacific Fleet. Twelve SSBNs are deployed at two Northern Fleet bases and five SSBNs are at one Pacific Fleet base.

Northern Fleet

During the Cold War the Soviet Union created a vast military/nuclear complex on the Kola Peninsula (which is known by the Russians as the "land of the dammed") and along the adjacent White Sea.[52] The main strategic sites for the Northern Fleet are shown in Figure 4.33.

Most of the Soviet Navy's newest warships had home parts at Severomorsk and ten other deep harbors in this region. The Kola Inlet (Kol'skiy Zaliv) extends approximately 70 kilometers inland before becoming the Tuloma River. Along the shores of the Kola Inlet are the cities of Murmashi, Kola, Murmansk (the largest city north of the Arctic Circle), Severomorsk (headquarters of the Northern Fleet), Polyarnyy (a major base for Northern Fleet submarines and ships) and Skalistyy. In addition to the Murmansk-



Population data from the 1989 Census is shown in red, and the approximate location of the *Kursk* submarine accident site is shown in blue.

weapons delivery) for submarines and ships. A description of the damage levels is provided in Table 4.8. Figure 4.36 shows the probability of achieving severe damage to seaworthiness (and thus also severe damage to weapons systems) for various vessel types as a function of distance between W76 ground zero and target. The damage radius for severe damage to surfaced submarines (capable of operating deeper than 183 meters) is found to decrease rapidly to zero for heights of burst of only several hundred meters. Therefore we select W76 ground bursts for all Russian naval targets.

In our MAO-NF, we examine two levels of attack against Northern Fleet targets and three levels of attack against Pacific Fleet Targets. We limit the first level of attack against the Northern Fleet to the pier areas of the two Russian naval bases where Typhoons, Delta III, and Delta IV SSBNs are moored. We use a total of 18 W76 warheads to cause severe damage to the SSBNs and the pier areas. In the second level of attack, all of the other Northern Fleet's naval bases are also attacked using an additional 74 warheads, for a total of 92 W76 warheads for the second level of attack. Table 4.9 provides summary information on the targets chosen for these two Northern Fleet attack scenarios in our MAO-NF.

Description of the three levels of damage to ship and submarine seaworthiness, mobility and weapons delivery. Source: *Physical Vulnerability Handbook—Nuclear Weapon* (U), p. I-20.

Seaworthiness, Type A	For ships: In danger of sinking, capsizing, or breaking up because of widespread, uncontrollable flooding or loss of girder strength. Danger is present even in normal weather, but there is some chance of saving the ship. For submarines: In danger of settling to the bottom because of damage to its structure of buoyancy-control gear.
Seaworthiness, Type B	For ships: About half-loss of seaworthiness, evidenced by appreciable plastic deformation of structure, possibly leading to rupture. This includes loss of girder strength or of topside structure to an extent that the ship is in danger of being swamped or being broken up in stormy weather. Any flooding is confined by compartmentation or by a side-protection system. For submarines: Loss of ability to submerge in a controlled manner because of damage to structure or buoyancy-control gear.
Seaworthiness, Type C	For ships: Slight plastic deformation of structure, which may cause minor leakage. Hogging or sagging, or topside structural damage may occur, but not enough to endanger the ship, even in stormy weather. For submarines: Slight reduction of maximum safe diving depth but can submerge in a controlled manner.
Mobility, Type A	For ships: Can at best just barely maintain steerageway in a desired direction, because of damage to main propulsion equipment, auxiliary machinery, and control gear, or because of personnel casualties. For submarines: Seaworthiness impairment controls.
Mobility, Type B	For ships: About half loss of mobility. Can maintain steerageway in a desired direction without difficulty, but cannot achieve speeds appreciably greater than half top speed, and/or cannot maneuver normally within its remaining speed range, because of damage to equipment and/or control gear, or because of personnel casualties. For submarines: Seaworthiness impairment controls.
Mobility, Type C	For ships or submarines: Slight loss of ability to achieve top speed and/or to maneuver normally, because of equipment damage or personnel casualties.
Weapon Delivery, Type A	Weapons can be released, but it is almost impossible to deliver them effectively because the target-acquisition and communication equipments are inoperative, either from damage to equipment or topside structure, or because of personnel casualties.
Weapon Delivery, Type B	About half-loss in ability to deliver weapons effectively, because of damage to equipment or topside structure, or because of personnel casualties.
Weapon Delivery, Type C	Slight reduction in weapon-delivery efficiency due to equipment or topside structural damage, or to personnel casualties.

1	' (in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet); 3 Typhoon SSBNs (60 SLBMs); piers potentially distributed over 2,700 meters of coastline	8 (300 meters between aimpoints)
1	' (in Sayda Bay near the town of Skalistyy at the mouth of the Kola Inlet); 2 Delta III (32 SLBMs) and 7 Delta IV SSBNs (112 SLBMs); piers potentially distributed over 3,500 meters of coastline	10 (300 meters between aimpoints)
Total Aimpoints for Attack Level 1		***18***
2	(central and northern portions of Murmansk); SSBN repair yard (refueling prior to 1992)	0 (withhold on cities under MAO-NF)
2	(10 km northeast of Murmansk) nuclear ship and sub repair	1
2	(15 km northeast of Murmansk) 30 surface ships, including heavy aircraft carrier *Admiral Kuznetsov*, heavy nuclear-powered missile-armed cruisers of the Admiral Ushakov class (Krov) and the *Marshal Ustinov* missile-armed cruiser of the Slava class; piers potentially distributed over 10,000 meters of coastline	11 (750 m separation between aimpoints)
2	' (1 km east of Severomorsk)	1
2	(26 km northeast of Murmansk) minor surface combatants; diesel submarines; a naval station of the Kola flotilla (surface ships and submarines of offshore defense brigades); piers potentially distributed over 1,000 meters of coastline	4 (300 m between aimpoints)[53]
2	(24 km northeast of Murmansk) auxiliaries; piers potentially distributed over 1,500 meters of coastline	2 (750 m between aimpoints)
2	' (25 km northeast of Murmansk) former SSBN base; surface ships and submarines of offshore defense brigades; piers potentially distributed over 1,700 meters of coastline	5 (300 m between aimpoints)
2	(24 km northeast of Murmansk) piers potentially distributed over 3,000 meters of coastline	5 (750 m between aimpoints)
2	(western end) piers	2
2	(13.5 km east of the mouth of the Kola Inlet) torpedo and missile boats	2
2	(piers, 65 km southeast of the mouth of the Kola Inlet) patrol ships	1
2	(located at the city of Gremikha, 280 km southeast of the mouth of the Kola Inlet); piers potentially distributed over 3,000 meters of coastline	4 (750 m between aimpoints)
2	(19 km west of the mouth of the Kola Inlet) minor surface combatants (minesweepers, etc.)	1
2	(35 km northwest of Murmansk) piers potentially distributed over 8,000 meters of coastline	10
2	(40 km northwest of Murmansk) piers potentially distributed over 3,000 meters of coastline	8 (300 m between aimpoints)
2	(in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet) piers potentially distributed over 2,000 meters of coastline	6 (300 m between aimpoints)
2	(in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet)	2
2	(in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet)	1
2	(96 km northeast of Murmanks) conventional submarines and escort ships	2 (the north end and mid-way up the fjord)
2	(along the White Sea near Arkhangel) workshops for construction and modernization of submarines; base for minor surface ships; SLBM loading facility	5 (spaced mid-way along the length of the Severodvinsk inlet)
2	(along the White Sea 300 km west of Arkhangel) a naval station of the Kola flotilla; surface ships and submarines	1
Total Aimpoints for Attack Level 2		***92***

1	' (in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet); 3 Typhoon SSBNs (60 SLBMs); piers potentially distributed over 2,700 meters of coastline	8 (300 meters between aimpoints)
1	' (in Sayda Bay near the town of Skalistyy at the mouth of the Kola Inlet); 2 Delta III (32 SLBMs) and 7 Delta IV SSBNs (112 SLBMs); piers potentially distributed over 3,500 meters of coastline	10 (300 meters between aimpoints)
Total Aimpoints for Attack Level 1		***18***
2	(central and northern portions of Murmansk); SSBN repair yard (refueling prior to 1992)	0 (withhold on cities under MAO-NF)
2	(10 km northeast of Murmansk) nuclear ship and sub repair	1
2	(15 km northeast of Murmansk) 30 surface ships, including heavy aircraft carrier *Admiral Kuznetsov*, heavy nuclear-powered missile-armed cruisers of the Admiral Ushakov class (Krov) and the *Marshal Ustinov* missile-armed cruiser of the Slava class; piers potentially distributed over 10,000 meters of coastline	11 (750 m separation between aimpoints)
2	' (1 km east of Severomorsk)	1
2	(26 km northeast of Murmansk) minor surface combatants; diesel submarines; a naval station of the Kola flotilla (surface ships and submarines of offshore defense brigades); piers potentially distributed over 1,000 meters of coastline	4 (300 m between aimpoints)[53]
2	(24 km northeast of Murmansk) auxiliaries; piers potentially distributed over 1,500 meters of coastline	2 (750 m between aimpoints)
2	' (25 km northeast of Murmansk) former SSBN base; surface ships and submarines of offshore defense brigades; piers potentially distributed over 1,700 meters of coastline	5 (300 m between aimpoints)
2	(24 km northeast of Murmansk) piers potentially distributed over 3,000 meters of coastline	5 (750 m between aimpoints)
2	(western end) piers	2
2	(13.5 km east of the mouth of the Kola Inlet) torpedo and missile boats	2
2	(piers, 65 km southeast of the mouth of the Kola Inlet) patrol ships	1
2	(located at the city of Gremikha, 280 km southeast of the mouth of the Kola Inlet); piers potentially distributed over 3,000 meters of coastline	4 (750 m between aimpoints)
2	(19 km west of the mouth of the Kola Inlet) minor surface combatants (minesweepers, etc.)	1
2	(35 km northwest of Murmansk) piers potentially distributed over 8,000 meters of coastline	10
2	(40 km northwest of Murmansk) piers potentially distributed over 3,000 meters of coastline	8 (300 m between aimpoints)
2	(in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet) piers potentially distributed over 2,000 meters of coastline	6 (300 m between aimpoints)
2	(in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet)	2
2	(in Zapadnaya Litsa Bay approximately 50 km west of the mouth of the Kola Inlet)	1
2	(96 km northeast of Murmanks) conventional submarines and escort ships	2 (the north end and mid-way up the fjord)
2	(along the White Sea near Arkhangel) workshops for construction and modernization of submarines; base for minor surface ships; SLBM loading facility	5 (spaced mid-way along the length of the Severodvinsk inlet)
2	(along the White Sea 300 km west of Arkhangel) a naval station of the Kola flotilla; surface ships and submarines	1
Total Aimpoints for Attack Level 2		***92***

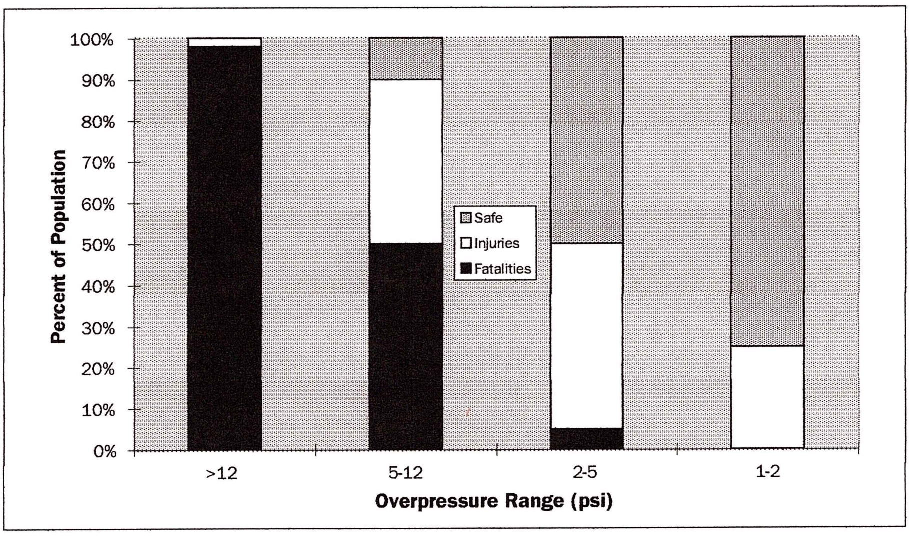
TABLE 3.5
Casualty Calculations for Ten Indian and Pakistani Cities

City Name	Total Population within 5 kilometers of Ground Zero (thousands)	Killed (thousands)	Severely Injured (thousands)	Slightly Injured (thousands)
		India		
		Pakistan		

extends three-times further out to 1.4 kilometers. But at this distance from ground zero, the thermal flux from the 300-kiloton explosion is 166 cal/cm^2. As general rule, the thermal flux increases at a given distance more rapidly than the peak blast overpressure as the explosive yield increases. Therefore the deaths and injuries from a high-yield nuclear explosion are probably underestimated in Figure 3.8. The thermal flux accompanying the blast would cause retinal burns, skin burns, and fires.

MIT physicist, Theodore Postol, calculated that "superfires," produced by much higher-yield weapons than those detonated at Nagasaki or Hiroshima, would create

FIGURE 3.8
Pecentages of the Population Killed, Injured, and Safe
As a function of peak blast overpressure. Source: The 1979 OTA report *The Effects of Nuclear War.*



U.S. war planners calculated that blast overpressures of 10,000 to 25,000 psi were required to severely damage the hardest Russian silos. These figures, and even higher ones, have been cited in the open literature.[5] Clearly this assessment of the hardness of Russian silos has a significant impact on the U.S. nuclear war planning process. For example, in an *Air Force* article, the Commander-in-Chief of Strategic Air Command, Gen. Bennie Davis stated: "Anytime you can get superhardening values well above 6,000 psi, you automatically complicate the targeting problem [i.e., for the attacker]."[6] According to General Davis, the complication is partially overcome by assigning "two or more RVs" to achieve the requisite high kill probability. The following figures illustrate General Davis' point: the probability of severely damaging a SS-11 silo (5,000 psi) using one Minuteman III (MM III) W78 warhead is 0.66 (assuming a yield of 335 kt and a CEP of 183 meters), whereas the probability of using one such MM III warhead on a SS-17 silo (12,000 psi) is only 0.39. The probability of severely damaging a SS-17 silo increases to 0.63 if two such MM III warheads are used and to 0.77 if three such MM III warheads are used.

By raising the height of burst above ground level, it is possible to reduce the total amount and extent of lethal fallout.

To achieve maximum kill probabilities against Russian ICBM silos, we assume that U.S. war planners assign accurate warheads with high yields to these targets. The most likely U.S. weapons they would assign would be W87 and W78 ICBM warheads and W88 and W76 SLBM warheads. U.S. nuclear-armed cruise missiles or bombers take too long to reach the silos considering the probable requirement in the SIOP to attack the silos before Russian forces launch the missiles. Table 4.2 shows the single-shot kill probabilities (SSPK—one warhead per silo) and double-shot kill probabilities (DSPK—two warheads per silo) for ground bursts of various U.S. ICBM and SLBM warheads. While ground bursts produce higher kill probabilities, they also cause more extensive fallout.

Achieving significant kill probabilities requires at least one MX warhead, or one W88 warhead, per silo, especially for the SS-11/19 III-G MOD silo type. To generate high probabilities of severe damage requires allocating two such warheads per silo.

TABLE 4.2

Single-Shot and Double-Shot Kill Probabilities for U.S. ICBM and SLBM Warheads Attacking Active Russian Silo Types

For Trident I and II warheads, a range is given for circular error probable (CEP). Single-shot kill probabilities are indicated by SSPK, and double-shot kill probabilities are indicated by DSPK.

Warhead	Yield (kt)	CEP (m)	SSPK (SS-18, Silo Type III-F)	DSPK (SS-18, Silo Type III-F)	SSPK (SS-11/19, Silo Type III-G)	DSPK (SS-11/19, Silo Type III-G)	SSPK (SS-11/19, Silo Type III-G MOD)	DSPK (SS-11/19, Silo Type III-G MOD)
W76 (Trident I)	100	500	0.022	0.044	0.024	0.047	0	0
W76 (Trident I)	100	229	0.103	0.195	0.112	0.211	0	0
W76 (Trident II)	100	183	0.155	0.286	0.169	0.309	0	0
W76 (Trident II)	100	129	0.286	0.490	0.309	0.523	0	0
W62 (MM III)	170	183	0.230	0.407	0.254	0.443	0.183	0.333
W78 (MM-III)	335	183	0.360	0.590	0.403	0.644	0.299	0.509
W88 (Trident II)	475	183	0.442	0.689	0.496	0.746	0.375	0.609
W88 (Trident II)	475	129	0.687	0.902	0.744	0.934	0.608	0.846
W87-0 (MX)	300	91	0.805	0.962	0.848	0.977	0.726	0.925