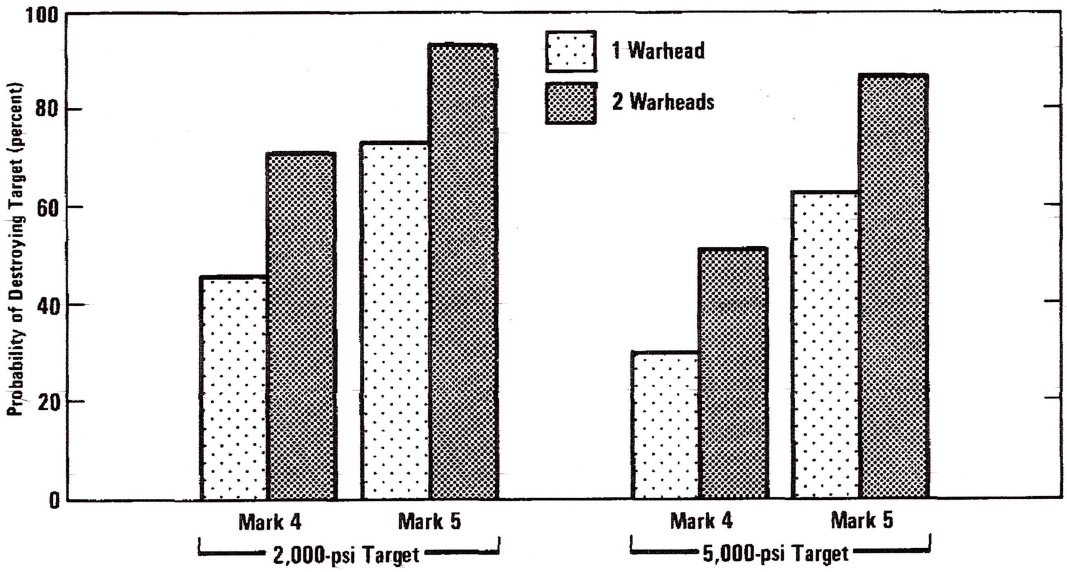
APPENDIX B

THE CHOICE OF TRIDENT II WARHEADS

This study assumes that 50 percent of the Trident II missiles would be deployed with the Mark 4 warhead and 50 percent with the Mark 5. This ratio affects the capability of the Trident II missile force. Although the Trident II can carry fewer Mark 5 warheads (six to nine) than Mark 4 warheads (11 to 13), the yield of the Mark 5 (400-500 kt) is higher than the yield of the Mark 4 (100 kt). The higher yield of the Mark 5 gives it a higher Single Shot Kill Probability (SSKP--the probability that an arriving warhead will destroy a target) than the Mark 4. One Mark 5 warhead, for example, has a higher probability than two Mark 4 warheads of destroying a target hardened to 2,000 or 5,000 pounds per square inch (psi) (see Figure B-1).

Figure B-1.
Effectiveness of Mark 4 and Mark 5 Warheads on the Trident II Missile Against Targets Hardened to 2,000 psi and 5,000 psi



SOURCE: Congressional Budget Office.

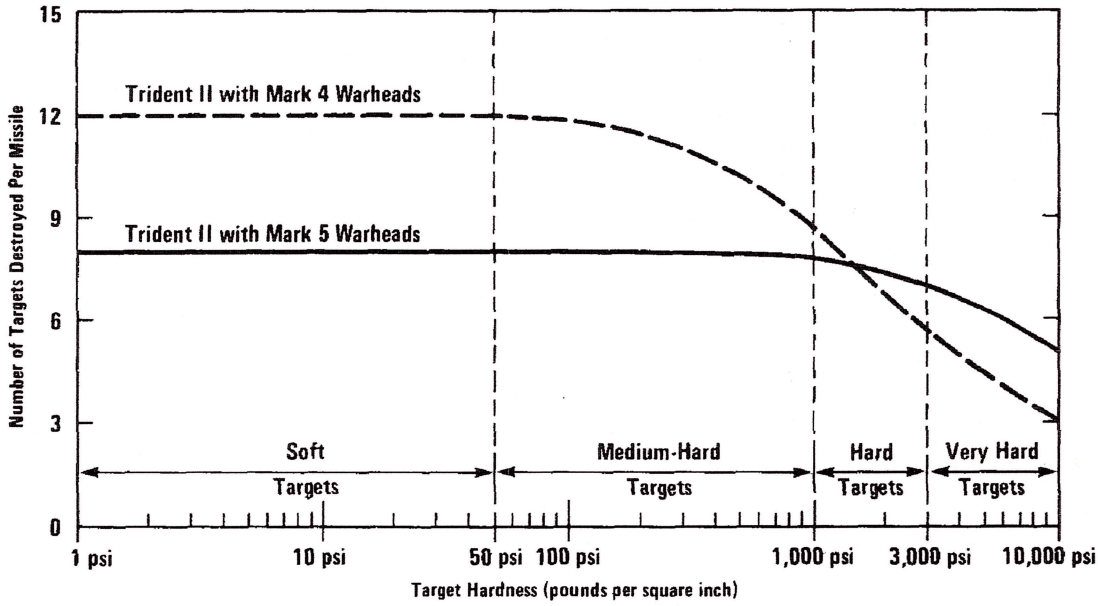
NOTE: Effectiveness is measured here by the probability that either one or two warheads will destroy a hardened target. That probability, known as the probability of kill (PK), is based on the Single Shot Kill Probability (SSKP) for each warhead type against a target of specified hardness and on the reliability (R) of 80 percent. The calculations employ the following equation, in which "N" is the number of warheads directed at the target:

$$PK = 1 - [1 - (SSKP \times R)]^N$$

Therefore, there is a trade-off between the number of warheads and the capability of the individual warheads. Against "soft" targets hardened to less than 50 psi--a situation in which the difference in yield between the Mark 4 and Mark 5 warheads has little effect on the SSKP--the Trident II missile with Mark 4 warheads could attack and destroy more soft targets than with Mark 5 warheads (see Figure B-2). Against targets hardened to greater than about 1,600 psi, however, the Trident II missile with Mark 5 warheads would be more effective. Because of the higher SSKP of the Mark 5 warhead against harder targets, a Trident II missile would destroy more targets with fewer Mark 5 warheads than with a larger number of Mark 4 warheads (see Figure B-2).

For attacking targets hardened to an intermediate range of between 50 psi and 1,600 psi, however, the relative effectiveness of Mark 4 and Mark 5 warheads is less clear. The Trident II with Mark 4 warheads is more effective if each warhead is directed against a separate target. But, if some Mark 4 warheads are not used because there are more warheads

Figure B-2.
Capability of a Single Trident II Missile as a Function of Warhead Type and Target Hardness



SOURCE: Congressional Budget Office.

NOTE: The Trident II could carry 11 to 13 Mark 4 warheads or 6 to 9 Mark 5 warheads. For the purpose of illustration, it is assumed that the missile would carry 12 Mark 4 warheads or 8 Mark 5 warheads.