They re-enter the atmosphere and travel a course determined by the initial thrust and the force of gravity. A *cruise* missile is an air-breathing missile which is propelled by a jet engine and never leaves the earth's atmosphere. Other missiles such as the short-range attack missile (SRAM) also operate within the atmosphere.

Nuclear weapons are classified as strategic, intermediate or tactical. However, these distinctions are not always clear and can be the subject of much debate in arms control forums. For the purpose of arms control negotiations, the Soviets have traditionally wanted to classify strategic missiles as all those missiles capable of hitting the enemy's territory, regardless of the actual physical distance they can travel or where they are deployed. Under this definition, American missiles such as the Pershing II and the GLCM, which are deployed in Europe, are classified as strategic and therefore are subject to overall reduction proposals, while Soviet SS-20 missiles, also deployed in Europe but not capable of hitting the United States, are excluded.

However, this general definition finds little acceptance outside of the Soviet Union and previous arms control treaties and negotiations have classified missiles according to their range, that is, the distance the missile can travel. For example, the SALT II Treaty defined a strategic missile as one with a range in excess of 5,500 km. Tactical nuclear weapons (TNW) are generally considered to have a range less than 1,000 km. Missiles with ranges falling between these two values are referred to as intermediate-range nuclear forces (INF).

Some missiles carry multiple, independently-targetable re-entry vehicles (MIRVs). This means that they can carry more than one warhead, each of which can be aimed at a distinct target. While the missile is the actual vehicle launched, it is the warheads which finally hit the targets and are therefore the more important counting units in comparing nuclear arsenals. Multiple re-entry vehicles (MRVs) are not independently targetable. Although the warheads are dispersed and will obviously cover a larger area than a single warhead, they can be aimed only at a single target. Thus most sources count MRVed missiles as launchers carrying single warheads.

One of the main drawbacks of the SALT II Treaty is its failure to deal adequately with the multiple warhead issue. SALT II places limits on the number of MIRVed launchers that each side can maintain but does not impose an upper limit or ceiling on warhead numbers. Recent arms control proposals in Geneva address this issue for the first time and have concentrated on limiting warhead numbers, with launcher ceilings given a secondary role.

YIELD AND EQUIVALENT MEGATONNAGE (EMT)

The yield of a warhead provides a measure of its explosive energy yield expressed in kilotons (kt) or megatons (Mt). (1 Mt = 1,000 kt.) As a useful comparison, the atomic bomb dropped on Hiroshima is generally considered to have had a yield of 14 kt or 0.014 Mt. The Soviet SS-18 warhead has a yield of 0.500 Mt and the American Minuteman III 12A W78 warhead has a yield of 0.335 Mt.

Estimates of the yield of Soviet warheads are primarily determined through seismic monitoring of Soviet underground nuclear tests. The magnitude* of a seismic event is used to determine the explosive yield of a Soviet test by calibrating it with measurements of other underground explosions of known yields.

Because of the nature of the nuclear explosion, however, destructive power and the yield of the warhead do not grow linearly in a 1:1 relationship. When an explosion takes place, a great deal of the energy released as blast wave is concentrated in the centre vertical plane of the explosion, as opposed to expanding equally outwards in the shape of a sphere. As the yield of a weapon increases, the energy 'lost' to the concentration effect in the centre also increases, but not in a one-to-one relationship to the increase in yield. Equivalent megatonnage (EMT) reflects this distribution of energy and provides a better measurement of overall destructiveness than yield alone.

$$EMT = Y^{2/3} \text{ **}$$

From this it can be seen that several smaller warheads will have a greater destructive capacity than one large one carrying the same total yield.

For example:

Number of warheads	*Total Yield (Mt)*	$Y^{2/3}$	=	*EMT (Mt)*
1	1	$(1)^{2/3}$	=	1.00
2	2(.5)	$2(.5)^{2/3}$	=	1.26
4	4(.25)	$4\ (.25)^{2/3}$	=	1.59

EMT is used to measure weapons effects against 'soft' urban and industrial targets. With a growing emphasis on destroying hardened military targets (counterforce targeting), EMT has become less important as a variable in the strategic balance than it has been in the past.

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* Magnitude is equal to the logarithm of the amplitude of a seismic event adjusted according to the distance between the seismic event and the seismic station.

** At yields of greater than one megaton, $EMT = Y^{1/2}$.