War. However, with sufficient warning, civil defense measures can be implemented in time to protect civil populations against chemical or biological attack.

Nuclear weapons differ markedly from chemical, biological, or conventional warheads. The principal difference is the size, shape, and inertial properties of the warhead. Generally, nuclear weapons have a lower limit on their weight and diameter, which determines characteristics of the delivery system, such as its fuselage girth. Though these limits may be small, geometric considerations often influence the selection of a delivery system. Chemical and biological weapons, which are usually fluids or dry powders, can be packed into almost any available volume. Nuclear weapons cannot be retrofitted to fit the available space; however, they can be designed to fit into a variety of munitions (e.g., artillery shells).

Nuclear weapons also have a different distribution of weight within the volume they occupy. Fissile material, the core of a nuclear weapon, weighs more per unit of volume than most other materials. This high specific gravity tends to concentrate weight at certain points in the flight vehicle. Since virtually all WMD delivery systems must fly through the atmosphere during a portion of their trip to a target, a designer has to consider the aerodynamic balance of the vehicle and the required size of control system to maintain a stable flight profile while carrying these concentrations of weight. Chemical, biological, and conventional weapons all have specific gravities near 1.0 gram/cc, so these materials may be placed further from the center of gravity of the vehicle without providing large compensating control forces and moments. In some special applications, such as ballistic missile reentry vehicles and artillery shells, the designer needs to include ballasting material—essentially useless weight—to balance the inertial forces and moments of the nuclear payload.

Because nuclear weapons have a large kill radius against soft and unhardened targets, accuracy is a minor consideration in the delivery system selection as long as the targeting strategy calls for counter value attacks. Nuclear weapons destroy people and the infrastructure they occupy. They only require that the delivery system places the warhead with an accuracy of approximately 3 kilometers of a target if the weapon has a yield of 20 kilotons and to an even larger radius as the yield grows. Most un-manned delivery systems with a range of less than 500 kilometers easily meet these criteria. Often, as is the case with ballistic missiles, the quality of the control system beyond a certain performance does not materially change the accuracy of a nuclear warhead, because a large fraction of the error arises after the powered phase of the flight as the vehicle reenters the atmosphere. While this is true of chemical and biological warheads as well, with a nuclear warhead, there is less need to compensate for this error with such technologies as terminal guidance or homing reentry vehicles. To be effective, a delivery vehicle employed to spread chemical or biological agents must distribute the material in a fine cloud below a certain altitude and above the surface. It should be capable of all-weather operations and should not betray its presence to air defense assets.

Anti-satellite (ASAT) System

The term ASAT is used to describe any device capable of destroying the operational capability of satellites in earth orbit. These devices can be ground-based, air-based or space-based. Ground and air-based systems can involve: (1) the direct ascent launch of a missile carrying either a nuclear or non-nuclear warhead; (2) co-orbital devices with explosive warheads; or (3) the use of a directed-energy weapon such as a laser. Space-based systems could involve explosive space mines, conventional interceptors, kinetic energy weapons or directed energy weapons.