

## Lethality

Lethality may be defined as “the probability that a weapon will damage or destroy a target such that it can no longer carry out its intended mission”. It is an essential figure of merit for any weapon system. The lethality of a given system will vary with the target chosen and the circumstances of deployment. In the former case, for example, a given weapon may be 90% lethal against a field bunker and 50% lethal against a main battle tank. In the latter, the lethality of an air-launched guided munition against a main battle tank may be 50% if released from an altitude of 10,000 feet and a standoff range of 4 miles and 65% if the altitude and range are reduced to 1,500 feet and 1 mile.

Any discussion of lethality must begin with the target set. Typically, a weapon system will be designed to attack a particular class of targets or sometimes more than one class, with appropriate priorities assigned. For instance, the Javelin infantry weapon is primarily designed to defeat armor but can be used against fixed structures and even helicopters. The lethality required of a proposed system will be a function of expected battle scenarios, including likely number of targets, the priority of those targets, the number of systems available (itself a function of logistics considerations), and deployment conditions. The latter must take into account adverse weather, smoke or other obscurants, and active enemy counter-measures such as jamming. Ideally, the number of systems available, along with the lethality, should combine to produce a near-100 percent probability of destroying all targets in the expected scenario.

There are currently a number of avenues along which enhancements to weapon lethality are being pursued. These include:

- Scalable warhead design, including guided blast and fragmentation warheads and kinetic energy penetrators
- High power micro/millimeter wave, frequency and modulation optimized for specific targets
- Chemical and other advanced laser technology
- High-density munition carriage with concomitant smaller, more precise weapons and increased lethality per platform load-out

*A priori* predictions of lethality are made difficult by the wide range of conditions encountered on the battlefield. Usually a good estimate may be made of CEP (“circular error probability”, or probable miss distance) for guided and unguided projectiles. Warhead effectiveness against different target classes is more usually determined by experiment. Conventional electronic jammers can usually be modeled accurately against known threat systems, such as enemy radars. Less conventional systems, such as directed energy weapons, require a combination of analysis and experiment. For any procurement of a new system (or upgrade of an existing one), a program of analysis and test must be designed to assess lethality in a realistic yet cost-effective manner.

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