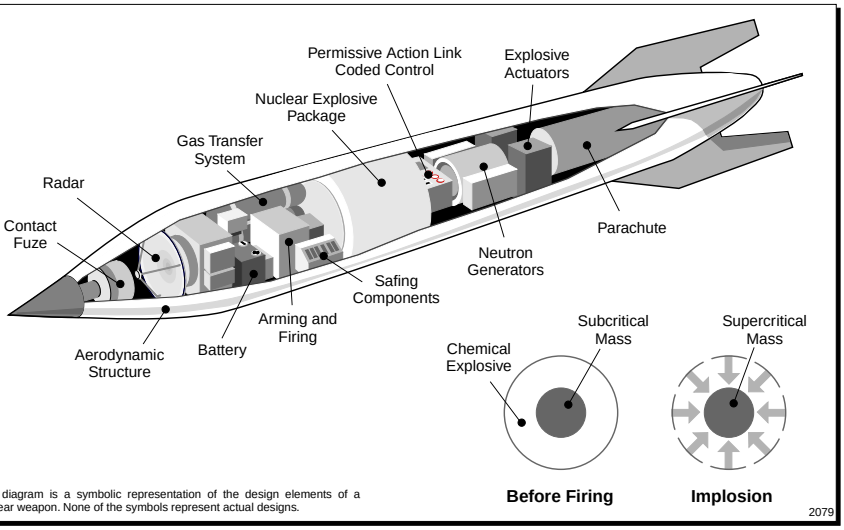
Nuclear explosions are produced by initiating and sustaining nuclear chain reactions in highly compressed material that can undergo both fission and fusion reactions. Most modern nuclear weapons use a nuclear package with two assemblies: the primary assembly, which is used as the initial source of energy; and the secondary assembly, which provides additional explosive energy release. The primary assembly contains a central core, called the "pit", which is surrounded by a layer of high explosive. The "pit" is typically composed of plutonium-239 and other materials.



The diagram is a symbolic representation of the design elements of a nuclear weapon. None of the symbols represent actual designs.

Primary Detonation

The primary nuclear explosion is initiated by detonating the layer of chemical high explosive that surrounds the pit which in turn drives the pit material into a compressed mass at the center of the primary assembly. This implosion process is illustrated in the inset of the diagram.

Boosting

In order to achieve higher explosive yields from primaries with relatively small quantities of pit material, a technique called "boosting" is used. Boosting is accomplished by injecting a mixture of tritium (T) and deuterium (D) gas into the pit. The deuterium and tritium are stored in high-pressure reservoirs until the gas transfer system is initiated. The implosion of the pit and the onset of the fissioning process heat the D–T mixture to the point that the D–T atoms undergo fusion. The fusion reaction produces large quantities of very high energy neutrons which flow through the compressed pit material and produce additional fission reactions.

Secondary Activation

The energy released by the primary explosion activates the secondary assembly. The secondary assembly is composed of lithium deuteride and other materials. As the secondary assembly implodes, lithium in the isotopic form lithium-6 is converted to tritium by neutron interactions. The tritium product in turn undergoes fusion with the deuterium to create the thermonuclear explosion.

Nonnuclear Components

Nonnuclear components include contact fuzes, radar components, aerodynamic structures, arming and firing systems, gas transfer systems, permissive action link coded controls, neutron generators, explosive actuators, safing components, batteries, and parachutes.

FIGURE 1.2.2–1.—*Nuclear Weapons Design.*