Atomic Bomb

INTRODUCTION

Atomic Bomb, extremely powerful explosive weapon whose force is fuelled by the splitting, or fission, of the nuclei of specific isotopes of uranium or plutonium (uranium-235, uranium-238, and plutonium-239) in a chain reaction.

The process of fission releases enormous energy in the form of extreme heat and a massive shock wave. A slow, carefully controlled fission reaction generates power for electricity companies worldwide, but in an atomic bomb the release of energy continues unabated until all fissile material is exhausted. In addition to its virtually limitless destructive effects —flash burns, and widespread destruction through pressure waves, and high winds—a nuclear explosion also produces deadly radiation in the form of gamma rays and neutrons, which destroy living matter and contaminate soil and water.

FISSION AND FUSION

Atomic bombs are nowadays called nuclear weapons, which are of two general types: fission or fusion. Fission weapons were the first atomic bombs to be developed, tested, and used in war, when the United States dropped two atomic bombs on Hiroshima and Nagasaki in Japan in 1945, at the end of World War II.

Fusion bombs, also called hydrogen or thermonuclear bombs, are vastly more powerful than fission bombs. They were developed and tested in the early 1950s, but these have never been used in warfare. A thermonuclear device depends on a fission reaction to produce extreme heat that causes hydrogen isotopes of deuterium and tritium to come together, or fuse. This process yields energy many times greater than that of fission-type devices. Most nuclear weapons in present-day stockpiles are thermonuclear devices.

DEVELOPMENT OF THE FIRST ATOMIC BOMBS

In the late 1930s, physicists in Europe and the United States realized that, in theory, the fission of uranium could be used to create an extremely powerful explosive weapon. In August 1939, the physicist Albert Einstein sent a letter to US President Franklin D. Roosevelt that described this possibility and warned of its potential development by other nations.

The US government explored this possibility for several years before establishing in 1942 the top-secret Manhattan Project, under the directorship of US Army Brigadier-General Leslie Groves. This team, working in several locations but in large part at Los Alamos, New Mexico, under the scientific leadership of physicist J. Robert Oppenheimer, designed and built the first atomic bombs, based on uranium-235 and on the more experimental plutonium-239. The first atomic explosion was conducted, as a test code-named Trinity, of the plutonium bomb. It was carried out near Alamogordo, New Mexico, at dawn on July 16, 1945. The energy released from this explosion was equivalent to that released by the detonation of 20,000 tons of trinitrotoluene (TNT). The United States dropped the first atomic bomb on the Japanese city of Hiroshima on August 6. It followed with a second against Nagasaki on August 9. As many as 100,000 people were killed by the Hiroshima uranium device, called Little Boy, and some 40,000 by the Nagasaki plutonium bomb, called Fat Man. Japan agreed to US terms of surrender on August 14.

These are the only times that a nuclear weapon has ever been used in a conflict between nations. Since then, several nations have exploded nuclear devices in tests, in the atmosphere, under the earth, and under the sea. Only the United States, Russia, Britain, France, and China admit to possessing nuclear weapons. Other nations, such as Israel and India among others, are also thought to have them, or to be able to assemble them quickly.

IV POST-WAR DEVELOPMENT

Since World War II, specific nuclear weapons for particular combat situations have been designed by nuclear scientists and deployed by military forces. Tactical or theatre nuclear weapons are intended for use in a limited area of conflict. They can be delivered to their target site in bombs or guided missiles, dropped from bomber aircraft or launched from fighters; in ballistic missiles launched from submarines; or, in artillery shells fired from a tank or an artillery.

Tactical nuclear weapons are meant to halt an enemy's advance through a massive and crippling attack. Strategic nuclear weapons, on the other hand, are designed for all-out battles of one nation against another across great distances, even across continents. They can be delivered to their targets in several ways: dropped by long-range bomber aircraft; or fired remotely as intercontinental ballistic missiles, (ICBMs) from fixed or mobile launchers on land, or from submarines. Some ICBMs were designed to carry multiple nuclear warheads that can separate on re-entry to the atmosphere and travel to different targets. Strategic nuclear weapons are designed to eliminate an opponent's ability to respond in kind.

V IMPACT OF THE ATOMIC BOMB

The development and use of atomic bombs has had so great an impact on the world that historians draw a sharp distinction between the atomic, or nuclear, age and all previous periods. The aftermath of Hiroshima and Nagasaki quickly made it apparent that humankind had succeeded in harnessing enough energy from nature itself to destroy the planet and all its inhabitants. At the height of the Cold War in the 1950s, the threat of nuclear warfare was to the fore in public consciousness. The use and rapid development of atomic weapons emphasized to many the extent to which science and technology could be harnessed to the services of war.

Beginning in the early 1960s, several nations have negotiated limitations on testing, producing, distributing, and deploying nuclear weapons and fissile materials. In 1963 the United States, the Soviet Union, and the United Kingdom signed the Limited Test Ban Treaty, which prohibits testing of nuclear weapons in the atmosphere, in outer space, or under the sea. The United States and Soviet Union agreed to limit their nuclear arsenals under the Strategic Arms Limitation Talks (SALT) treaties I (in 1972) and II (in 1979), and to actually reduce the number of their strategic nuclear weapons under the terms of the Strategic Arms Reduction Talks (START) treaties I (in 1991) and II (in 1993). Fulfilment of these arms control agreements will reduce the US and (now) Russian stockpile of strategic nuclear weapons by more than one half, to about 6,000, in the coming years.

The issue of non-proliferation—trying to keep nuclear weapons from spreading into the possession of non-nuclear nation states or terrorist groups—is a main security concern in the post-Cold War era. A treaty on the Non-Proliferation of Nuclear Weapons was established in 1968 and has been signed by more than 150 nations. While most analysts believe that the risk from nuclear weapons has become considerably reduced in recent years with the break-up of the Soviet Union and the reduction of the superpowers' nuclear arsenals, others warn that the risk has simply shifted, and that it is now the use of nuclear weapons by rogue nations or terrorists that the world must closely monitor and guard against.

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