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Chapter 1 : Securing the Bomb | NTI

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Nuclear weapon design The Trinity test of the Manhattan Project was the first detonation of a nuclear weapon, which lead J. Robert Oppenheimer to recall verses from the Hindu scripture Bhagavad Gita: Weapons whose explosive output is exclusively from fission reactions are commonly referred to as atomic bombs or atom bombs abbreviated as A-bombs. This has long been noted as something of a misnomer , as their energy comes from the nucleus of the atom, just as it does with fusion weapons. In fission weapons, a mass of fissile material enriched uranium or plutonium is forced into supercriticality â€"allowing an exponential growth of nuclear chain reactions â€"either by shooting one piece of sub-critical material into another the "gun" method or by compressing using explosive lenses a sub-critical sphere of material using chemical explosives to many times its original density the "implosion" method. The latter approach is considered more sophisticated than the former, and only the latter approach can be used if the fissile material is plutonium. The amount of energy released by fission bombs can range from the equivalent of just under a ton to upwards of , tons kilotons of TNT 4. Many fission products are either highly radioactive but short-lived or moderately radioactive but long-lived , and as such, they are a serious form of radioactive contamination if not fully contained. Fission products are the principal radioactive component of nuclear fallout. The most commonly used fissile materials for nuclear weapons applications have been uranium and plutonium Less commonly used has been uranium Neptunium and some isotopes of americium may be usable for nuclear explosives as well, but it is not clear that this has ever been implemented, and their plausible use in nuclear weapons is a matter of dispute. Thermonuclear weapon The basics of the Tellerâ€"Ulam design for a hydrogen bomb: The other basic type of nuclear weapon produces a large proportion of its energy in nuclear fusion reactions. Such fusion weapons are generally referred to as thermonuclear weapons or more colloquially as hydrogen bombs abbreviated as H-bombs , as they rely on fusion reactions between isotopes of hydrogen deuterium and tritium. All such weapons derive a significant portion of their energy from fission reactions used to "trigger" fusion reactions, and fusion reactions can themselves trigger additional fission reactions. Whether India has detonated a "true" multi-staged thermonuclear weapon is controversial. Almost all of the nuclear weapons deployed today use the thermonuclear design because it is more efficient. In the Teller-Ulam design , which accounts for all multi-megaton yield hydrogen bombs, this is accomplished by placing a fission bomb and fusion fuel tritium , deuterium , or lithium deuteride in proximity within a special, radiation-reflecting container. When the fission bomb is detonated, gamma rays and X-rays emitted first compress the fusion fuel, then heat it to thermonuclear temperatures. The ensuing fusion reaction creates enormous numbers of high-speed neutrons , which can then induce fission in materials not normally prone to it, such as depleted uranium. Each of these components is known as a "stage", with the fission bomb as the "primary" and the fusion capsule as the "secondary". In large, megaton-range hydrogen bombs, about half of the yield comes from the final fissioning of depleted uranium. This technique can be used to construct thermonuclear weapons of arbitrarily large yield, in contrast to fission bombs, which are limited in their explosive force. Most thermonuclear weapons are considerably smaller than this, due to practical constraints from missile warhead space and weight requirements. Other types Main articles: Boosted fission weapon , Neutron bomb , Radiological warfare , and Antimatter weapon There are other types of nuclear weapons as well. For example, a boosted fission weapon is a fission bomb that increases its explosive yield through a small number of fusion reactions, but it is not a fusion bomb. In the boosted bomb, the neutrons produced by the fusion reactions serve primarily to increase the efficiency of the fission bomb. There are two types of boosted fission bomb: Some nuclear weapons are designed for special purposes; a neutron bomb is a thermonuclear weapon that yields a relatively small explosion but a relatively large amount of neutron radiation ; such a device could theoretically be used to

cause massive casualties while leaving infrastructure mostly intact and creating a minimal amount of fallout. The detonation of any nuclear weapon is accompanied by a blast of neutron radiation. Surrounding a nuclear weapon with suitable materials such as cobalt or gold creates a weapon known as a salted bomb. This device can produce exceptionally large quantities of long-lived radioactive contamination. It has been conjectured that such a device could serve as a "doomsday weapon" because such a large quantity of radioactivities with half-lives of decades, lifted into the stratosphere where winds would distribute it around the globe, would make all life on the planet extinct. In connection with the Strategic Defense Initiative , research into the nuclear pumped laser was conducted under the DOD program Project Excalibur but this did not result in a working weapon. The concept involves the tapping of the energy of an exploding nuclear bomb to power a single-shot laser which is directed at a distant target. During the Starfish Prime high-altitude nuclear test in , an unexpected effect was produced which is called a nuclear electromagnetic pulse. This flash of energy can permanently destroy or disrupt electronic equipment if insufficiently shielded. Because the effect is produced by high altitude nuclear detonations, it can produce damage to electronics over a wide, even continental, geographical area. Research has been done into the possibility of pure fusion bombs: Such a device might provide a simpler path to thermonuclear weapons than one that required development of fission weapons first, and pure fusion weapons would create significantly less nuclear fallout than other thermonuclear weapons, because they would not disperse fission products. Air Force funded studies of the physics of antimatter in the Cold War , and began considering its possible use in weapons, not just as a trigger, but as the explosive itself. Nuclear weapons delivery , Nuclear triad , Strategic bomber , Intercontinental ballistic missile , and Submarine-launched ballistic missile The first nuclear weapons were gravity bombs , such as this " Fat Man " weapon dropped on Nagasaki , Japan. Upon its first fielding in the late s, the SS remains the single highest throw weight missile delivery system ever built. The system used to deliver a nuclear weapon to its target is an important factor affecting both nuclear weapon design and nuclear strategy. This method places few restrictions on the size of the weapon. It does, however, limit attack range, response time to an impending attack, and the number of weapons that a country can field at the same time. With miniaturization, nuclear bombs can be delivered by both strategic bombers and tactical fighter-bombers. This method is the primary means of nuclear weapons delivery; the majority of U. Although even short-range missiles allow for a faster and less vulnerable attack, the development of long-range intercontinental ballistic missiles ICBMs and submarine-launched ballistic missiles SLBMs has given some nations the ability to plausibly deliver missiles anywhere on the globe with a high likelihood of success. More advanced systems, such as multiple independently targetable reentry vehicles MIRVs , can launch multiple warheads at different targets from one missile, reducing the chance of a successful missile defense. Today, missiles are most common among systems designed for delivery of nuclear weapons. Making a warhead small enough to fit onto a missile, though, can be difficult. An atomic mortar has been tested by the United States. Small, two-man portable tactical weapons somewhat misleadingly referred to as suitcase bombs , such as the Special Atomic Demolition Munition , have been developed, although the difficulty of combining sufficient yield with portability limits their military utility. The policy of trying to prevent an attack by a nuclear weapon from another country by threatening nuclear retaliation is known as the strategy of nuclear deterrence. During the Cold War, policy and military theorists considered the sorts of policies that might prevent a nuclear attack, and they developed game theory models that could lead to stable deterrence conditions. Each missile, like the heavier lift Russian SS Satan , could contain up to ten nuclear warheads shown in red , each of which could be aimed at a different target. A factor in the development of MIRVs was to make complete missile defense difficult for an enemy country. Different forms of nuclear weapons delivery see above allow for different types of nuclear strategies. The goals of any strategy are generally to make it difficult for an enemy to launch a pre-emptive strike against the weapon system and difficult to defend against the delivery of the weapon during a potential conflict. This can mean keeping weapon locations hidden, such as deploying them on submarines or land mobile transporter erector launchers whose locations are difficult to track, or it can mean protecting

weapons by burying them in hardened missile silo bunkers. Other components of nuclear strategies included using missile defenses to destroy the missiles before they land, or implementing civil defense measures using early-warning systems to evacuate citizens to safe areas before an attack. Weapons designed to threaten large populations or to deter attacks are known as strategic weapons. Nuclear weapons for use on a battlefield in military situations are called tactical weapons. Critics of nuclear war strategy often suggest that a nuclear war between two nations would result in mutual annihilation. From this point of view, the significance of nuclear weapons is to deter war because any nuclear war would escalate out of mutual distrust and fear, resulting in mutually assured destruction. This threat of national, if not global, destruction has been a strong motivation for anti-nuclear weapons activism. Critics from the peace movement and within the military establishment[citation needed] have questioned the usefulness of such weapons in the current military climate. According to an advisory opinion issued by the International Court of Justice in , the use of or threat of use of such weapons would generally be contrary to the rules of international law applicable in armed conflict, but the court did not reach an opinion as to whether or not the threat or use would be lawful in specific extreme circumstances such as if the survival of the state were at stake. Another deterrence position is that nuclear proliferation can be desirable. In this case, it is argued that, unlike conventional weapons, nuclear weapons deter all-out war between states, and they succeeded in doing this during the Cold War between the U. Strategy for the Nuclear Age that mere possession of a nuclear arsenal was enough to ensure deterrence, and thus concluded that the spread of nuclear weapons could increase international stability. Some prominent neo-realist scholars, such as Kenneth Waltz and John Mearsheimer , have argued, along the lines of Gallois, that some forms of nuclear proliferation would decrease the likelihood of total war , especially in troubled regions of the world where there exists a single nuclear-weapon state. Aside from the public opinion that opposes proliferation in any form, there are two schools of thought on the matter: The prospect of mutually assured destruction might not deter an enemy who expects to die in the confrontation. Further, if the initial act is from a stateless terrorist instead of a sovereign nation, there might not be a nation or specific target to retaliate against. It has been argued, especially after the September 11, attacks , that this complication calls for a new nuclear strategy, one that is distinct from that which gave relative stability during the Cold War. By threatening retaliation against those states, the United States may be able to deter that which it cannot physically prevent. By identifying unique attributes of the fissile material, including its impurities and contaminants, one could trace the path back to its origin. Anti-nuclear movement The International Atomic Energy Agency was created in to encourage peaceful development of nuclear technology while providing international safeguards against nuclear proliferation. Because they are weapons of mass destruction, the proliferation and possible use of nuclear weapons are important issues in international relations and diplomacy. In most countries, the use of nuclear force can only be authorized by the head of government or head of state. It highlighted the dangers posed by nuclear weapons and called for world leaders to seek peaceful resolutions to international conflict. The signatories included eleven pre-eminent intellectuals and scientists, including Albert Einstein , who signed it just days before his death on April 18, A few days after the release, philanthropist Cyrus S. By the s, steps were taken to limit both the proliferation of nuclear weapons to other countries and the environmental effects of nuclear testing. The Partial Nuclear Test Ban Treaty restricted all nuclear testing to underground nuclear testing , to prevent contamination from nuclear fallout, whereas the Treaty on the Non-Proliferation of Nuclear Weapons attempted to place restrictions on the types of activities signatories could participate in, with the goal of allowing the transference of non-military nuclear technology to member countries without fear of proliferation. In , the International Atomic Energy Agency IAEA was established under the mandate of the United Nations to encourage development of peaceful applications of nuclear technology, provide international safeguards against its misuse, and facilitate the application of safety measures in its use. In , many nations signed the Comprehensive Nuclear-Test-Ban Treaty , [38] which prohibits all testing of nuclear weapons. A testing ban imposes a significant hindrance to nuclear arms development by any complying country. Nuclear weapons have also been opposed by agreements between countries. Many nations have been

declared Nuclear-Weapon-Free Zones , areas where nuclear weapons production and deployment are prohibited, through the use of treaties. The Treaty of Tlatelolco prohibited any production or deployment of nuclear weapons in Latin America and the Caribbean , and the Treaty of Pelindaba prohibits nuclear weapons in many African countries. The court ruled that the use or threat of use of nuclear weapons would violate various articles of international law , including the Geneva Conventions , the Hague Conventions , the UN Charter , and the Universal Declaration of Human Rights. Given the unique, destructive characteristics of nuclear weapons, the International Committee of the Red Cross calls on States to ensure that these weapons are never used, irrespective of whether they consider them lawful or not. In the wake of the tests by India and Pakistan in , economic sanctions were temporarily levied against both countries, though neither were signatories with the Nuclear Non-Proliferation Treaty. One of the stated casus belli for the initiation of the Iraq War was an accusation by the United States that Iraq was actively pursuing nuclear arms though this was soon discovered not to be the case as the program had been discontinued.

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nuclear materials management, approach decisions on the ultimate disposition of nuclear materials, enhance the institutional capabilities necessary to ensure success, and encourage sound dismantlement and materials management in Russia.

In fact, it is the only world power to use the atomic bomb in war. However, more than , nuclear warheads have been built since All but close to three percent were built by the United States alone. Since the end of the Cold War, the United States and the other nuclear powers of the world have moved an increasing percentage of their warheads from operational status to various reserve, inactive or contingency categories, as arms control agreements traditionally have not required the destruction of warheads. The goal of these proliferation movements is to prevent the onslaught of nuclear destruction. Despite what many would view as improbable, nuclear war is still a possibility in our world. There has been progress made on the elimination of nuclear weapons: Of the more than 70, warheads produced by the United States since , more than 60, have been disassembled by mid The Pentagon has custody of approximately 10, stockpiled warheads, of which about 5, are considered active or operational. The remaining are categorized as reserve or inactive. From developing grids to power cities, to ensuring national security, the NNSA is an anti-proliferation organization. The NNSA is interested in maintaining the warhead stockpile with a project management system that allows the agency to maintain its self and its mission. The NNSA project management system includes: Project management policy and procedure counsel; independent project review capabilities; and, Other project management resources to support management of NNSA construction projects. For those who believe that this agency is working against the efforts of proliferation, we must remember that all of the major nations that have nuclear weapons have not fully renounced their weapons. Going forward, I anticipate the NNSA to continue their efforts to secure nuclear energy to study and refine that into new innovations for the public. However, proliferation efforts will continue, and it will be a challenge for the agency. One thing is for certain, the NNSA will adapt along with their under-budget, one-time delivery of their projects. Agencies should work towards developing projects that allow for on-time delivery and under-budgeting. Up until now, not many knew of this agency and its successes. I personally like to see a world free of nuclear weapons for myself and my children; however, I respect the efforts of the NNSA to advance technology through nuclear science. Andrew R Vaz, M. About The American Society for Public Administration is the largest and most prominent professional association for public administration. It is dedicated to advancing the art, science, teaching and practice of public and non-profit administration.

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