The Atomic Bomb

A Report By:

Stephen

Introduction

Over the years, man's desire to gain more knowledge and power outgrew his body's abilities to provide and control it. The chaos of World War II spurred development of amazing technological advances in many areas, including aviation, naval power, and weaponry. The country with the fastest aircraft or ship, most advanced radar, sonar, or most powerful armaments would now dominate in the offensive and defensive capabilities of the war. Yet, these advances were incapable of satisfying man's want for unchallenged power.

The emerging area of Nuclear Physics became a science that rapidly started developing weapons for war: If Nazi Germany could develop an atomic bomb, they would be able to dictate their will to other countries. The major powers proceeded to push their atomic bomb programs with large amounts of finances and scientific endeavor.

The race for an atomic weapon of destruction had begun.

Part 1: The History

Mathematician and scientist Sir Isaac Newton theorized that atoms were the smallest particles that determined the makeup of matter. He compared them to marbles, except that atoms could not be divided further and marbles could. He did not conclude that protons, neutrons, and electrons existed.

Then, in the 1930's, scientists in Great Britain proved otherwise. At the same time, Einstein discovered that the energy of one ounce of matter was equal to the exploding energy of millions of tons of TNT, the most powerful explosive then available to man.

In 1932, Leo Szilard proved that neutrons could split (fission) an atom. Because of the charges of the atom, protons and electrons were repelled, but a single neutron could penetrate the nucleus and split the atom apart. Research commenced to find an atom that could prove the theory.

The country that found the fissionable atom turned out to be Germany. Scientists in Berlin discovered that as uranium was split, it released a tremendous amount of energy. Shortly afterwards, Hitler invaded Poland, providing a much-needed incentive for other countries to start their own research. Ironically, while Germany's research was slowly advancing, Hitler's anti-Semitism (anti-Jew) doctrine drove many potential talented Jewish scientists out of the country.

As Hitler's army marched through Poland, President Franklin D. Roosevelt approved funding for a small nuclear program. Research crawled along while the Allies worried about German progress.

While researchers in the U.S. studied the fission of atoms by slow neutrons, scientists Otto Frisch and Rudolf Peierls started on the research of fission by fast neutrons in Britain. After some initial progress from the British scientists, the U.S. team switched to fast neutrons and increased funding. The overhaul was complete when the old researchers were replaced.

While World War II was being fought, the Allied powers could all imagine German atomic bombs falling on London and Paris. Because of this fear, considerable funding was pumped into their projects. The Allies wouldn't know until the last year of the war (1945) that the German programs were practically standing still.

After concluding many experiments, a scientist named Enrico Fermi determined the amount of uranium needed for a self-sustaining chain reaction—in other words, an explosion. He named it "pile", a term many scientists hated. Work commenced underneath Stagg Field, Chicago, to build a prototype "pile".

After seventeen days, on December 2nd, the pile was completed and a limited chain reaction took place. Before the pile could explode and unleash deadly radiation upon the citizens of Chicago, safety devices were inserted and the reaction stopped. The nuclear program in the United States (codenamed the Manhattan Project) now moved from the research of a bomb to the actual building of it.

The team that would build an atomic bomb was relocated to a mesa (large, flat hill) in Los

Alamos, New Mexico, into a building that was formerly a school. Work began on a 2-by-17-foot gun-type bomb called "The Gadget" or "Thin Man", but the 10,000-pound bomb was abandoned for a more-manageably-sized bomb called "Little Boy". "Little Boy" was six feet long and weighed 9,000 pounds.

The scientists were so confident in Little Boy that it was never tested. The reaction in the gun-type bomb was too slow for plutonium, though, so research began on an implosion-type bomb called "Fat Man". The scientists struggled to ready the bomb by the time the nuclear fuel arrived.

Britain was accepted as a partner in the development of the bomb at this point. President Roosevelt died, leaving Harry S. Truman president. Since Hitler had just been defeated, Truman decided to use the bombs on Japan.

President Truman warned the Japanese government to surrender or face "total destruction". There was a problem, though: If Japan surrendered, the Emperor would be prosecuted for war crimes. The Japanese people considered this disgraceful because they thought of the Emperor as a god, so no reply came. Truman finally turned the bombs over to the military for use.

Lieutenant Colonel Paul W. Tibbets and his crew had been training with their B-29 bomber, the *Enola Gay*, for months. Paul was finally told what they were doing on August 6th, the day of the flight. After the plane barely managed to take off, he asked his crew what they thought they were dropping today. "A chemist's nightmare?" asked one. It dawned on him and he asked, "Are we splitting the atom today?" Indeed.

At 7:30 AM (Japanese local time), Little Boy was armed. When it detonated 1,900 feet over the Aioi Bridge of Hiroshima, the explosion was estimated to be equal to the force of 12,000-15,000 tons of TNT. Japan was told to surrender again.

After waiting another three days, no response seemed forthcoming, so Major Charles W. Sweeney and the crew of his B-29 bomber, *Bock's Car*, flew to Japan with Fat Man. Since clouds had covered the target city of Kokura, *Bock's Car* headed to the secondary target, Nagasaki.

At 10:58 Japanese time, Fat Man exploded at 1,650 feet with the force of 21,000 tons of exploding TNT. The Japanese officials, fearing more bombs would fall on their people, surrendered on August 10, 1945. They didn't know the U.S. had only one more atomic bomb ready for use.

Part 2: Workings of the Bombs

Terms:

subcritical amount = mass does not react
critical mass = the minimum amount of nuclear material needed to "chain react"
supercritical mass = reaction time shrinks rapidly and will explode if left unchecked

Description:

Nuclear fission gets its energy from the splitting of atoms. When a single neutron is fired into the nucleus of an atom, the nucleus splits into two smaller atoms and two or three neutrons shoot off. The newly separated neutrons may strike other nuclei and cause more reactions, which will continue quickly. The explosion will occur in one millionth of a second.

The purpose of an atomic bomb is to fuse two subcritical masses together, forming a supercritical mass that explodes, spreading the radiation and destruction described earlier.

In a gun-type bomb, an explosive charge fires a wedge of uranium at the large ball that will react. The pieces fuse together and explode. In an implosion-type bomb, a small core of beryllium and polonium trigger is inside two halves of plutonium, which is placed within a layer of natural uranium, which is inside a shell of high explosives. When the bomb is detonated, the high explosives squeeze the uranium ore and plutonium tightly around the beryllium/polonium trigger, which starts the nuclear reaction.

Conclusion

In my opinion, the development of the atomic bombs ushered in a new age in which innocent people fear unimaginably painful suffering or outright death. Even though we no longer use the atomic bombs described in this report, their more powerful descendants have eaten up huge amounts of the national budget, and we now have a weapon we are too afraid to use and too reluctant to destroy. The world must live with the threat of nuclear war, but we don't have to like it.

And now, a quote from some guy whose name I don't remember:

> "For the first time in history there was a nuclear explosion; and what an explosion! . . . it lighted every peak . . . of the nearby mountain range with a clarity and beauty that . . . the great poets dream about but describe most poorly and inadequately . . . the air blast [came] pressing hard against people and things, to be followed . . . by the strong, sustained, awesome roar which warned of doomsday and made us feel that we puny things were blasphemous to dare tamper with the forces heretofore reserved to the Almighty."

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NOTE: I unfortunately forgot to write down some web addresses I used when I found them. Since I used searches on three different web sites, now I can't find them.