

The race to build the bomb

■ **1937, July 7:** Japan invades China. Ultra-nationalist military leaders justify plan to occupy China, Manchuria and Korea under pretext of *Hakko Ichiu* – ancient *Shinto* concept of “all the world under one roof”, ruled by Japan’s divine Emperor. **Invasion sets Japan on course for World War Two**

Emperor Hirohito (right). Believed to have opposed Japan’s drift to war



■ **1938:** German scientists **Otto Hahn** and **Fritz Strassman** demonstrate nuclear fission – splitting the nucleus of a uranium atom and converting some of its mass to energy.

Japanese atom bomb project begins under direction of physicist Yoshio Nishina (right). Japan purchases cyclotron – to enrich uranium – from University of California



■ **1939:** Germany starts project to build atom bomb. Rival teams led by physicists **Kurt Diebner** and **Werner Heisenberg** (left) explore uranium and plutonium devices



■ **Aug:** Scientists led by **Albert Einstein** (left) write to U.S. President **Franklin D. Roosevelt** (right), warning of Nazi Germany’s A-bomb project. **Letter recommends that U.S. develops its own atom bomb – Manhattan Project is born**



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■ **Sep 1:** **Adolf Hitler** invades Poland. Britain and France declare war on Germany. **Britain begins GEN75 project to build atom bomb**

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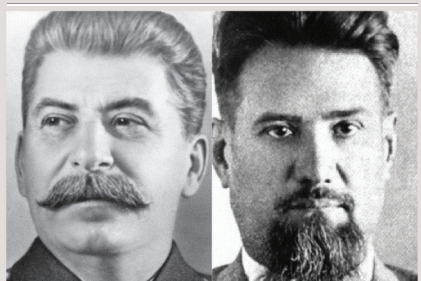
■ **1940:** Heisenberg’s protégé **Carl Friedrich Freiherr von Weizsäcker** proposes use of *eka-rhenium* as nuclear explosive. Eka-rhenium – now called *neptunium* – decays into plutonium

■ **1941:** Heisenberg’s team files patent for plutonium bomb in Germany

On August 6, 1945, a single American aircraft dropped an atom bomb on the Japanese city of Hiroshima. Three days later Nagasaki met the same fate. Japan surrendered within a week, ending World War Two. More than 120,000 of the 450,000 people in the two cities were killed – a further 100,000 died from radiation-related illnesses



■ **Dec 7:** Japan attacks Pearl Harbour, bringing U.S. into war



■ **Oct 1942:** Soviet leader **Joseph Stalin** (above left) learns of U.S. and German A-bomb projects. Soviet atomic weapons programme begins under leadership of physicist **Igor Kurchatov** (right)

■ **1944:** In U.S., Manhattan Project employs almost 129,000 people – including British and Canadian atom scientists – under leadership of **Robert Oppenheimer**

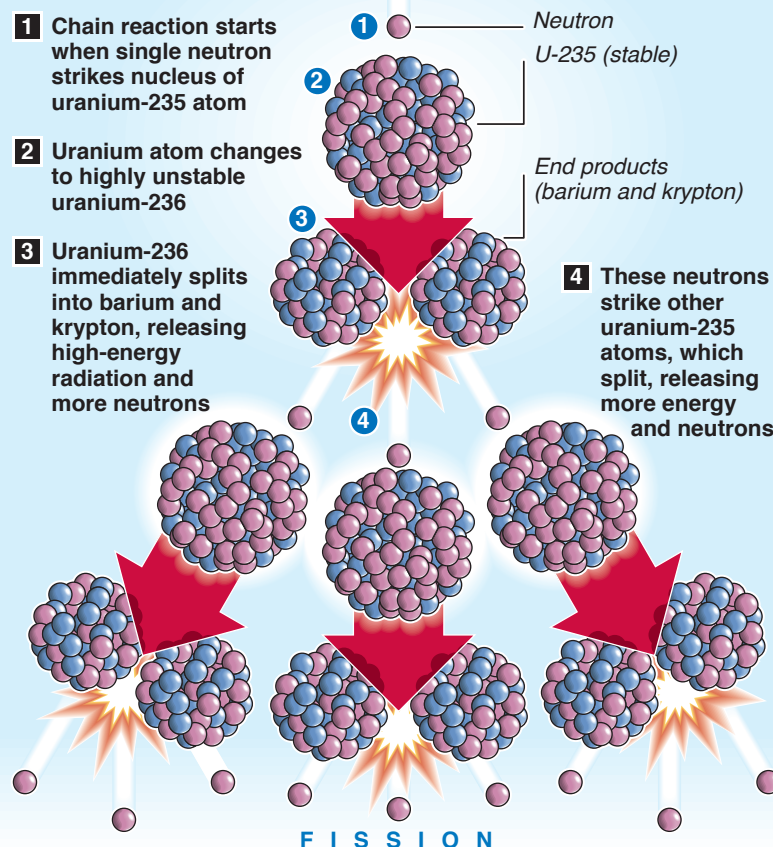
■ **1945, April 1:** U.S. invades Okinawa – last stepping stone on road to Japan – 81-day battle claims more than 110,000 Japanese and 14,000 American lives. **U.S. firebombing of Japanese cities forces Tokyo’s A-bomb project to be moved to Hungnam, in what is now North Korea**

■ **Apr 12:** Roosevelt dies, **Harry S. Truman** becomes U.S. president. Briefed on Manhattan Project, Truman sees bomb as way to end war quickly and save American lives

■ **May 7:** Allied Armies accept unconditional surrender of Nazi Germany – Pacific war continues



CHAIN REACTION: The power of an atom bomb comes from the release of energy holding together each individual atom of uranium. **When sufficient fuel is brought together a chain reaction occurs – energy released is a hundred million times greater than that from a chemical reaction**



Little Boy uranium bomb

Length: **3 metres**
Weight: **4,400kg**
Yield: **15 kilotons**

1. Barometric safety switch operates when bomb is just 1,500m above target

2. Proximity fuze fires explosive charge

3. Wedge of uranium-235 is fired at large target of U-235

4. Force of impact welds two pieces together, creating super-critical mass of uranium drenched in neutrons. Chain reaction accelerates and atomic blast follows

■ **Jun 18, 1945:** Truman approves plan to invade and occupy Japan. Invasion will employ 2.7 million U.S. troops

■ **Jul:** Two atomic bombs – uranium-fuelled *Little Boy* and plutonium-fuelled *Fat Man* – are transported to Tinian in U.S.-occupied Marianas

■ **Jul 16, Trinity Test:** After \$2 billion of research (\$23bn in current value), prototype plutonium device is detonated in New Mexico desert. **It yields four times more energy than scientists had thought possible.** Oppenheimer quotes Hindu *Bhagavad Gita*: “*I am become Death, the destroyer of worlds*”

■ **Jul 26, Potsdam Declaration:** U.S., Britain and China demand Japanese surrender or face “**prompt and utter destruction**”. Japan ignores declaration

■ **Aug 6, 8:15am:** B-29 bomber *Enola Gay*, flying at 9,150 metres, drops atomic bomb on Hiroshima, killing almost everyone within 1,000m of ground zero



■ **Aug 9, 11:02am:** U.S. drops plutonium bomb on Nagasaki, killing 40,000 people instantly

■ **Aug 14:** Japan surrenders