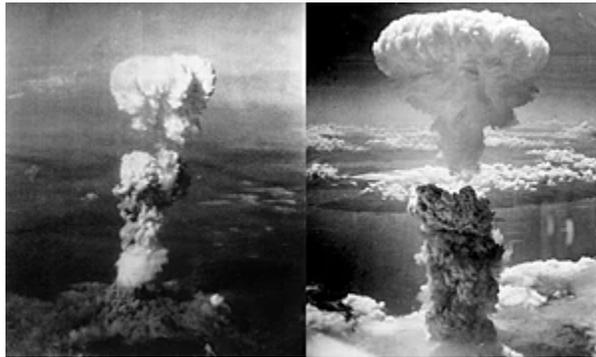


Atomic bombings of Hiroshima and Nagasaki

The United States detonated two [atomic bombs](#) over the Japanese cities of [Hiroshima](#) and [Nagasaki](#) on 6 and 9 August 1945, respectively. The two bombings killed between 129,000 and 226,000 people, most of whom were civilians, and remain the only use of nuclear weapons in armed conflict.

Atomic bombings of Hiroshima and Nagasaki

Part of the [Pacific War](#) of [World War II](#)



Atomic bomb [mushroom clouds](#) over Hiroshima (*left*) and Nagasaki (*right*)

Date 6 and 9 August 1945

Location [Hiroshima](#) and [Nagasaki](#), Japan

Result Allied victory

Belligerents

 [United States](#)

Manhattan Project:

◦  [United Kingdom](#)

◦  [Canada](#)

 [Japan](#)

Commanders and leaders

 [William S. Parsons](#)

 [Paul Tibbets](#)

 [Robert A. Lewis](#)^[1]

 [Charles Sweeney](#)

 [Frederick Ashworth](#)

 [Shunroku Hata](#)

Units involved

[Manhattan Project](#): 50 U.S., 2 British

[509th Composite Group](#): 1,770 U.S.

[Second General Army](#):

Hiroshima: 40,000 (5 [anti-aircraft batteries](#))

Nagasaki: 9,000 (4 [anti-aircraft batteries](#))

Casualties and losses

1 British, 7 Dutch, and 12 American prisoners of war killed

2 atomic bombs detonated

Hiroshima:

- 20,000 soldiers killed
- 70,000–126,000 civilians killed

Nagasaki:

- 39,000–80,000 killed
- At least 150 soldiers killed

Total killed:

• 129,000–226,000

In the final year of [World War II](#), the [Allies](#) prepared for a costly [invasion of the Japanese mainland](#). This undertaking was preceded by a [conventional and firebombing campaign](#) that devastated 64 Japanese cities. The [war in the European theatre](#) concluded when Germany [surrendered](#) on 8 May 1945, and the Allies turned their full attention to the [Pacific War](#). By July 1945, the Allies' [Manhattan Project](#) had produced two types of atomic bombs: "[Fat Man](#)", a [plutonium implosion-type nuclear weapon](#); and "[Little Boy](#)", an [enriched uranium gun-type fission weapon](#). The [509th Composite Group](#) of the [United States Army Air Forces](#) was trained and equipped with the specialized [Silverplate](#) version of the [Boeing B-29 Superfortress](#), and deployed to [Tinian](#) in the [Mariana Islands](#). The Allies called for the unconditional surrender of the [Imperial Japanese armed forces](#) in the [Potsdam Declaration](#) on 26 July 1945, the alternative being "prompt and utter destruction". The Japanese government chose to ignore the ultimatum.

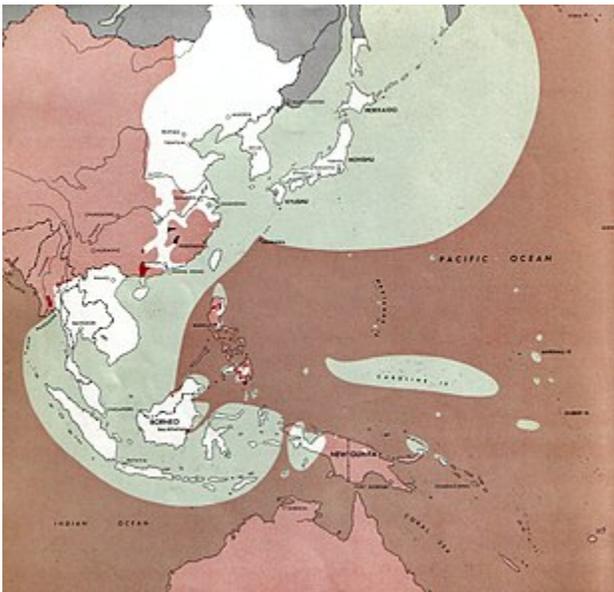
The consent of the United Kingdom was obtained for the bombing, as was required by the [Quebec Agreement](#), and orders were issued on 25 July by [General Thomas Handy](#), the acting [Chief of Staff of the United States Army](#), for atomic bombs to be used against Hiroshima, [Kokura](#), [Niigata](#), and Nagasaki. These targets were chosen because they were large urban areas that also held militarily significant facilities. On 6 August, a Little Boy was dropped on Hiroshima, to which [Prime Minister Suzuki](#) reiterated the Japanese government's commitment to ignore the Allies' demands and fight on. Three days later, a Fat Man was dropped on Nagasaki. Over the next two to four months, the [effects of the atomic bombings](#) killed between 90,000 and 146,000 people in Hiroshima and 39,000 and 80,000 people in Nagasaki; roughly half occurred on the first day. For months afterward, many people continued to die from the effects of burns, [radiation sickness](#), and injuries, compounded by illness and malnutrition. Though Hiroshima had a sizable military garrison, most of the dead were civilians.

[Japan surrendered](#) to the Allies on 15 August, six days after the [Soviet Union's declaration of war](#) and the bombing of Nagasaki. The Japanese government signed the [instrument of surrender](#) on 2 September, effectively [ending the war](#). Scholars have extensively studied the effects of the

bombings on the social and political character of subsequent world history and [popular culture](#), and there is still [much debate](#) concerning the ethical and legal justification for the bombings. Supporters believe that the atomic bombings were necessary to bring a swift end to the war with minimal casualties; critics dispute how the Japanese government was brought to surrender, and highlight the moral and ethical implications of nuclear weapons and the deaths caused to civilians.

Background

Pacific War



Situation of the Pacific War on 1 August 1945.

White and green: Areas still controlled by Japan included Korea, Taiwan, [Indochina](#), and much of [China](#), including most of the main cities, and the [Dutch East Indies](#)

Red: Allied-held areas

Grey: Neutral Soviet Union

In 1945, the [Pacific War](#) between the [Empire of Japan](#) and the [Allies](#) entered its fourth year. Most Japanese military units fought fiercely, ensuring that the Allied victory would come at an enormous cost. The 1.25 million battle casualties incurred in total by the United States in [World War II](#) included both [military personnel killed in action](#) and [wounded in action](#). Nearly one million

of the casualties occurred during the last year of the war, from June 1944 to June 1945. In December 1944, American battle casualties hit an all-time monthly high of 88,000 as a result of the German [Ardennes Offensive](#). America's reserves of manpower were running out. Deferments for groups such as agricultural workers were tightened, and there was consideration of drafting women. At the same time, the public was becoming war-weary, and demanding that long-serving servicemen be sent home.^[2]

In the Pacific, the Allies [returned to the Philippines](#),^[3] [recaptured Burma](#),^[4] and [invaded Borneo](#).^[5] Offensives were undertaken to reduce the Japanese forces remaining in [Bougainville, New Guinea](#) and the Philippines.^[6] In April 1945, American forces [landed on Okinawa](#), where heavy fighting continued until June. Along the way, the ratio of Japanese to American casualties dropped from five to one in the Philippines to two to one on Okinawa.^[2] Although some Japanese soldiers were [taken prisoner](#), most fought until they were killed or committed [suicide](#). Nearly 99 percent of the 21,000 defenders of [Iwo Jima](#) were killed. Of the 117,000 Okinawan and Japanese troops defending [Okinawa](#) in April to June 1945, 94 percent were killed;^[7] 7,401 Japanese soldiers surrendered, an unprecedentedly large number.^[8]

As the Allies advanced towards Japan, conditions became steadily worse for the Japanese people. Japan's merchant fleet declined from 5,250,000 [gross tons](#) in 1941 to 1,560,000 tons in March 1945, and 557,000 tons in August 1945. Lack of raw materials forced the Japanese war economy into a steep decline after the middle of 1944. The civilian economy, which had slowly deteriorated throughout the war, reached disastrous levels by the middle of 1945. The loss of shipping also affected the fishing fleet, and the 1945 catch was only 22 percent of that in 1941. The 1945 rice harvest was the worst since 1909, and hunger and malnutrition became widespread. U.S. industrial production was overwhelmingly superior to Japan's. By 1943, the U.S. produced almost 100,000 aircraft a year, compared to Japan's production of 70,000 for the entire war. In February 1945, Prince [Fumimaro Konoe](#) advised [Emperor Hirohito](#) that defeat was inevitable, and urged him to abdicate.^[9]

Preparations to invade Japan

Even before the [surrender of Nazi Germany](#) on 8 May 1945, plans were underway for the largest operation of the Pacific War, [Operation Downfall](#), the Allied invasion of Japan.^[10] The operation had two parts: [Operation Olympic](#) and [Operation Coronet](#). Set to begin in October 1945, Olympic involved a series of landings by the U.S. [Sixth Army](#) intended to capture the southern third of the southernmost main Japanese island, [Kyūshū](#).^[11] Operation Olympic was to be followed in March

1946 by Operation Coronet, the capture of the [Kantō Plain](#), near Tokyo on the main Japanese island of [Honshū](#) by the U.S. [First](#), [Eighth](#) and [Tenth](#) Armies, as well as a [Commonwealth Corps](#) made up of Australian, British and Canadian divisions. The target date was chosen to allow for Olympic to complete its objectives, for troops to be redeployed from Europe, and the [Japanese winter](#) to pass.^[12]



U.S. Army propaganda poster depicting [Uncle Sam](#) preparing the public for the invasion of Japan after ending war on Germany and Italy

[Japan's geography](#) made this invasion plan obvious to the Japanese; they were able to predict the Allied invasion plans accurately and thus adjust their defensive plan, [Operation Ketsugō](#), accordingly. The Japanese planned an all-out defense of Kyūshū, with little left in reserve for any subsequent defense operations.^[13] Four veteran divisions were withdrawn from the [Kwantung Army](#) in [Manchuria](#) in March 1945 to strengthen the forces in Japan,^[14] and 45 new divisions were activated between February and May 1945. Most were immobile formations for coastal defense, but 16 were high quality mobile divisions.^[15] In all, there were 2.3 million [Japanese Army](#) troops prepared to defend the home islands, backed by a [civilian militia](#) of 28 million men and women. Casualty predictions varied widely, but were extremely high. The Vice Chief of the [Imperial Japanese Navy General Staff](#), [Vice Admiral Takijirō Ōnishi](#), predicted up to 20 million Japanese deaths.^[16]

On 15 June 1945, a study by the Joint War Plans Committee,^[17] who provided planning information to the [Joint Chiefs of Staff](#), estimated that Olympic would result in 130,000 to

220,000 U.S. casualties, with U.S. dead in the range from 25,000 to 46,000. Delivered on 15 June 1945, after insight gained from the Battle of Okinawa, the study noted Japan's inadequate defenses due to the very effective sea blockade and the American firebombing campaign. The [Chief of Staff of the United States Army, General of the Army George Marshall](#), and the Army Commander in Chief in the Pacific, General of the Army [Douglas MacArthur](#), signed documents agreeing with the Joint War Plans Committee estimate.^[18]

The Americans were alarmed by the Japanese buildup, which was accurately tracked through [Ultra](#) intelligence.^[19] [Secretary of War Henry L. Stimson](#) was sufficiently concerned about high American estimates of probable casualties to commission his own study by [Quincy Wright](#) and [William Shockley](#). Wright and Shockley spoke with Colonels [James McCormack](#) and [Dean Rusk](#), and examined casualty forecasts by [Michael E. DeBakey](#) and Gilbert Beebe. Wright and Shockley estimated the invading Allies would suffer between 1.7 and 4 million casualties in such a scenario, of whom between 400,000 and 800,000 would be dead, while Japanese fatalities would have been around 5 to 10 million.^{[20][21]}

Marshall began contemplating the use of a weapon that was "readily available and which assuredly can decrease the cost in American lives":^[22] [poison gas](#). Quantities of [phosgene](#), [mustard gas](#), [tear gas](#) and [cyanogen chloride](#) were moved to [Luzon](#) from stockpiles in Australia and New Guinea in preparation for Operation Olympic, and MacArthur ensured that [Chemical Warfare Service](#) units were trained in their use.^[22] Consideration was also given to using [biological weapons](#) against Japan.^[23]

Air raids on Japan



A B-29 over Osaka on 1 June 1945

While the United States had developed plans for an air campaign against Japan prior to the Pacific War, the capture of Allied bases in the western Pacific in the first weeks of the conflict meant that this offensive did not begin until mid-1944 when the long-ranged [Boeing B-29 Superfortress](#) became ready for use in combat.^[24] [Operation Matterhorn](#) involved India-based B-29s staging through bases around [Chengdu](#) in China to make a series of raids on strategic targets in Japan.^[25] This effort failed to achieve the strategic objectives that its planners had intended, largely because of logistical problems, the bomber's mechanical difficulties, the vulnerability of Chinese staging bases, and the extreme range required to reach key Japanese cities.^[26]

[Brigadier General Haywood S. Hansell](#) determined that [Guam](#), [Tinian](#), and [Saipan](#) in the [Mariana Islands](#) would better serve as B-29 bases, but they were in Japanese hands.^[27] Strategies were shifted to accommodate the air war,^[28] and the [islands were captured](#) between June and August 1944. Air bases were developed,^[29] and B-29 operations commenced from the Marianas in October 1944.^[30] These bases were easily resupplied by cargo ships.^[31] The [XXI Bomber Command](#) began missions against Japan on 18 November 1944.^[32] The early attempts to bomb Japan from the Marianas proved just as ineffective as the China-based B-29s had been. Hansell continued the practice of conducting so-called high-altitude [precision bombing](#), aimed at key industries and transportation networks, even after these tactics had not produced acceptable results.^[33] These efforts proved unsuccessful due to logistical difficulties with the remote location, technical problems with the new and advanced aircraft, unfavorable weather conditions, and enemy action.^{[34][35]}



The Operation Meetinghouse [firebombing of Tokyo](#) on the night of 9–10 March 1945, was the single deadliest air raid in history,^[36] with a greater area of fire damage and loss of life than either of the atomic bombings of Hiroshima or Nagasaki.^{[37][38]}

Hansell's successor, [Major General Curtis LeMay](#), assumed command in January 1945 and initially continued to use the same precision bombing tactics, with equally unsatisfactory results. The attacks initially targeted key industrial facilities but much of the Japanese manufacturing process was carried out in small workshops and private homes.^[39] Under pressure from [United States Army Air Forces](#) (USAAF) headquarters in Washington, LeMay changed tactics and decided that low-level [incendiary raids](#) against Japanese cities were the only way to destroy their production capabilities, shifting from precision bombing to [area bombardment](#) with incendiaries.^[40] Like most [strategic bombing during World War II](#), the aim of the air offensive against Japan was to destroy the enemy's war industries, kill or disable civilian employees of these industries, and [undermine civilian morale](#).^{[41][42]}

Over the next six months, the XXI Bomber Command under LeMay firebombed 64 Japanese cities.^[43] The [firebombing of Tokyo](#), codenamed *Operation Meetinghouse*, on 9–10 March killed an estimated 100,000 people and destroyed 41 km² (16 sq mi) of the city and 267,000 buildings in a single night. It was the deadliest bombing raid of the war, at a cost of 20 B-29s shot down by flak and fighters.^[44] By May, 75 percent of bombs dropped were incendiaries designed to burn down Japan's "paper cities". By mid-June, Japan's six largest cities had been devastated.^[45] The end of the [fighting on Okinawa](#) that month provided airfields even closer to the Japanese mainland, allowing the bombing campaign to be further escalated. Aircraft flying from Allied [aircraft carriers](#) and the [Ryukyu Islands](#) also regularly struck targets in Japan during 1945 in preparation for Operation Downfall.^[46] Firebombing switched to smaller cities, with populations ranging from 60,000 to 350,000. According to [Yuki Tanaka](#), the U.S. fire-bombed over a hundred Japanese towns and cities.^[47] These raids were devastating.^[48]

The Japanese military was unable to stop the Allied attacks and the country's [civil defense](#) preparations proved inadequate. Japanese fighters and anti-aircraft guns had difficulty engaging bombers flying at high altitude.^[49] From April 1945, the Japanese interceptors also had to face American fighter escorts based on [Iwo Jima](#) and Okinawa.^[50] That month, the [Imperial Japanese Army Air Service](#) and [Imperial Japanese Navy Air Service](#) stopped attempting to intercept the air raids to preserve fighter aircraft to counter the expected invasion.^[51] By mid-1945 the Japanese only occasionally scrambled aircraft to intercept individual B-29s conducting reconnaissance sorties over the country, to conserve supplies of fuel.^[52] In July 1945, the Japanese had 137,800,000 litres (1,156,000 US bbl) of [avgas](#) stockpiled for the invasion of Japan. About 72,000,000 litres (604,000 US bbl) had been consumed in the home islands area in April, May and June 1945.^[53] While the Japanese [military](#) decided to resume attacks on Allied

bombers from late June, by this time there were too few operational fighters available for this change of tactics to hinder the Allied air raids.^[54]

Atomic bomb development



Leslie Groves, Manhattan Project director, with a map of Japan

The discovery of [nuclear fission](#) by German chemists [Otto Hahn](#) and [Fritz Strassmann](#) in 1938, and its theoretical explanation by [Lise Meitner](#) and [Otto Frisch](#), made the development of an atomic bomb a theoretical possibility.^[55] Fears that a [German atomic bomb project](#) would develop atomic weapons first, especially among scientists who were refugees from Nazi Germany and other fascist countries, were expressed in the [Einstein-Szilard letter](#). This prompted preliminary research in the United States in late 1939.^[56] Progress was slow until the arrival of the British [MAUD Committee](#) report in late 1941, which indicated that only 5 to 10 kilograms of isotopically enriched [uranium-235](#) were needed for a bomb instead of tons of natural uranium and a [neutron moderator](#) like [heavy water](#).^[57]

The 1943 [Quebec Agreement](#) merged the nuclear weapons projects of the United Kingdom and Canada, [Tube Alloys](#) and the [Montreal Laboratory](#), with the [Manhattan Project](#),^{[58][59]} under the direction of Major General [Leslie R. Groves, Jr.](#), of the [U.S. Army Corps of Engineers](#).^[60] Groves appointed [J. Robert Oppenheimer](#) to organize and head the project's [Los Alamos Laboratory](#) in [New Mexico](#), where bomb design work was carried out.^[61] Two types of bombs were eventually developed, both named by [Robert Serber](#). [Little Boy](#) was a [gun-type fission weapon](#) that used [uranium-235](#), a rare [isotope](#) of uranium separated at the [Clinton Engineer Works](#) at [Oak Ridge, Tennessee](#).^[62] The other, known as a [Fat Man](#) device, was a more powerful and efficient, but

more complicated, [implosion-type nuclear weapon](#) that used [plutonium](#) created in [nuclear reactors](#) at [Hanford, Washington](#).^[63]

There was a [Japanese nuclear weapon program](#), but it lacked the human, mineral and financial resources of the Manhattan Project, and never made much progress towards developing an atomic bomb.^[64]

Preparations

Organization and training



The "Tinian Joint Chiefs": Captain William S. Parsons (left), Rear Admiral William R. Purnell (center), and Brigadier General Thomas F. Farrell (right)

The [509th Composite Group](#) was constituted on 9 December 1944, and activated on 17 December 1944, at [Wendover Army Air Field](#), Utah, commanded by [Colonel Paul Tibbets](#).^[65] Tibbets was assigned to organize and command a [combat group](#) to develop the means of delivering an atomic weapon against targets in Germany and Japan. Because the flying squadrons of the group consisted of both bomber and transport aircraft, the group was designated as a "composite" rather than a "bombardment" unit.^[66] Working with the Manhattan Project at Los Alamos, Tibbets selected Wendover for his training base over [Great Bend, Kansas](#), and [Mountain Home, Idaho](#), because of its remoteness.^[67] Each bombardier completed at least 50 practice drops of inert or conventional explosive [pumpkin bombs](#) and Tibbets declared his group combat-ready.^[68] On 5 April 1945, the [code name](#) Operation Centerboard was assigned. The officer responsible for its allocation in the [War Department's](#) Operations Division was not

cleared to know any details of it. The first bombing was later codenamed Operation Centerboard I, and the second, Operation Centerboard II.^[69]



Aircraft of the [509th Composite Group](#) that took part in the Hiroshima bombing. Left to right: *Big Stink*, *The Great Artiste*, *Enola Gay*

The 509th Composite Group had an authorized strength of 225 officers and 1,542 enlisted men, almost all of whom eventually deployed to Tinian. In addition to its authorized strength, the 509th had attached to it on Tinian 51 civilian and military personnel from [Project Alberta](#),^[70] known as the 1st Technical Detachment.^[71] The 509th Composite Group's [393d Bombardment Squadron](#) was equipped with 15 [Silverplate](#) B-29s. These aircraft were specially adapted to carry nuclear weapons, and were equipped with [fuel-injected](#) engines, Curtiss Electric [reversible-pitch propellers](#), pneumatic actuators for rapid opening and closing of bomb bay doors and other improvements.^[72]

The ground support echelon of the 509th Composite Group moved by rail on 26 April 1945, to its port of embarkation at [Seattle](#), Washington. On 6 May the support elements sailed on the SS *Cape Victory* for the Marianas, while group materiel was shipped on the SS *Emile Berliner*. The *Cape Victory* made brief port calls at [Honolulu](#) and [Eniwetok](#) but the passengers were not permitted to leave the dock area. An advance party of the air echelon, consisting of 29 officers and 61 enlisted men, flew by C-54 to [North Field](#) on Tinian, between 15 and 22 May.^[73] There were also two representatives from Washington, D.C., [Brigadier General Thomas Farrell](#), the deputy commander of the Manhattan Project, and [Rear Admiral William R. Purnell](#) of the Military Policy Committee,^[74] who were on hand to decide higher policy matters on the spot. Along with Captain [William S. Parsons](#), the commander of Project Alberta, they became known as the "Tinian Joint Chiefs".^[75]

Choice of targets



The mission runs of 6 and 9 August, with Hiroshima, Nagasaki, and *Kokura* (the original target for 9 August) displayed

In April 1945, Marshall asked Groves to nominate specific targets for bombing for final approval by himself and Stimson. Groves formed a Target Committee, chaired by himself, that included Farrell, Major John A. Derry, Colonel William P. Fisher, Joyce C. Stearns and David M. Dennison from the USAAF; and scientists John von Neumann, Robert R. Wilson and William Penney from the Manhattan Project. The Target Committee met in Washington on 27 April; at Los Alamos on 10 May, where it was able to talk to the scientists and technicians there; and finally in Washington on 28 May, where it was briefed by Tibbets and Commander Frederick Ashworth from Project Alberta, and the Manhattan Project's scientific advisor, Richard C. Tolman.^[76]

The Target Committee nominated five targets: *Kokura* (now *Kitakyushu*), the site of one of Japan's largest munitions plants; *Hiroshima*, an embarkation port and industrial center that was the site of a major military headquarters; *Yokohama*, an urban center for aircraft manufacture, machine tools, docks, electrical equipment and oil refineries; *Niigata*, a port with industrial

facilities including steel and aluminum plants and an oil refinery; and [Kyoto](#), a major industrial center. The target selection was subject to the following criteria:

- The target was larger than 4.8 km (3 mi) in diameter and was an important target in a large city.
- The [blast wave](#) would create effective damage.
- The target was unlikely to be attacked by August 1945.^[77]

These cities were largely untouched during the nightly bombing raids, and the Army Air Forces agreed to leave them off the target list so accurate assessment of the damage caused by the atomic bombs could be made. Hiroshima was described as "an important army depot and port of embarkation in the middle of an urban industrial area. It is a good radar target and it is such a size that a large part of the city could be extensively damaged. There are adjacent hills which are likely to produce a focusing effect which would considerably increase the blast damage. Due to rivers it is not a good [incendiary](#) target."^[77]

The Target Committee stated that "It was agreed that psychological factors in the target selection were of great importance. Two aspects of this are (1) obtaining the greatest psychological effect against Japan and (2) making the initial use sufficiently spectacular for the importance of the weapon to be internationally recognized when publicity on it is released. ... Kyoto has the advantage of the people being more highly intelligent and hence better able to appreciate the significance of the weapon. Hiroshima has the advantage of being such a size and with possible focussing from nearby mountains that a large fraction of the city may be destroyed. The [Emperor's palace](#) in Tokyo has a greater fame than any other target but is of least strategic value."^[77]

[Edwin O. Reischauer](#), a Japan expert for the [U.S. Army Intelligence Service](#), was incorrectly said to have prevented the bombing of Kyoto.^[77] In his autobiography, Reischauer specifically refuted this claim:

... the only person deserving credit for saving Kyoto from destruction is Henry L. Stimson, the Secretary of War at the time, who had known and admired Kyoto ever since his honeymoon there several decades earlier.^{[78][79]}

On 30 May, Stimson asked Groves to remove Kyoto from the target list due to its historical, religious and cultural significance, but Groves pointed to its military and industrial

significance.^[80] Stimson then approached [President Harry S. Truman](#) about the matter. Truman agreed with Stimson, and Kyoto was temporarily removed from the target list.^[81] Groves attempted to restore Kyoto to the target list in July, but Stimson remained adamant.^{[82][83]} On 25 July, [Nagasaki](#) was put on the target list in place of Kyoto. It was a major military port, one of Japan's largest shipbuilding and repair centers, and an important producer of naval ordnance.^[83]

Proposed demonstration

In early May 1945, the [Interim Committee](#) was created by Stimson at the urging of leaders of the Manhattan Project and with the approval of Truman to advise on matters pertaining to [nuclear energy](#).^[84] During the meetings on 31 May and 1 June, scientist [Ernest Lawrence](#) had suggested giving the Japanese a non-combat demonstration.^[85] [Arthur Compton](#) later recalled that:

It was evident that everyone would suspect trickery. If a bomb were exploded in Japan with previous notice, the Japanese air power was still adequate to give serious interference. An atomic bomb was an intricate device, still in the developmental stage. Its operation would be far from routine. If during the final adjustments of the bomb the Japanese defenders should attack, a faulty move might easily result in some kind of failure. Such an end to an advertised demonstration of power would be much worse than if the attempt had not been made. It was now evident that when the time came for the bombs to be used we should have only one of them available, followed afterwards by others at all-too-long intervals. We could not afford the chance that one of them might be a dud. If the test were made on some neutral territory, it was hard to believe that Japan's determined and fanatical military men would be impressed. If such an open test were made first and failed to bring surrender, the chance would be gone to give the shock of surprise that proved so effective. On the contrary, it would make the Japanese ready to interfere with an atomic attack if they could. Though the possibility of a demonstration that would not destroy human lives was attractive, no one could suggest a way in which it could be made so convincing that it would be likely to stop the war.^[86]

The possibility of a demonstration was raised again in the [Franck Report](#) issued by physicist [James Franck](#) on 11 June and the Scientific Advisory Panel rejected his report on 16 June, saying that "we can propose no technical demonstration likely to bring an end to the war; we see no acceptable alternative to direct military use." Franck then took the report to Washington, D.C., where the Interim Committee met on 21 June to re-examine its earlier conclusions; but it reaffirmed that there was no alternative to the use of the bomb on a military target.^[87]

Like Compton, many U.S. officials and scientists argued that a demonstration would sacrifice the shock value of the atomic attack, and the Japanese could deny the atomic bomb was lethal, making the mission less likely to produce surrender. Allied [prisoners of war](#) might be moved to the demonstration site and be killed by the bomb. They also worried that the bomb might be a failure, as the Trinity test was that of a stationary device, not an air-dropped bomb. In addition, although more bombs were in production, only two would be available at the start of August, and they cost billions of dollars, so using one for a demonstration would be expensive.^{[88][89]}

Leaflets



Various leaflets were dropped on Japan, three versions showing the names of 11 or 12 Japanese cities targeted for destruction by firebombing. The other side contained text stating "... we cannot promise that only these cities will be among those attacked ..."^[90]

For several months, the U.S. had warned civilians of potential air raids by dropping more than 63 million leaflets across Japan. Many Japanese cities suffered terrible damage from aerial bombings; some were as much as 97 percent destroyed. LeMay thought that leaflets would increase the psychological impact of bombing, and reduce the international stigma of area-bombing cities. Even with the warnings, [Japanese opposition to the war](#) remained ineffective. In general, the Japanese regarded the leaflet messages as truthful, with many Japanese choosing to leave major cities. The leaflets caused such concern that the government ordered the arrest

of anyone caught in possession of a leaflet.^{[90][91]} Leaflet texts were prepared by recent Japanese prisoners of war because they were thought to be the best choice "to appeal to their compatriots".^[92]

In preparation for dropping an atomic bomb on Hiroshima, the Oppenheimer-led [Scientific Panel of the Interim Committee](#) decided against a demonstration bomb and against a special leaflet warning. Those decisions were implemented because of the uncertainty of a successful detonation and also because of the wish to maximize [shock in the leadership](#).^[93] No warning was given to Hiroshima that a new and much more destructive bomb was going to be dropped.^[94] Various sources gave conflicting information about when the last leaflets were dropped on Hiroshima prior to the atomic bomb. [Robert Jay Lifton](#) wrote that it was 27 July,^[94] and Theodore H. McNelly wrote that it was 30 July.^[93] The USAAF history noted that eleven cities were targeted with leaflets on 27 July, but Hiroshima was not one of them, and there were no leaflet sorties on 30 July.^[91] Leaflet sorties were undertaken on 1 and 4 August. Hiroshima may have been leafleted in late July or early August, as survivor accounts talk about a delivery of leaflets a few days before the atomic bomb was dropped.^[94] Three versions were printed of a leaflet listing 11 or 12 cities targeted for firebombing; a total of 33 cities listed. With the text of this leaflet reading in Japanese "... we cannot promise that only these cities will be among those attacked ..."^[90] Hiroshima was not listed.^{[95][96]}

Consultation with Britain and Canada



General [Thomas Handy](#)'s order to General [Carl Spaatz](#) ordering the dropping of the atomic bombs

In 1943, the United States and the United Kingdom signed the [Quebec Agreement](#), which stipulated that nuclear weapons would not be used against another country without mutual consent. Stimson therefore had to obtain British permission. A meeting of the [Combined Policy Committee](#), which included one Canadian representative, was held at [the Pentagon](#) on 4 July 1945.^[97] [Field Marshal Sir Henry Maitland Wilson](#) announced that the British government concurred with the use of nuclear weapons against Japan, which would be officially recorded as a decision of the Combined Policy Committee.^{[97][98][99]} As the release of information to third parties was also controlled by the Quebec Agreement, discussion then turned to what scientific details would be revealed in the press announcement of the bombing. The meeting also considered what Truman could reveal to [Joseph Stalin](#), the leader of the [Soviet Union](#), at the upcoming [Potsdam Conference](#), as this also required British concurrence.^[97]

Orders for the attack were issued to General [Carl Spaatz](#) on 25 July under the signature of General [Thomas T. Handy](#), the acting chief of staff, since Marshall was at the Potsdam Conference with Truman.^[100] It read:

1. The 509th Composite Group, 20th Air Force will deliver its first special bomb as soon as weather will permit visual bombing after about 3 August 1945 on one of the targets: Hiroshima, Kokura, Niigata and Nagasaki. To carry military and civilian scientific personnel from the War Department to observe and record the effects of the explosion of the bomb, additional aircraft will accompany the airplane carrying the bomb. The observing planes will stay several miles distant from the point of impact of the bomb.
2. Additional bombs will be delivered on the above targets as soon as made ready by the project staff. Further instructions will be issued concerning targets other than those listed above.^[101]

That day, Truman noted in his diary that:

This weapon is to be used against Japan between now and August 10th. I have told the Sec. of War, Mr. Stimson, to use it so that military objectives and soldiers and sailors are the target and not women and children. Even if the Japs are savages, ruthless, merciless and fanatic,

we as the leader of the world for the common welfare cannot drop that terrible bomb on the old capital [Kyoto] or the new [Tokyo]. He and I are in accord. The target will be a purely military one.^[102]

Potsdam Declaration

The 16 July success of the [Trinity Test](#) in the [New Mexico](#) desert exceeded expectations.^[103] On 26 July, Allied leaders issued the [Potsdam Declaration](#), which outlined the terms of surrender for Japan. The declaration was presented as an [ultimatum](#) and stated that without a surrender, the Allies would attack Japan, resulting in "the inevitable and complete destruction of the Japanese armed forces and just as inevitably the utter devastation of the Japanese homeland". The atomic bomb was not mentioned in the communiqué.^[104]

On 28 July, Japanese papers reported that the declaration had been rejected by the Japanese government. That afternoon, [Prime Minister Kantarō Suzuki](#) declared at a press conference that the Potsdam Declaration was no more than a rehash (*yakinaoshi*) of the [Cairo Declaration](#), that the government intended to ignore it (*mokusatsu*, "kill by silence"), and that Japan would fight to the end.^[105] The statement was taken by both Japanese and foreign papers as a clear rejection of the declaration. Emperor Hirohito, who was waiting for a Soviet reply to non-committal Japanese peace feelers, made no move to change the government position.^[106] Japan's willingness to surrender remained conditional on the preservation of the *kokutai* (Imperial institution and national [polity](#)), assumption by the Imperial Headquarters of responsibility for disarmament and demobilization, no occupation of the [Japanese Home Islands](#), Korea or [Formosa](#), and delegation of the punishment of war criminals to the Japanese government.^[107]

At Potsdam, Truman agreed to a request from [Winston Churchill](#) that Britain be represented when the atomic bomb was dropped. [William Penney](#) and [Group Captain Leonard Cheshire](#) were sent to Tinian, but found that LeMay would not let them accompany the mission. All they could do was send a strongly worded signal to Wilson.^[108]

Bombs

The Little Boy bomb, except for the uranium payload, was ready at the beginning of May 1945.^[109] There were two uranium-235 components, a hollow cylindrical projectile and a cylindrical target insert. The projectile was completed on 15 June, and the target insert on 24 July.^[110] The projectile and eight bomb pre-assemblies (partly assembled bombs without the powder charge and fissile components) left [Hunters Point Naval Shipyard](#), California, on 16 July

aboard the [cruiser USS Indianapolis](#), and arrived on Tinian on 26 July.^[111] The target insert followed by air on 30 July, accompanied by Commander [Francis Birch](#) from Project Alberta.^[110] Responding to concerns expressed by the 509th Composite Group about the possibility of a B-29 crashing on takeoff, Birch had modified the Little Boy design to incorporate a removable breech plug that would permit the bomb to be armed in flight.^[109]

The first [plutonium core](#), along with its [polonium-beryllium urchin initiator](#), was transported in the custody of Project Alberta courier [Raemer Schreiber](#) in a magnesium field carrying case designed for the purpose by [Philip Morrison](#). Magnesium was chosen because it does not act as a [neutron reflector](#).^[112] The core departed from [Kirtland Army Air Field](#) on a [C-54](#) transport aircraft of the 509th Composite Group's [320th Troop Carrier Squadron](#) on 26 July, and arrived at North Field 28 July. Three Fat Man high-explosive pre-assemblies, designated F31, F32, and F33, were picked up at Kirtland on 28 July by three B-29s, two from the 393d Bombardment Squadron plus one from the 216th Army Air Force Base Unit, and transported to North Field, arriving on 2 August.^[113]

Hiroshima

Hiroshima during World War II



The Enola Gay dropped the "Little Boy" atomic bomb on Hiroshima. [Paul Tibbets](#) (center in photograph) can be seen with six of the aircraft's crew.

At the time of its bombing, Hiroshima was a city of industrial and military significance. A number of military units were located nearby, the most important of which was the headquarters of [Field Marshal Shunroku Hata's Second General Army](#), which commanded the defense of all of

southern Japan,^[114] and was located in [Hiroshima Castle](#). Hata's command consisted of some 400,000 men, most of whom were on Kyushu where an Allied invasion was correctly anticipated.^[115] Also present in Hiroshima were the headquarters of the [59th Army](#), the [5th Division](#) and the [224th Division](#), a recently formed mobile unit.^[116] The city was defended by five batteries of 70 mm and 80 mm (2.8 and 3.1 inch) [anti-aircraft guns](#) of the 3rd Anti-Aircraft Division, including units from the 121st and 122nd Anti-Aircraft Regiments and the 22nd and 45th Separate Anti-Aircraft Battalions. In total, an estimated 40,000 Japanese military personnel were stationed in the city.^[117]

Hiroshima was a supply and logistics base for the Japanese military.^[118] The city was a communications center, a key port for shipping, and an assembly area for troops.^[80] It supported a large war industry, manufacturing parts for planes and boats, for bombs, rifles, and handguns.^[119] The center of the city contained several [reinforced concrete](#) buildings and lighter structures. Outside the center, the area was congested by a dense collection of small timber workshops set among Japanese houses. A few larger industrial plants lay near the outskirts of the city. The houses were constructed of timber with tile roofs, and many of the industrial buildings were also built around timber frames. The city as a whole was highly susceptible to fire damage.^[120] It was the second largest city in Japan after Kyoto that was still undamaged by air raids,^[121] primarily because it lacked the aircraft manufacturing industry that was the XXI Bomber Command's priority target. On 3 July, the Joint Chiefs of Staff placed it off limits to bombers, along with Kokura, Niigata and Kyoto.^[122]

The population of Hiroshima had reached a peak of over 381,000 earlier in the war but prior to the atomic bombing, the population had steadily decreased because of a [systematic evacuation ordered by the Japanese government](#). At the time of the attack, the population was approximately 340,000–350,000.^[123] Residents wondered why Hiroshima had been spared destruction by firebombing.^[124] Some speculated that the city was to be saved for U.S. occupation headquarters, others thought perhaps their relatives in Hawaii and California had petitioned the U.S. government to avoid bombing Hiroshima.^[125] More realistic city officials had ordered buildings torn down to create long, straight [firebreaks](#).^[126] These continued to be expanded and extended up to the morning of 6 August 1945.^[127]

Bombing of Hiroshima

Hiroshima was the primary target of the first atomic bombing mission on 6 August, with Kokura and Nagasaki as alternative targets. The 393d Bombardment Squadron B-29 [Enola Gay](#), named

after Tibbets's mother and piloted by Tibbets, took off from North Field, [Tinian](#), about six hours' flight time from Japan.^[128] *Enola Gay* was accompanied by two other B-29s: *The Great Artiste*, commanded by Major [Charles Sweeney](#), which carried instrumentation, and a then-nameless aircraft later called *Necessary Evil*, commanded by Captain George Marquardt. *Necessary Evil* was the [photography aircraft](#).^[129]

10000 UNCLASSIFIED REPORT
Office of the Operations Director
4800, 48th Avenue
San Francisco, California

3 August 1945

OPERATIONAL ORDER

NUMBER 283

Date of Mission: 5 August 1945

Out of Route: Mission at 0700
Mission at 0700

Destination: New Britain

Time: 0700 to 0800

Subsidiary: Number Range at 0700 (Special)
Number Range at 0700 (Special)

Location: 30 W 2230
30 W 2230

Strike: 3 W 2230
4 W 2230

NO. 29	TYPE	OFFICER	UNIT	POSITION
1	B-29	Tibbets	39th Bombardment Group	Enola Gay
2	B-29	Sweeney	39th Bombardment Group	The Great Artiste
3	B-29	Marquardt	39th Bombardment Group	Necessary Evil

Remarks: 1. Mission at 0700.
2. Mission at 0700.
3. Mission at 0700.
4. Mission at 0700.

Approved: [Signature]
Operations Director

Strike order for the Hiroshima bombing as posted on 5 August 1945

Special Mission 13, primary target Hiroshima, 6 August 1945^{[129][130]}

Aircraft	Pilot	Call sign	Mission role
<i>Straight Flush</i>	Major Claude R. Eatherly	Dimples 85	Weather reconnaissance (Hiroshima)
<i>Jabit III</i>	Major John A. Wilson	Dimples 71	Weather reconnaissance (Kokura)
<i>Full House</i>	Major Ralph R. Taylor	Dimples 83	Weather reconnaissance (Nagasaki)
<i>Enola Gay</i>	Colonel Paul W. Tibbets	Dimples 82	Weapon delivery
<i>The Great Artiste</i>	Major Charles W. Sweeney	Dimples 89	Blast measurement instrumentation
<i>Necessary Evil</i>	Captain George W. Marquardt	Dimples 91	Strike observation and photography
<i>Top Secret</i>	Captain Charles F. McKnight	Dimples 72	Strike spare – did not complete mission

After leaving Tinian, the aircraft made their way separately to Iwo Jima to rendezvous with Sweeney and Marquardt at 05:55 at 2,800 meters (9,200 ft),^[131] and set course for Japan. The aircraft arrived over the target in clear visibility at 9,470 meters (31,060 ft).^[132] Parsons, who was in command of the mission, armed the bomb in flight to minimize the risks during takeoff. He had witnessed four B-29s crash and burn at takeoff, and feared that a nuclear explosion would occur if a B-29 crashed with an armed Little Boy on board.^[133] His assistant, [Second Lieutenant Morris R. Jeppson](#), removed the safety devices 30 minutes before reaching the target area.^[134]



The Hiroshima atom bomb cloud 2–5 minutes after detonation^[135]

During the night of 5–6 August, Japanese early warning radar detected the approach of numerous American aircraft headed for the southern part of Japan. Radar detected 65 bombers headed for Saga, 102 bound for [Maebashi](#), 261 en route to [Nishinomiya](#), 111 headed for [Ube](#) and 66 bound for Imabari. An alert was given and radio broadcasting stopped in many cities, among them Hiroshima. The all-clear was sounded in Hiroshima at 00:05.^[136] About an hour before the bombing, the air raid alert was sounded again, as *Straight Flush* flew over the city. It broadcast a short message which was picked up by *Enola Gay*. It read: "Cloud cover less than 3/10th at all altitudes. Advice: bomb primary."^[137] The all-clear was sounded over Hiroshima again at 07:09.^[138]

At 08:09, Tibbets started his bomb run and handed control over to his bombardier, Major [Thomas Ferebee](#).^[139] The release at 08:15 (Hiroshima time) went as planned, and the Little Boy containing about 64 kg (141 lb) of uranium-235 took 44.4 seconds to fall from the aircraft flying at about 9,400 meters (31,000 ft) to a detonation height of about 580 meters (1,900 ft) above the city.^{[140][141]} *Enola Gay* traveled 18.5 km (11.5 mi) before it felt the shock waves from the blast.^[142]

Due to [crosswind](#), the bomb missed the [aiming point](#), the [Aioi Bridge](#), by approximately 240 m (800 ft) and detonated directly over [Shima Surgical Clinic](#).^[143] It released the equivalent energy of 16 ± 2 kilotons of TNT (66.9 ± 8.4 TJ).^[140] The weapon was [considered very inefficient](#), with only 1.7 percent of its material fissioning.^[144] The radius of total destruction was about 1.6 kilometres (1 mi), with resulting fires across 11 km² (4.4 sq mi).^[145]

Enola Gay stayed over the target area for two minutes and was 16 kilometres (10 mi) away when the bomb detonated. Only Tibbets, Parsons, and Ferebee knew of the nature of the weapon; the others on the bomber were only told to expect a blinding flash and given black goggles. "It was hard to believe what we saw", Tibbets told reporters, while Parsons said "the whole thing was tremendous and awe-inspiring ... the men aboard with me gasped 'My God'". He and Tibbets compared the shockwave to "a close burst of [ack-ack](#) fire".^[146]

Events on the ground

People on the ground reported a *pika* (ピカ)—a brilliant flash of light—followed by a *don* (ドン)—a loud booming sound.^[147] Some 70,000–80,000 people, around 30 percent of the population of Hiroshima at the time, were killed by the blast and resultant firestorm,^{[148][149]} and another 70,000 were injured.^[150] It is estimated that as many as 20,000 Japanese military personnel were killed.^[151] U.S. surveys estimated that 12 km² (4.7 sq mi) of the city were destroyed. Japanese officials determined that 69 percent of Hiroshima's buildings were destroyed and another 6 to 7 percent damaged.^[152]

Some of the reinforced concrete buildings in Hiroshima had been very strongly constructed because of the earthquake danger in Japan, and their framework did not collapse even though they were fairly close to the blast center. Since the bomb detonated in the air, the blast was directed more downward than sideways, which was largely responsible for the survival of the [Prefectural Industrial Promotional Hall](#), now commonly known as the *Genbaku* (A-bomb) dome, which was only 150 m (490 ft) from [ground zero](#) (the [hypocenter](#)). The ruin was named *Hiroshima Peace Memorial* and was made a UNESCO [World Heritage Site](#) in 1996 over the objections of the United States and China, which expressed reservations on the grounds that other Asian nations were the ones who suffered the greatest loss of life and property, and a focus on Japan lacked historical perspective.^[153] The bombing started intense fires that spread rapidly through timber and paper homes, burning everything in a radius of 2 kilometers (1.2 mi).^[154] As in other Japanese cities, the firebreaks proved ineffective.^[155]

Hiroshima bombing



Hiroshima in the aftermath of the bombing



Ruins of Hiroshima



The [Hiroshima Genbaku Dome](#) after the bombing



The pattern of the clothing worn by a survivor burned into their skin in tight-fitting areas.



Direct, [thermal flash burns](#)



22-year old victim Toyoko Kugata being treated at the Hiroshima Red Cross Hospital (6 October 1945)



A photograph of the aftermath of the bombing of Hiroshima



Memorial at [Andersonville NHS](#) for the American airmen who died in the blast.



A victim with burns



A victim with whole body burns



Elder sister and younger brother who suffered radiation disease. The brother died in 1949 and the sister in 1965.

The air raid warning had been cleared at 07:31, and many people were outside, going about their activities.^[156] Eizō Nomura was the closest known survivor, being in the basement of a reinforced concrete building (it remained as the *Rest House* after the war) only 170 meters (560 ft) from ground zero at the time of the attack.^{[157][158]} He died in 1982, aged 84.^[159] Akiko Takakura was among the closest survivors to the hypocenter of the blast. She was in the solidly-built Bank of Hiroshima only 300 meters (980 ft) from ground-zero at the time of the attack.^[160]



For decades this "Hiroshima strike" photo was misidentified as the *mushroom cloud* of the bomb that formed at c. 08:16.^{[161][162]} However, due to its much greater height, the scene was identified by a researcher in March 2016 as the *firestorm-cloud* that engulfed the city,^[162] a fire that reached its peak intensity some three hours after the bomb.^[163]

Over 90 percent of the doctors and 93 percent of the nurses in Hiroshima were killed or injured—most had been in the downtown area which received the greatest damage.^[164] The hospitals were destroyed or heavily damaged. Only one doctor, [Terufumi Sasaki](#), remained on duty at the Red Cross Hospital.^[155] Nonetheless, by early afternoon the police and volunteers had established evacuation centres at hospitals, schools and tram stations, and a morgue was established in the Asano library.^[165] Survivors of the blast gathered for medical treatment, but many would die before receiving any help, leaving behind rings of corpses around hospitals.^[166]

Most elements of the Japanese [Second General Army](#) headquarters were undergoing physical training on the grounds of [Hiroshima Castle](#), barely 820 metres (900 yd) from the hypocenter. The attack killed 3,243 troops on the parade ground.^[167] The communications room of [Chugoku Military District Headquarters](#) that was responsible for issuing and lifting air raid warnings was located in a semi-basement in the castle. Yoshie Oka, a Hijiya Girls High School student who had been mobilized to serve as a communications officer, had just sent a message that the alarm had been issued for Hiroshima and neighboring [Yamaguchi](#), when the bomb exploded. She used a special phone to inform [Fukuyama Headquarters](#) (some 100 kilometers (62 mi) away) that "Hiroshima has been attacked by a new type of bomb. The city is in a state of near-total destruction."^[168]

Since Mayor [Senkichi Awaya](#) had been killed while eating breakfast with his son and granddaughter at the mayoral residence, Field Marshal [Shunroku Hata](#), who was only slightly wounded, took over the administration of the city, and coordinated relief efforts. Many of his staff had been killed or fatally wounded, including a Korean Prince as a member of the [imperial family](#) of Korea, [Yi U](#), who was serving as a lieutenant colonel in the Japanese Army.^{[169][170]} Hata's senior surviving staff officer was the wounded Colonel [Kumao Imoto](#), who acted as his chief of staff. Soldiers from the undamaged Hiroshima Ujina Harbor used [Shin'yō-class suicide motorboats](#), intended to repel the American invasion, to collect the wounded and take them down the rivers to the military hospital at Ujina.^[169] Trucks and trains brought in relief supplies and evacuated survivors from the city.^[171]

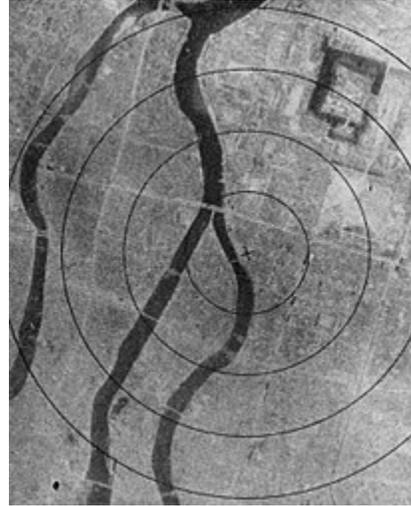
Twelve American airmen were imprisoned at the Chugoku Military Police Headquarters, about 400 metres (1,300 ft) from the hypocenter of the blast.^[172] Most died instantly, although two were reported to have been executed by their captors, and two prisoners badly injured by the bombing were left next to the Aioi Bridge by the [Kempei Tai](#), where they were stoned to death.^{[173][174]} Eight U.S. prisoners of war killed as part of the medical experiments program at

[Kyushu University](#) were falsely reported by Japanese authorities as having been killed in the atomic blast as part of an attempted cover up.^[175]

Japanese realization of the bombing



Hiroshima before the bombing



Hiroshima after the bombing and subsequent [firestorm](#)

The Tokyo control operator of the [Japan Broadcasting Corporation](#) noticed that the Hiroshima station had gone off the air. He tried to re-establish his program by using another telephone line, but it too had failed.^[176] About 20 minutes later the Tokyo railroad telegraph center realized that the main line telegraph had stopped working just north of Hiroshima. From some small railway stops within 16 km (10 mi) of the city came unofficial and confused reports of a terrible explosion in Hiroshima. All these reports were transmitted to the headquarters of the [Imperial Japanese Army General Staff](#).^[177]

Military bases repeatedly tried to call the Army Control Station in Hiroshima. The complete silence from that city puzzled the General Staff; they knew that no large enemy raid had occurred and that no sizable store of explosives was in Hiroshima at that time. A young officer was instructed to fly immediately to Hiroshima, to land, survey the damage, and return to Tokyo with reliable information for the staff. It was felt that nothing serious had taken place and that the explosion was just a rumor.^[177]

The staff officer went to the airport and took off for the southwest. After flying for about three hours, while still nearly 160 km (100 mi) from Hiroshima, he and his pilot saw a great cloud of smoke from the firestorm created by the bomb. After circling the city to survey the damage they landed south of the city, where the staff officer, after reporting to Tokyo, began to organize relief measures. Tokyo's first indication that the city had been destroyed by a new type of bomb came from President Truman's announcement of the strike, sixteen hours later.^[177]

Events of 7–9 August

After the Hiroshima bombing, Truman issued a statement announcing the use of the new weapon. He stated, "We may be grateful to Providence" that [the German atomic bomb project](#) had failed, and that the United States and its allies had "spent two billion dollars on the greatest scientific gamble in history—and won". Truman then warned Japan: "If they do not now accept our terms, they may expect a rain of ruin from the air, the like of which has never been seen on this earth. Behind this air attack will follow sea and land forces in such numbers and power as they have not yet seen and with the fighting skill of which they are already well aware."^[178] This was a widely broadcast speech picked up by Japanese news agencies.^[179]



Leaflet AB12, with information on the Hiroshima bomb and a warning to civilians to petition the Emperor to surrender was dropped over Japan beginning on 9 August, by the 509th Composite Group.^[180] An AB11 is in the possession of the [Nagasaki Atomic Bomb Museum](#).^[181]

The 50,000-watt [standard wave](#) station on [Saipan](#), the OWI [radio station](#), broadcast a similar message to Japan every 15 minutes about Hiroshima, stating that more Japanese cities would face a similar fate in the absence of immediate acceptance of the terms of the Potsdam Declaration and emphatically urged civilians to evacuate major cities. [Radio Japan](#), which continued to extoll victory for Japan by never surrendering,^[90] had informed the Japanese of the destruction of Hiroshima by a single bomb.^[182] Prime Minister [Suzuki](#) felt compelled to meet the Japanese press, to whom he reiterated his government's commitment to ignore the Allies' demands and fight on.^[183]

Soviet Foreign Minister [Vyacheslav Molotov](#) had informed Tokyo of the Soviet Union's unilateral abrogation of the [Soviet–Japanese Neutrality Pact](#) on 5 April.^[184] At two minutes past midnight on 9 August, [Tokyo time](#), Soviet infantry, armor, and air forces had launched the [Manchurian Strategic Offensive Operation](#).^[185] Four hours later, word reached Tokyo of the Soviet Union's official declaration of war. The senior leadership of the Japanese Army began preparations to impose [martial law](#) on the nation, with the support of Minister of War [Korechika Anami](#), to stop anyone attempting to make peace.^[186]

On 7 August, a day after Hiroshima was destroyed, Dr. [Yoshio Nishina](#) and other atomic physicists arrived at the city, and carefully examined the damage. They then went back to Tokyo and told the cabinet that Hiroshima was indeed destroyed by a nuclear weapon. Admiral [Soemu Toyoda](#), the Chief of the Naval General Staff, estimated that no more than one or two additional bombs could be readied, so they decided to endure the remaining attacks, acknowledging "there would be more destruction but the war would go on".^[187] American [Magic codebreakers](#) intercepted the cabinet's messages.^[188]

Purnell, Parsons, Tibbets, Spaatz, and LeMay met on Guam that same day to discuss what should be done next.^[189] Since there was no indication of Japan surrendering,^[188] they decided to proceed with dropping another bomb. Parsons said that [Project Alberta](#) would have it ready by 11 August, but Tibbets pointed to weather reports indicating poor flying conditions on that day due to a storm, and asked if the bomb could be readied by 9 August. Parsons agreed to try to do so.^{[190][189]}

Nagasaki

Nagasaki during World War II



The [Bockscar](#) and its crew, who dropped a [Fat Man](#) atomic bomb on Nagasaki

The city of Nagasaki had been one of the largest seaports in southern Japan, and was of great wartime importance because of its wide-ranging industrial activity, including the production of [ordnance](#), ships, military equipment, and other war materials. The four largest companies in the city were [Mitsubishi](#) Shipyards, Electrical Shipyards, Arms Plant, and Steel and Arms Works, which employed about 90 percent of the city's labor force, and accounted for 90 percent of the city's industry.^[191] Although an important industrial city, Nagasaki had been spared from firebombing because its geography made it difficult to locate at night with [AN/APQ-13](#) radar.^[122]

Unlike the other target cities, Nagasaki had not been placed off limits to bombers by the Joint Chiefs of Staff's 3 July directive,^{[122][192]} and was bombed on a small scale five times. During one of these raids on 1 August, a number of conventional high-explosive bombs were dropped on the city. A few hit the shipyards and dock areas in the southwest portion of the city, and several hit the Mitsubishi Steel and Arms Works.^[191] By early August, the city was defended by the 134th Anti-Aircraft Regiment of the 4th Anti-Aircraft Division with four batteries of 7 cm (2.8 in) anti-aircraft guns and two [searchlight](#) batteries.^[117]



Special Mission 16, secondary target Nagasaki, 9 August 1945^[196]

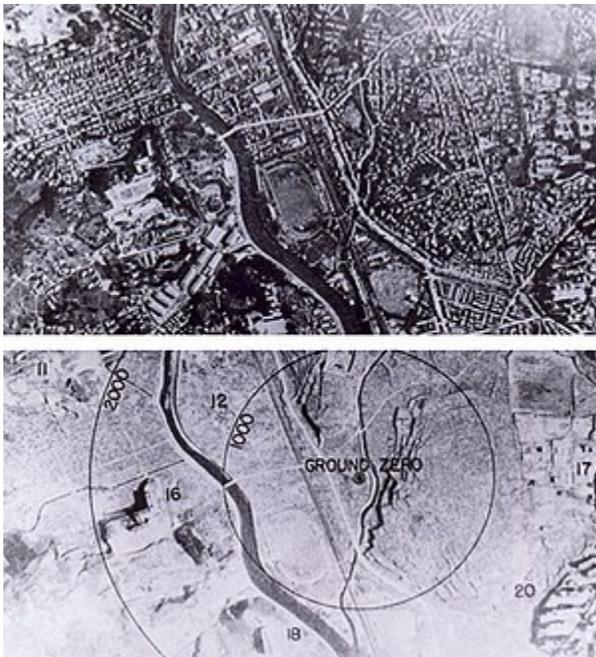
Aircraft	Pilot	Call sign	Mission role
<i>Enola Gay</i>	Captain George W. Marquardt	Dimples 82	Weather reconnaissance (Kokura)
<i>Laggin' Dragon</i>	Captain Charles F. McKnight	Dimples 95	Weather reconnaissance (Nagasaki)
<i>Bockscar</i>	Major Charles W. Sweeney	Dimples 77	Weapon delivery
<i>The Great Artiste</i>	Captain Frederick C. Bock	Dimples 89	Blast measurement instrumentation
<i>Big Stink</i>	Major James I. Hopkins, Jr.	Dimples 90	Strike observation and photography
<i>Full House</i>	Major Ralph R. Taylor	Dimples 83	Strike spare – did not complete mission

At 03:47 Tinian time (GMT+10), 02:47 Japanese time ^[197] on the morning of 9 August 1945, *Bockscar*, flown by Sweeney's crew, lifted off from [Tinian](#) island with the Fat Man, with Kokura as the primary target and Nagasaki the secondary target. The mission plan for the second attack was nearly identical to that of the Hiroshima mission, with two B-29s flying an hour ahead as weather scouts and two additional B-29s in Sweeney's flight for instrumentation and photographic support of the mission. Sweeney took off with his weapon already armed but with the electrical safety plugs still engaged. ^[198]

During pre-flight inspection of *Bockscar*, the flight engineer notified Sweeney that an inoperative fuel transfer pump made it impossible to use 2,400 litres (640 US gal) of fuel carried in a reserve tank. This fuel would still have to be carried all the way to Japan and back, consuming still more fuel. Replacing the pump would take hours; moving the Fat Man to another aircraft might take just as long and was dangerous as well, as the bomb was live. Tibbets and Sweeney therefore elected to have *Bockscar* continue the mission. ^{[199][200]}

This time Penney and Cheshire were allowed to accompany the mission, flying as observers on the third plane, *Big Stink*, flown by the group's operations officer, Major James I. Hopkins, Jr. Observers aboard the weather planes reported both targets clear. When Sweeney's aircraft

arrived at the assembly point for his flight off the coast of Japan, *Big Stink* failed to make the rendezvous.^[198] According to Cheshire, Hopkins was at varying heights including 2,700 metres (9,000 ft) higher than he should have been, and was not flying tight circles over [Yakushima](#) as previously agreed with Sweeney and Captain [Frederick C. Bock](#), who was piloting the support B-29 *The Great Artiste*. Instead, Hopkins was flying 64-kilometre (40 mi) dogleg patterns.^[201] Though ordered not to circle longer than fifteen minutes, Sweeney continued to wait for *Big Stink* for forty minutes. Before leaving the rendezvous point, Sweeney consulted Ashworth, who was in charge of the bomb. As commander of the aircraft, Sweeney made the decision to proceed to the primary, the city of Kokura.^[202]



Nagasaki before and after the bombing, after the fires had burned out.

After exceeding the original departure time limit by nearly a half-hour, *Bockscar*, accompanied by *The Great Artiste*, proceeded to Kokura, thirty minutes away. The delay at the rendezvous had resulted in clouds and drifting smoke over Kokura from fires started by a major firebombing raid by 224 B-29s on nearby [Yahata](#) the previous day.^[203] Additionally, the Yahata Steel Works intentionally burned [coal tar](#), to produce black smoke.^[204] The clouds and smoke resulted in 70 percent of the area over Kokura being covered, obscuring the aiming point. Three bomb runs were made over the next 50 minutes, burning fuel and exposing the aircraft repeatedly to the

heavy defenses around Kokura, but the bombardier was unable to drop visually. By the time of the third bomb run, Japanese anti-aircraft fire was getting close, and Second Lieutenant [Jacob Beser](#), who was monitoring Japanese communications, reported activity on the Japanese fighter direction radio bands.^[205]

With fuel running low because of the failed fuel pump, *Bockscar* and *The Great Artiste* headed for their secondary target, Nagasaki.^[198] Fuel consumption calculations made en route indicated that *Bockscar* had insufficient fuel to reach Iwo Jima and would be forced to divert to [Okinawa](#), which had become entirely Allied-occupied territory [only six weeks earlier](#). After initially deciding that if Nagasaki were obscured on their arrival the crew would carry the bomb to Okinawa and dispose of it in the ocean if necessary, Ashworth agreed with Sweeney's suggestion that a radar approach would be used if the target was obscured.^{[206][207]} At about 07:50 Japanese time, an air raid alert was sounded in Nagasaki, but the "all clear" signal was given at 08:30. When only two B-29 Superfortresses were sighted at 10:53 Japanese Time (GMT+9), the Japanese apparently assumed that the planes were only on reconnaissance and no further alarm was given.^[208]

A few minutes later at 11:00 Japanese Time, *The Great Artiste* dropped instruments attached to three parachutes. These instruments also contained an unsigned letter to Professor Ryokichi Sagane, a physicist at the [University of Tokyo](#) who studied with three of the scientists responsible for the atomic bomb at the [University of California, Berkeley](#), urging him to tell the public about the danger involved with these [weapons of mass destruction](#). The messages were found by military authorities but not turned over to Sagane until a month later.^[209] In 1949, one of the authors of the letter, [Luis Alvarez](#), met with Sagane and signed the letter.^[210]

At 11:01 Japanese Time, a last-minute break in the clouds over Nagasaki allowed *Bockscar*'s bombardier, Captain [Kermit Beahan](#), to visually sight the target as ordered. The Fat Man weapon, containing a core of about 5 kg (11 lb) of [plutonium](#), was dropped over the city's industrial valley. It exploded 47 seconds later at 11:02 Japanese Time^[197] at 503 ± 10 m ($1,650 \pm 33$ ft), above a tennis court,^[211] halfway between the Mitsubishi Steel and Arms Works in the south and the Nagasaki Arsenal in the north. This was nearly 3 km (1.9 mi) northwest of the planned hypocenter; the blast was confined to the [Urakami Valley](#) and a major portion of the city was protected by the intervening hills.^[212] The resulting explosion released the equivalent energy of 21 ± 2 kt (87.9 ± 8.4 TJ).^[140] *Big Stink* spotted the explosion from 160 kilometres (100 mi) away, and flew over to observe.^[213]



Urakami Tenshudo (Catholic Church in Nagasaki) destroyed by the bomb, the dome/bell of the church, at right, having toppled off

Bockscar flew on to Okinawa, arriving with only sufficient fuel for a single approach. Sweeney tried repeatedly to contact the control tower for landing clearance, but received no answer. He could see heavy air traffic landing and taking off from [Yontan Airfield](#). Firing off every flare on board to alert the field to his emergency landing, the *Bockscar* came in fast, landing at 230 km/h (140 mph) instead of the normal 190 kilometres per hour (120 mph). The number two engine died from fuel starvation as he began the final approach. Touching down on only three engines midway down the landing strip, *Bockscar* bounced up into the air again for about 7.6 metres (25 ft) before slamming back down hard. The heavy B-29 slewed left and towards a row of parked B-24 bombers before the pilots managed to regain control. Its reversible propellers were insufficient to slow the aircraft adequately, and with both pilots standing on the brakes, *Bockscar* made a swerving 90-degree turn at the end of the runway to avoid running off it. A second engine died from fuel exhaustion before the plane came to a stop.^[214]

Following the mission, there was confusion over the identification of the plane. The first eyewitness account by war correspondent [William L. Laurence](#) of *The New York Times*, who accompanied the mission aboard the aircraft piloted by Bock, reported that Sweeney was leading the mission in *The Great Artiste*. He also noted its "Victor" number as 77, which was that of *Bockscar*.^[215] Laurence had interviewed Sweeney and his crew, and was aware that they referred to their airplane as *The Great Artiste*. Except for *Enola Gay*, none of the 393d's B-29s had yet had names painted on the noses, a fact which Laurence himself noted in his account. Unaware of the switch in aircraft, Laurence assumed Victor 77 was *The Great Artiste*,^[216] which was in fact, Victor 89.^[217]

Events on the ground



The Nagasaki Prefecture Report on the bombing characterized Nagasaki as "like a graveyard with not a tombstone standing".^[218]

Although the bomb was more powerful than the one used on Hiroshima, its effects were confined by hillsides to the narrow Urakami Valley.^[219] Of 7,500 Japanese employees who worked inside the Mitsubishi Munitions plant, including "mobilized" students and regular workers, 6,200 were killed. Some 17,000–22,000 others who worked in other war plants and factories in the city died as well.^[220] Casualty estimates for immediate deaths vary widely, ranging from 22,000 to 75,000.^[220] At least 35,000–40,000 people were killed and 60,000 others injured.^{[221][222]} In the days and months following the explosion, more people died from their injuries. Because of the presence of undocumented foreign workers, and a number of military personnel in transit, there are great discrepancies in the estimates of total deaths by the end of 1945; a range of 39,000 to 80,000 can be found in various studies.^[123]

Unlike Hiroshima's military death toll, only 150 Japanese soldiers were killed instantly, including 36 from the 134th AAA Regiment of the 4th AAA Division.^[117] At least eight Allied [prisoners of war](#) (POWs) died from the bombing, and as many as thirteen may have died. The eight confirmed deaths included a British POW, [Royal Air Force](#) Corporal [Ronald Shaw](#),^[223] and seven Dutch POWs.^[224] One American POW, [Joe Kieyoomia](#), was in Nagasaki at the time of the bombing but survived, reportedly having been shielded from the effects of the bomb by the concrete walls of his cell.^[225] There were 24 Australian POWs in Nagasaki, all of whom survived.^[226]

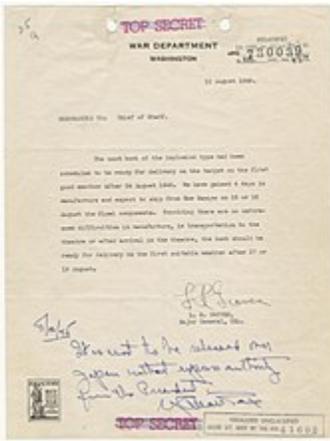


Partially incinerated child in Nagasaki. Photo from Japanese photographer [Yōsuke Yamahata](#), one day after the blast and building fires had subsided. Once the American forces had Japan under their military control, they imposed censorship on all such images including those from the conventional bombing of Tokyo; this prevented the distribution of Yamahata's photographs. These restrictions were lifted in 1952.^{[227][228]}

The radius of total destruction was about 1.6 km (1 mi), followed by fires across the northern portion of the city to 3.2 km (2 mi) south of the bomb.^{[145][229]} About 58 percent of the Mitsubishi Arms Plant was damaged, and about 78 percent of the Mitsubishi Steel Works. The Mitsubishi Electric Works suffered only 10 percent structural damage as it was on the border of the main destruction zone. The Nagasaki Arsenal was destroyed in the blast.^[230] Although many fires likewise burnt following the bombing, in contrast to Hiroshima where sufficient **fuel density** was available, no **firestorm** developed in Nagasaki as the damaged areas did not furnish enough fuel to generate the phenomenon. Instead, ambient wind pushed the fire spread along the valley.^[231]

As in Hiroshima, the bombing badly dislocated the city's medical facilities. A makeshift hospital was established at the Shinkozen Primary School, which served as the main medical centre. The trains were still running, and evacuated many victims to hospitals in nearby towns. A medical team from a naval hospital reached the city in the evening, and fire-fighting brigades from the neighboring towns assisted in fighting the fires.^[232] [Takashi Nagai](#) was a doctor working in the radiology department of Nagasaki Medical College Hospital. He received a serious injury that severed his right temporal artery, but joined the rest of the surviving medical staff in treating bombing victims.^[233]

Plans for more atomic attacks on Japan



Memorandum from Groves to Marshall regarding the third bomb, with Marshall's hand-written caveat that the third bomb not be used without express presidential instruction.

Groves expected to have another "Fat Man" atomic bomb ready for use on 19 August, with three more in September and a further three in October;^[89] a second Little Boy bomb (using U-235) would not be available until December 1945.^{[234][235]} On 10 August, he sent a memorandum to Marshall in which he wrote that "the next bomb ... should be ready for delivery on the first suitable weather after 17 or 18 August." Marshall endorsed the memo with the hand-written comment, "It is not to be released over Japan without express authority from the President",^[89] something Truman had requested that day. This modified the previous order that the target cities were to be attacked with atomic bombs "as made ready".^[236] There was already discussion in the War Department about conserving the bombs then in production for [Operation Downfall](#), and Marshall suggested to Stimson that the remaining cities on the target list be spared attack with atomic bombs.^[237]

Two more Fat Man assemblies were readied, and scheduled to leave [Kirtland Field](#) for Tinian on 11 and 14 August,^[238] and Tibbets was ordered by LeMay to return to [Albuquerque, New Mexico](#), to collect them.^[239] At Los Alamos, technicians worked 24 hours straight to cast [another plutonium core](#).^[240] Although cast, it still needed to be pressed and coated, which would take until 16 August.^[241] Therefore, it could have been ready for use on 19 August. Unable to reach Marshall, Groves ordered on his own authority on 13 August that the core should not be shipped.^[236]

Surrender of Japan and subsequent occupation

Until 9 August, Japan's war council still insisted on its four conditions for surrender. The full cabinet met at 14:30 on 9 August, and spent most of the day debating surrender. Anami conceded that victory was unlikely, but argued in favour of continuing the war nonetheless. The meeting ended at 17:30, with no decision having been reached. Suzuki went to the palace to report on the outcome of the meeting, where he met with [Kōichi Kido](#), the [Lord Keeper of the Privy Seal of Japan](#). Kido informed him that the emperor had agreed to hold an imperial conference, and gave a strong indication that the emperor would consent to surrender on condition that *kokutai* be preserved. A second cabinet meeting was held at 18:00. Only four ministers supported Anami's position of adhering to the four conditions, but since cabinet decisions had to be unanimous, no decision was reached before it ended at 22:00.^[242]

Calling an imperial conference required the signatures of the prime minister and the two service chiefs, but the [Chief Cabinet Secretary Hisatsune Sakomizu](#) had already obtained signatures from Toyoda and General [Yoshijirō Umezu](#) in advance, and he reneged on his promise to inform them if a meeting was to be held. The meeting commenced at 23:50. No consensus had emerged by 02:00 on 10 August, but the emperor gave his "sacred decision",^[243] authorizing the [Foreign Minister, Shigenori Tōgō](#), to notify the Allies that Japan would accept their terms on one condition, that the declaration "does not comprise any demand which prejudices the prerogatives of His Majesty as a Sovereign ruler."^[244]

On 12 August, the Emperor informed the imperial family of his decision to surrender. One of his uncles, [Prince Asaka](#), then asked whether the war would be continued if the *kokutai* could not be preserved. Hirohito simply replied, "Of course."^[245] As the Allied terms seemed to leave intact the principle of the preservation of the Throne, Hirohito recorded on 14 August his [capitulation announcement](#) which was broadcast to the Japanese nation the next day despite a [short rebellion](#) by militarists opposed to the surrender.^[246]

In his declaration's fifth paragraph, Hirohito solely mentions the duration of the conflict; and did not explicitly mention the Soviets as a factor for surrender:

But now the war has lasted for nearly four years. Despite the best that has been done by every one—the gallant fighting of military and naval forces, the diligence and assiduity of Our servants of the State and the devoted service of Our one hundred million people, the war situation has developed not necessarily to Japan's advantage, while the general trends of the world have all turned against her interest.

The sixth paragraph by Hirohito specifically mentions the use of nuclear ordnance devices against Japan by the United States, from the aspect of the unprecedented damage they caused:

Moreover, the enemy has begun to employ a new and most cruel bomb, the power of which to do damage is, indeed, incalculable, taking the toll of many innocent lives. Should we continue to fight, not only would it result in an ultimate collapse and obliteration of the Japanese nation, but also it would lead to the total extinction of human civilization.

The seventh paragraph gives the reason for the ending of hostilities against the Allies:

Such being the case, how are we to save the millions of our subjects, or to atone ourselves before the hallowed spirits of our imperial ancestors? This is the reason why we have ordered the acceptance of the provisions of the joint declaration of the powers.^[247]

In his "Rescript to the Soldiers and Sailors" delivered on 17 August, Hirohito did not refer to the atomic bombs or possible human extinction, and instead described the Soviet declaration of war as "endangering the very foundation of the Empire's existence."^[248]

Reportage

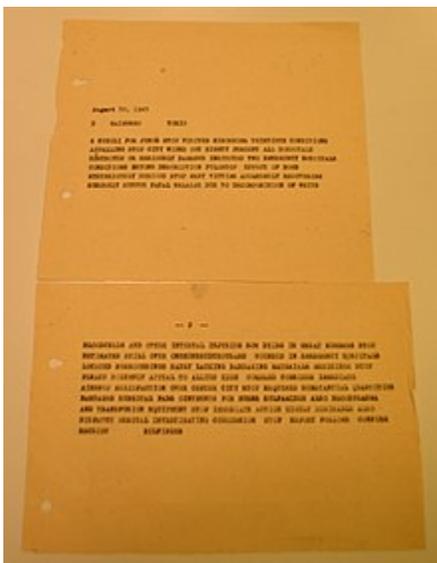


The Hiroshima ruins in March and April 1946, by Daniel A. McGovern and Harry Mimura

On 10 August 1945, the day after the Nagasaki bombing, military photographer [Yōsuke Yamahata](#), correspondent Higashi, and artist Yamada arrived in the city with instructions to record the destruction for [propaganda](#) purposes. Yamahata took scores of photographs, and on

21 August, they appeared in *Mainichi Shimbun*, a popular Japanese newspaper. After Japan's surrender and the arrival of American forces, copies of his photographs were seized amid the ensuing censorship, but some records have survived.^[249]

Leslie Nakashima, a former *United Press* (UP) journalist, filed the first personal account of the scene to appear in American newspapers. He observed that large numbers of survivors continued to die from what later became recognized as radiation poisoning.^[250] On 31 August, *The New York Times* published an abbreviated version of his 27 August UP article. Nearly all references to uranium poisoning were omitted. An editor's note was added to say that, according to American scientists, "the atomic bomb will not have any lingering after-effects."^{[251][250]}



A telegram sent by *Fritz Bilfinger*, delegate of the *International Committee of the Red Cross* (ICRC), on 30 August 1945 from Hiroshima

Wilfred Burchett was also one of the first Western journalists to visit Hiroshima after the bombing. He arrived alone by train from Tokyo on 2 September, defying the traveling ban put in place on Western correspondents.^[252] Burchett's *Morse code* dispatch, "The Atomic Plague", was printed by the *Daily Express* newspaper in London on 5 September 1945. The reports from Nakashima and Burchett informed the public for the first time of the gruesome effects of *radiation* and *nuclear fallout*—*radiation burns* and *radiation poisoning*, sometimes lasting more than thirty days after the blast.^{[253][254]} Burchett especially noted that people were dying

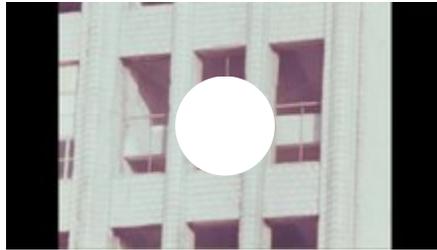
"horribly" after bleeding from orifices, and their flesh would rot away from the injection holes where vitamin A was administered, to no avail.^[252]

The New York Times then apparently reversed course and ran a front-page story by [Bill Lawrence](#) confirming the existence of a terrifying affliction in Hiroshima, where many had symptoms such as hair loss and vomiting of blood before dying.^[252] Lawrence had gained access to the city as part of a press junket promoting the [U.S. Army Air Force](#). Some reporters were horrified by the scene, however, referring to what they saw as a "death laboratory" littered with "human guinea pigs". General MacArthur found the reporting to have turned from good PR into bad PR and threatened to court martial the entire group. He withdrew Burchett's press accreditation and expelled the journalist from the occupation zones.^[255] The authorities also accused him of being under the sway of Japanese propaganda and later suppressed another story, on the Nagasaki bombing, by [George Weller](#) of the *Chicago Daily News*. Less than a week after his *New York Times* story was published, Lawrence also backtracked and dismissed the reports on radiation sickness as Japanese efforts to undermine American morale.^{[256][252]}

A member of the U.S. [Strategic Bombing Survey](#), Lieutenant Daniel McGovern, used a film crew to document the effects of the bombings in early 1946. The film crew shot 27,000 m (90,000 ft) of film, resulting in a three-hour documentary titled *The Effects of the Atomic Bombs Against Hiroshima and Nagasaki*. The documentary included images from hospitals showing the human effects of the bomb; it showed burned-out buildings and cars, and rows of skulls and bones on the ground. It was classified "secret" for the next 22 years.^{[257][258]} Motion picture company [Nippon Eigasha](#) started sending cameramen to Nagasaki and Hiroshima in September 1945. On 24 October 1945, a [U.S. military policeman](#) stopped a *Nippon Eigasha* cameraman from continuing to film in Nagasaki. All *Nippon Eigasha*'s reels were confiscated by the American authorities, but they were requested by the Japanese government, and declassified.^[258] The public release of film footage of the city post-attack, and some research about the effects of the attack, was restricted during the [occupation of Japan](#),^[259] but the Hiroshima-based magazine, *Chugoku Bunka*, in its first issue published on 10 March 1946, devoted itself to detailing the damage from the bombing.^[260]

The book *Hiroshima*, written by [Pulitzer Prize](#) winner [John Hersey](#), which was originally published in article form in the popular magazine *The New Yorker*,^[261] on 31 August 1946, is reported to have reached Tokyo in English by January 1947, and the translated version was released in Japan in 1949.^{[262][263][264]} It narrated the stories of the lives of six bomb survivors from immediately prior to, and months after, the dropping of the Little Boy bomb.^[261] Beginning in 1974, a compilation of drawings and artwork made by the survivors of the bombings began to be

compiled, with completion in 1977, and under both book and exhibition format, it was titled *The Unforgettable Fire*.^[265]

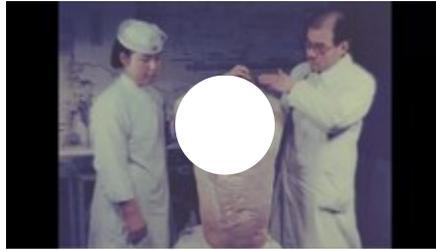


Life among the rubble in Hiroshima in March and April 1946. Film footage taken by Lieutenant Daniel A. McGovern (director) and Harry Mimura (cameraman) for a [United States Strategic Bombing Survey](#) project.

The bombing amazed [Otto Hahn](#) and other German atomic scientists, whom the British held at Farm Hall in [Operation Epsilon](#). Hahn stated that he had not believed an atomic weapon "would be possible for another twenty years"; [Werner Heisenberg](#) did not believe the news at first. [Carl Friedrich von Weizsäcker](#) said "I think it's dreadful of the Americans to have done it. I think it is madness on their part", but Heisenberg replied, "One could equally well say 'That's the quickest way of ending the war'". Hahn was grateful that the German project had not succeeded in developing "such an inhumane weapon"; [Karl Wirtz](#) observed that even if it had, "we would have obliterated London but would still not have conquered the world, and then they would have dropped them on us".^[266]

Hahn told the others, "Once I wanted to suggest that all uranium should be sunk to the bottom of the ocean".^[266] The Vatican agreed; *L'Osservatore Romano* expressed regret that the bomb's inventors did not destroy the weapon for the benefit of humanity.^[267] Rev. [Cuthbert Thicknesse](#), the [dean of St Albans](#), prohibited using [St Albans Abbey](#) for a thanksgiving service for the war's end, calling the use of atomic weapons "an act of wholesale, indiscriminate massacre".^[268] Nonetheless, news of the atomic bombing was greeted enthusiastically in the U.S.; a poll in [Fortune magazine](#) in late 1945 showed a significant minority of Americans (23 percent) wishing that more atomic bombs could have been dropped on Japan.^{[269][270]} The initial positive response was supported by the imagery presented to the public (mainly the powerful images of the [mushroom cloud](#)).^[269] During this time in America, it was a common practice for editors to keep graphic images of death out of films, magazines, and newspapers.^[271]

Post-attack casualties



Silent film footage taken in Hiroshima in March 1946 showing survivors with severe burns and [keloid](#) scars. Survivors were asked to stand in the orientation they were in at the time of the flash, to document and convey the [line-of-sight](#) nature of [flash burns](#), and to show that, much like a [sunburn](#), thick clothing and fabric offered protection in many cases. The sometimes extensive [burn scar contracture](#) is not unusual, being common to all [second- and third-degree burns](#) when they cover a large area of skin.

An estimated 90,000 to 140,000 people in Hiroshima (up to 39 percent of the population) and 60,000 to 80,000 people in Nagasaki (up to 32 percent of the population) died in 1945,^[123] though the number which died immediately as a result of exposure to the blast, heat, or due to radiation, is unknown. One [Atomic Bomb Casualty Commission](#) report discusses 6,882 people examined in Hiroshima, and 6,621 people examined in Nagasaki, who were largely within 2,000 meters (6,600 ft) from the [hypocenter](#), who suffered injuries from the blast and heat but died from complications frequently compounded by [acute radiation syndrome](#) (ARS), all within about 20 to 30 days.^{[272][273]} Many people uninjured by the blast eventually died within that timeframe as well after suffering from ARS. At the time, the doctors had no idea what was the cause and were unable to effectively treat the condition.^[252] [Midori Naka](#) was to be the first death officially certified as a result of radiation poisoning or, as it was referred to by many, the "atomic bomb disease". She was some 650 meters (2,130 ft) from the hypocenter at Hiroshima and would die on 24 August 1945 after traveling to Tokyo. It was unappreciated at the time but the average radiation dose that will kill approximately 50 percent of adults, the [LD50](#), was approximately halved, that is, smaller doses were made more lethal, when the individual experienced concurrent blast or burn [polytraumatic](#) injuries.^[274] Conventional skin injuries that cover a large area frequently result in bacterial infection; the risk of [sepsis](#) and death is increased when a usually non-lethal radiation dose moderately [suppresses the white blood cell count](#).^[275]

In the spring of 1948, the [Atomic Bomb Casualty Commission](#) (ABCC) was established in accordance with a presidential directive from Truman to the [National Academy of Sciences–National Research Council](#) to conduct investigations of the late effects of radiation among the survivors in Hiroshima and Nagasaki.^[276] In 1956, the ABCC published *The Effect of Exposure to the Atomic Bombs on Pregnancy Termination in Hiroshima and Nagasaki*.^[277] The ABCC became the [Radiation Effects Research Foundation](#) (RERF), on 1 April 1975. A binational organization run by both the United States and Japan, the RERF is still in operation today.^[278]

Cancer increases

[Cancers do not immediately emerge after exposure to radiation](#); instead, radiation-induced cancer has a minimum [latency period](#) of some five years and above, and [leukemia](#) some two years and above, peaking around six to eight years later.^[279] Dr Jarrett Foley published the first major reports on the significant increased incidence of the latter among survivors. Almost all cases of leukemia over the following 50 years were in people exposed to more than 1 Gy.^[280] In a [strictly dependent manner dependent on their distance from the hypocenter](#), in the 1987 *Life Span Study*, conducted by the [Radiation Effects Research Foundation](#), a statistical excess of 507 cancers, of undefined lethality, were observed in 79,972 hibakusha who had still been living between 1958 and 1987 and who took part in the study.^[281] As the [epidemiology](#) study continues with time, the RERF estimates that, from 1950 to 2000, 46 percent of leukemia deaths which may include [Sadako Sasaki](#) and 11 percent of [solid cancers](#) of unspecified lethality were likely due to radiation from the bombs or some other post-attack city effects, with the statistical excess being 200 leukemia deaths and 1,700 solid cancers of undeclared lethality. Both of these statistics being derived from the observation of approximately half of the total survivors, strictly those who took part in the study.^[282] A meta-analysis from 2016 found that radiation exposure increases cancer risk, but also that the average lifespan of survivors was reduced by only a few months compared to those not exposed to radiation.^[283]

Birth defect investigations

While during the preimplantation period, that is one to ten days following [conception](#), intrauterine radiation exposure of "at least 0.2 Gy" can cause complications of implantation and death of the [human embryo](#).^[284] The number of [miscarriages](#) caused by the radiation from the bombings, during this [radiosensitive](#) period, is not known.

One of the early studies conducted by the ABCC was on the outcome of pregnancies occurring in Hiroshima and Nagasaki, and in a [control](#) city, [Kure](#), located 29 km (18 mi) south of Hiroshima, to discern the conditions and outcomes related to radiation exposure.^[285] [James V. Neel](#) led the study which found that the overall number of [birth defects](#) was not significantly higher among the children of survivors who were pregnant at the time of the bombings.^[286] He also studied the longevity of the children who survived the bombings of Hiroshima and Nagasaki, reporting that between 90 and 95 percent were still living 50 years later.^[287]

While The National Academy of Sciences raised the possibility that Neel's procedure did not filter the Kure population for possible radiation exposure which could bias the results,^[288] overall, a [statistically insignificant](#) increase in birth defects occurred directly after the bombings of Nagasaki and Hiroshima when the cities were taken as wholes, in terms of distance from the hypocenters. However, Neel and others noted that in approximately 50 humans who were of an early [gestational age](#) at the time of the bombing and who were all within about 1 kilometre (0.62 mi) of the hypocenter, an increase in [microencephaly](#) and [anencephaly](#) was observed upon birth, with the incidence of these two particular malformations being nearly 3 times what was to be expected when compared to the [control group](#) in Kure, where approximately 20 cases were observed in a similar sample size.^[289]

In 1985, [Johns Hopkins University](#) geneticist [James F. Crow](#) examined Neel's research and confirmed that the number of birth defects was not significantly higher in Hiroshima and Nagasaki.^[290] Many members of the ABCC and its successor [Radiation Effects Research Foundation](#) (RERF) were still looking for possible birth defects among the survivors decades later, but found no evidence that they were significantly common among the survivors, or [inherited](#) in the children of survivors.^{[287][291]}

Investigations into brain development

Despite the small sample size of 1,600 to 1,800 persons who came forth as [prenatally](#) exposed at the time of the bombings, that were both within a close proximity to the two hypocenters, to survive the [in utero](#) absorption of a substantial dose of radiation and then the [malnourished](#) post-attack environment, data from this cohort does support the increased risk of [severe mental retardation](#) (SMR), that was observed in some 30 individuals, with SMR being a common outcome of the aforementioned microencephaly. While a lack of statistical data, with just 30 individuals out of 1,800, prevents a definitive determination of a [threshold point](#), the data collected suggests a threshold intrauterine or *fetal* dose for SMR, at the most radiosensitive

period of cognitive development, when there is the largest number of [undifferentiated](#) neural cells (8 to 15 weeks post-conception) [to begin at a threshold dose](#) of approximately "0.09" to "0.15" [Gy](#), with the risk then linearly increasing to a 43-percent rate of SMR when exposed to a fetal dose of 1 Gy at any point during these weeks of rapid [neurogenesis](#).^{[292][293]}

However either side of this radiosensitive age, none of the prenatally exposed to the bombings at an age *less than 8 weeks*, that is prior to [synaptogenesis](#) or at a gestational age *more than 26 weeks* "were observed to be mentally retarded", with the condition therefore being isolated to those solely of 8–26 weeks of age and who absorbed more than approximately "0.09" to "0.15" Gy of *prompt* radiation energy.^{[292][294]}

Examination of the prenatally exposed in terms of IQ performance and school records, determined the beginning of a statistically significant reduction in both, when exposed to greater than 0.1 to 0.5 gray, during the same gestational period of 8–25 weeks. However outside this period, at less than 8 weeks and greater than 26 after conception, "there is no evidence of a radiation-related effect on scholastic performance."^[292]

The reporting of doses in terms of absorbed energy in units of [grays](#) and [rads](#), rather than the use of the biologically significant, biologically weighted [sievert](#) in both the SMR and cognitive performance data, is typical.^[294] The reported threshold dose variance between the two cities, is suggested to be a manifestation of the [difference between X-ray and neutron absorption](#), with [Little Boy](#) emitting substantially more [neutron flux](#), whereas the [Baratol](#) that surrounded the core of [Fat Man](#), filtered or shifted the absorbed neutron-radiation profile, so that the dose of radiation energy received in Nagasaki, is mostly that from exposure to x-rays/gamma rays, in contrast to the environment within 1500 meters of the hypocenter at Hiroshima, were instead the in-utero dose more depended on the absorption of [neutrons](#), which have a [higher biological effect per unit of energy absorbed](#).^[295] From the [radiation dose reconstruction](#) work, which were also informed by the 1962 [BREN Tower](#) Japanese city analog, the estimated [dosimetry](#) at Hiroshima still has the largest uncertainty as the Little Boy bomb design was never tested before deployment or afterward, therefore the estimated radiation profile absorbed by individuals at Hiroshima had required greater reliance on calculations than the Japanese soil, concrete and roof-tile measurements which began to reach accurate levels and thereby inform researchers, in the 1990s.^{[296][297][298]}

Many other investigations into cognitive outcomes, such as [schizophrenia](#) as a result of prenatal exposure, have been conducted with "no statistically significant linear relationship seen", there is a suggestion that in the most extremely exposed, those who survived within a kilometer or so of

the hypocenters, a trend emerges akin to that seen in SMR, though the sample size is too small to determine with any significance.^[299]

Hibakusha



Torii, Nagasaki, Japan. One-legged torii in the background

The survivors of the bombings are called *hibakusha* (被爆者, pronounced [çiba⁺kuj̥ɕa] or [çibakuj̥⁺ɕa]), a Japanese word that literally translates to "explosion-affected people". The Japanese government has recognized about 650,000 people as *hibakusha*. As of March 31, 2022, 118,935 were still alive, mostly in Japan.^[300] The government of Japan recognizes about one percent of these as having illnesses caused by radiation.^[301] The memorials in Hiroshima and Nagasaki contain lists of the names of the *hibakusha* who are known to have died since the bombings. Updated annually on the anniversaries of the bombings, as of August 2022, the memorials record the names of 526,000 *hibakusha*; 333,907 in Hiroshima^[302] and 192,310 in Nagasaki.^[303]

If they discuss their background, *hibakusha* and their children were (and still are) victims of fear-based *discrimination* and exclusion when it comes to prospects of marriage or work^[304] due to *public ignorance* about the consequences of *radiation sickness* or that the low doses that the majority received were less than a routine *diagnostic x-ray*, much of the public however persist with the belief that the *hibakusha* carry some hereditary or even contagious disease.^[305] This is despite the fact that no statistically demonstrable increase of birth defects/congenital malformations was found among the *later conceived* children born to survivors of the nuclear weapons used at Hiroshima and Nagasaki, or indeed has been found in the later conceived

children of cancer survivors who had previously received [radiotherapy](#).^{[306][307][308]} The surviving women of Hiroshima and Nagasaki, that could conceive, who were exposed to substantial amounts of radiation, went on and had children with no higher incidence of abnormalities/birth defects than the rate which is observed in the Japanese average.^{[309][310][311]} A study of the long-term psychological effects of the bombings on the survivors found that even 17–20 years after the bombings had occurred survivors showed a higher prevalence of [anxiety](#) and [somatization](#) symptoms.^[312]

Double survivors

Perhaps as many as 200 people from Hiroshima sought refuge in Nagasaki. The 2006 documentary *Twice Survived: The Doubly Atomic Bombed of Hiroshima and Nagasaki* documented 165 *nijū hibakusha* (lit. *double explosion-affected people*), nine of whom claimed to be in the blast zone in both cities.^[313] On 24 March 2009, the Japanese government officially recognized [Tsutomu Yamaguchi](#) as a double *hibakusha*. He was confirmed to be 3 km (1.9 mi) from ground zero in Hiroshima on a business trip when the bomb was detonated. He was seriously burnt on his left side and spent the night in Hiroshima. He arrived at his home city of Nagasaki on 8 August, the day before the bombing, and he was exposed to residual radiation while searching for his relatives. He was the first officially recognized survivor of both bombings.^[314] He died on 4 January 2010, at age 93, of stomach cancer.^[315]

Korean survivors

During the war, Japan brought as many as 670,000 Korean conscripts to Japan to work as [forced labor](#).^[316] About 5,000–8,000 Koreans were killed in Hiroshima and another 1,500–2,000 died in Nagasaki.^[317] For many years, Korean survivors had a difficult time fighting for the same recognition as *Hibakusha* as afforded to all Japanese survivors, a situation which resulted in the denial of the free health benefits to them in Japan. Most issues were eventually addressed in 2008 through lawsuits.^[318]

Memorials

Hiroshima

Hiroshima was subsequently struck by [Typhoon Ida](#) on 17 September 1945. More than half the bridges were destroyed, and the roads and railroads were damaged, further devastating the city.^[319] The population increased from 83,000 soon after the bombing to 146,000 in February 1946.^[320] The city was rebuilt after the war, with help from the national government through the Hiroshima Peace Memorial City Construction Law passed in 1949. It provided financial assistance for reconstruction, along with land donated that was previously owned by the national government and used for military purposes.^[321] In 1949, a design was selected for the [Hiroshima Peace Memorial Park](#). Hiroshima Prefectural Industrial Promotion Hall, the closest surviving building to the location of the bomb's detonation, was designated the [Hiroshima Peace Memorial](#). The [Hiroshima Peace Memorial Museum](#) was opened in 1955 in the Peace Park.^[322] Hiroshima also contains a [Peace Pagoda](#), built in 1966 by [Nipponzan-Myōhōji](#).^[323]



Panoramic view of Hiroshima Peace Memorial Park. The [Genbaku Dome](#) can be seen in the center left of the image. The original target for the bomb was the "T"-shaped [Aioi Bridge](#) seen in the left of the image.

Nagasaki

Nagasaki was also rebuilt after the war, but was dramatically changed in the process. The pace of reconstruction was initially slow, and the first simple emergency dwellings were not provided until 1946. The focus on redevelopment was the replacement of war industries with foreign trade, shipbuilding and fishing. This was formally declared when the Nagasaki International Culture City Reconstruction Law was passed in May 1949.^[320] New temples were built, as well as new churches owing to an increase in the presence of Christianity. Some of the rubble was left as a memorial, such as a *torii* at [Sannō Shrine](#), and an arch near ground zero. New structures were also raised as memorials, such as the [Nagasaki Atomic Bomb Museum](#), which was opened in the mid-1990s.^[324]



Panoramic view of the monument marking the hypocenter, or ground zero, of the atomic bomb explosion over Nagasaki

Debate over bombings

The role of the bombings in [Japan's surrender](#), and the ethical, legal, and military controversies surrounding the United States' justification for them have been the subject of scholarly and popular debate.^[325] On one hand, it has been argued that the bombings caused the Japanese surrender, thereby preventing casualties that an invasion of Japan would have involved.^{[7][326]} Stimson talked of saving one million casualties.^[327] The naval blockade might have starved the Japanese into submission without an invasion, but this would also have resulted in many more Japanese deaths.^[328]

However, critics of the bombings have cited a belief that atomic weapons are fundamentally immoral, that the bombings were [war crimes](#), and that they constituted [state terrorism](#).^[329] Others, such as historian [Tsuyoshi Hasegawa](#), argued that the entry of the Soviet Union into the war against Japan "played a much greater role than the atomic bombs in inducing Japan to surrender because it dashed any hope that Japan could terminate the war through Moscow's mediation".^[330] A view among critics of the bombings, popularized by American historian [Gar Alperovitz](#) in 1965, is the idea of atomic diplomacy: that the United States used nuclear weapons to intimidate the Soviet Union in the early stages of the [Cold War](#). James Orr wrote that this idea became the accepted position in Japan and that it may have played some part in the decision making of the US government.^[331]

Legacy

The manner in which World War II ended cast a long shadow over international relations for decades afterwards. By 30 June 1946, there were components for nine atomic bombs in the US arsenal, all Fat Man devices identical to the one used in the bombing of Nagasaki.^[332] The nuclear weapons were handmade devices, and a great deal of work remained to improve their ease of assembly, safety, reliability and storage before they were ready for production. There were also many improvements to their performance that had been suggested or recommended, but that had not been possible under the pressure of wartime development.^[333] The [Chairman of the Joint Chiefs of Staff, Fleet Admiral William D. Leahy](#) had decried the use of the atomic bombs as adopting "an ethical standard common to the barbarians of the Dark Ages",^[334] but in October 1947, he reported a military requirement for 400 bombs.^[335]

The American monopoly on nuclear weapons lasted four years before the Soviet Union detonated an atomic bomb in September 1949.^[335] The United States responded with the development of the [hydrogen bomb](#), a nuclear weapon a thousand times as powerful as the bombs that devastated Hiroshima and Nagasaki.^[336] Such ordinary fission bombs would henceforth be regarded as small [tactical nuclear weapons](#). By 1986, the United States had 23,317 nuclear weapons, while the [Soviet Union](#) had 40,159. In early 2019, more than 90% of the world's 13,865 nuclear weapons were owned by [Russia](#) and the United States.^{[337][338]}

By 2020, [nine nations had nuclear weapons](#),^[339] but Japan was not one of them.^[340] Japan reluctantly signed the [Treaty on the Non-Proliferation of Nuclear Weapons](#) in February 1970,^[341] but it is still sheltered under the American nuclear umbrella. American nuclear weapons were stored on Okinawa, and sometimes in Japan itself, albeit in contravention of agreements between the two nations.^[342] Lacking the resources to fight the Soviet Union using conventional forces, the [Western Alliance](#) came to depend on the use of nuclear weapons to defend itself during the [Cold War](#), a policy that became known in the 1950s as the [New Look](#).^[343] In the decades after Hiroshima and Nagasaki, the United States would threaten to use its nuclear weapons many times.^[344]

On 7 July 2017, more than 120 countries voted to adopt the UN [Treaty on the Prohibition of Nuclear Weapons](#). Elayne Whyte Gómez, President of the UN negotiations on the nuclear ban treaty, said "the world has been waiting for this legal norm for 70 years," since the atomic bombings of Hiroshima and Nagasaki in August 1945.^[345] As of 2020, Japan has not signed the treaty.^{[346][347]}

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