The Manhattan Project:

The Making of the Atomic Bombs Which Brought About the Biggest Triumph in the 20th Century Despite the Inevitable Tragedy

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Historical Paper

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"We are now prepared to obliterate rapidly and completely every productive enterprise the Japanese have above ground in any city. We shall destroy their docks, their factories, and their communications. Let there be no mistake, we shall completely destroy Japan's power to make war[1]."

- *President Harry S. Truman, 1945*

In a flash of blinding light, a sunny August morning was suddenly shadowed with enormous devastation. Tens of thousands of people were vaporized instantly from the extreme heat. The remaining started to wish they were killed instantly, not having to suffer any longer[2]...

On August 6, 1945, a United States Army airplane dropped the world's first atomic bomb on Hiroshima, an important Japanese army base[3]. This was the result of the Manhattan Project, the codename for the collaborative effort among the Government, the U.S. Military, and the industrial and scientific sectors to develop atomic bombs for the United States during World War II. The dropping of the atomic bombs inflicted a huge tragedy on Japan, instantly killing at least 120,000 people. It then led to the dangerous, unpredictable Cold War era, following the end of World War II. Despite the inevitable tragedy, the success of the Manhattan Project won the most significant triumph for the United States and the Allies. Within days of the dropping of the

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[1] Fox, J. A. "Atomic Bomb, World's Greatest, Hits Japs." *The Evening Star* [Washington, D.C.], 6 Aug. 1945, p. 1. *Chronicling America*, chroniclingamerica.loc.gov/lccn/sn83045462/1945-08-06/ed-1/seq-1.pdf. Accessed 3 Dec. 2018.

[2] Kristof, Nicholas D. "Hiroshima: A Special Report.; The Bomb: An Act That Haunts Japan and America." *New York Times*, 6 Aug. 1995, explore.proquest.com/document/430292035?searchid=1537125096&accountid=66038. Accessed 13 Dec. 2018.

[3] Fox, J. A. "Atomic Bomb, World's Greatest, Hits Japs." *The Evening Star* [Washington, D.C.], 6 Aug. 1945, p. 1. *Chronicling America*, chroniclingamerica.loc.gov/lccn/sn83045462/1945-08-06/ed-1/seq-1.pdf. Accessed 3 Dec. 2018.

bombs, Japan announced their surrender. This ended the atrocity of World War II which was started in 1939 by Hitler's Germany, taking a total of 35 to 60 million lives around the world by the end of the war in 1945[4]. The triumph of the Manhattan Project also lies in the fact that it ushered in the Atomic Age when important advances made by nuclear scientists gave the world breakthroughs in terms of energy, technology, and medicine.

The Beginning of the Manhattan Project: A Race with Germany

The possibility of an atomic bomb became apparent when Austrian-Swedish physicist, Lise Meitner discovered fission, in which the nucleus of an atom splits into smaller parts causing a large amount of energy to be released[5], in December 1938[6]. Germany began Uranverein, its secret nuclear weapons program, in April 1938, thus causing them to have a significant head start over the Manhattan Project, which officially started in January 1942[7]. Fission was introduced to American and foreign scientists at a conference held at George Washington University in January 1939[8]. In August 1939, Albert Einstein, at the urging of Leo Szilard, an American-Hungarian physicist, wrote a letter to President Franklin D. Roosevelt, titled the Einstein-Szilard letter. The letter said, "Now it appears almost certain that this (nuclear chain reaction) could be achieved in the immediate future. This phenomenon would also lead to the

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[4] "World War II." *HISTORY*, A&E Television Networks, 29 Oct. 2009, www.history.com/topics/world-war-ii/world-war-ii-history. Accessed 12 Jan. 2019.

[5] *"Fission."* Merriam-Webster.com, Merriam-Webster, www.merriam-webster.com/dictionary/fission. Accessed 7 Dec. 2018.

[6] Kilbourn, Jonathan. *"The Atomic Bomb."* Yank, the Army Weekly, 7 Sept. 1945, www.oldmagazinearticles.com/article-summary/

[7] *"German Atomic Bomb Project."* Atomicheritage.org, Atomic Heritage Foundation, 18 Oct. 2016, www.atomicheritage.org/history/german-atomic-bomb-project. Accessed 6 Dec. 2018.

[8] Teller, Edward. "Edward Teller: Memoirs." Atomicheritage.org, Atomic Heritage Foundation, www.atomicheritage.org/key-documents/edward-teller-memoirs. Accessed 16 Oct. 2001.

construction of bombs, and it is conceivable—though much less certain—that extremely powerful bombs of a new type may thus be constructed[9] .” Einstein believed the Germans were actively supporting research in this area and urged the United States government to do the same. It was Vannevar Bush, an American engineer and science administrator, who initiated the Manhattan Project. On October 9, 1941, Bush met with President Roosevelt and briefed him on the potential nuclear project. “Bush received the President’s permission to explore construction needs with the Army. Roosevelt instructed him to move as quickly as possible but not to go beyond research and development.[10]” Bush’s meeting with the President played a key role in initiating the Manhattan Project.

The production stage of the nuclear bomb was started following Roosevelt’s approval on Jan 19, 1942, a little over a month after the Japanese Attack on Pearl Harbor on December 7, 1941, which brought the United States into World War II[11]. The Office of Scientific Research and Development (OSRD)[12], which was headed by Bush and carried out almost all major wartime military R&D, formed the Manhattan Engineer District (Manhattan Project) on August 13, 1942 and appointed U.S. Army Colonel Leslie R. Groves to lead the project[13]. On December 28, 1942, the establishment of a government investment in excess of $2 billion for the Manhattan

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[9] Einstein, Albert. *"Einstein-Szilard Letter."* Received by Franklin Delano Roosevelt, 2 Aug. 1939. Atomic Heritage Foundation, www.atomicheritage.org/key-documents/einstein-szilard-letter. Accessed 30 Nov. 2018. Letter.

[10] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 11

[11] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 19

[12] "Manhattan Project." HISTORY, A&E Television Networks, 26 July 2017, www.history.com/topics/world-war-ii/the-manhattan-project. Accessed 3 Oct. 2018.

[13] "Manhattan Project." HISTORY, A&E Television Networks, 26 July 2017, www.history.com/topics/world-war-ii/the-manhattan-project. Accessed 3 Oct. 2018.

Project was approved by the President, committing the United States to the pursuing of atomic weapons[14].

The Making of the World's First Atomic Bombs

Facilities were soon set up in remote locations in New Mexico, Tennessee, and Washington for research, production, and atomic tests to be conducted[15]. The special laboratory in Los Alamos, New Mexico was led by Dr. J. Robert Oppenheimer, an American theoretical physicist and professor of physics. It was at the Los Alamos National Laboratory that the atomic bombs were designed and finally put together. "By 1942, J. Robert Oppenheimer was one of the world's leading theoretical physicists at the University of California at Berkeley and had been appointed scientific director of the top-secret weapons project[16]." Oppenheimer visited university after university and invited nuclear scientists to move to a then undecided location, which was later established as Los Alamos[17]. "There was a center at Stanford, there was a center in Minnesota, there was a center in Princeton, there was a center in Cornell, and a few others[18]," said Oppenheimer during a 1965 interview, describing his experience in consolidating the nuclear research efforts throughout the country at the time.

Hundreds and thousands of scientists and technicians had worked at different locations of the Manhattan Project during 1941-1945 in a race to produce the first atomic bombs, "Little

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[14] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 12

[15] "Manhattan Project." HISTORY, A&E Television Networks, 26 July 2017, www.history.com/topics/world-war-ii/the-manhattan-project. Accessed 3 Oct. 2018.

[16] "Los Alamos, NM." *Atomicheritage.org*, Atomic Heritage Foundation, www.atomicheritage.org/location/los-alamos-nm. Accessed 13 Jan. 2019.

[17] Oppenheimer, Robert. Interview. By Stephane Groueff. 1965.

[18] Oppenheimer, Robert. Interview. By Stephane Groueff. 1965.

Boy" and "Fat Man." Each individual focused on tackling a specific part of the nuclear weapon. Dr. Dieter Gruen, a German-born American chemist, helped to extract uranium-235 to make Little Boy. "My role was in the chemical research division at Oak Ridge and my job was to help to solve various chemical problems encountered in making the physical separations because it required a particular kind of compound to be sensitized in very large quantities, which had never been done before… I helped to devise processes that could be used on a very large scale in order to make sure that compound could be used in the mass spectrometers[19]," Dr. Gruen, 96, a Chicago resident, described his part in the Manhattan Project in a recent telephone interview.

Dr. Benjamin Bederson, an American physicist, first worked in Oak Ridge, and then in Los Alamos, where he worked on the ignition switches of the implosion bomb of Fat Man. "The bomb consisted of a whole assembly of switches that were meant to explode simultaneously and compress the plutonium into a lower volume and cause a complete chain reaction of the atomic bomb. So, I worked on the critical reaction for the bomb[20]," said Dr. Bederson, 97, a New York native, in a recent telephone interview with the author.

Dr. Oppenheimer, the brain behind the project, was crucial in effectively managing the complicated scientific and technical process, which was based on the collaboration among the huge number of scientists and technicians. Then it was the cooperation between General Groves, the military leader, and Dr. Oppenheimer, that eventually led to the success of the Manhattan Project, a tremendous undertaking which involved government, national security, military, construction of huge plants, on top of countless scientific and technical issues, all in a timed race against the enemies.

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[19] Gruen, Dieter. Telephone interview. 1 Oct. 2018.
[20] Bederson, Benjamin. Telephone interview. 7 Oct. 2018.

At 5:30 a.m. on Monday, July 16, 1945, the test of the plutonium weapon, named the Trinity Test, was successfully conducted on the Alamogordo Bombing Range, just 210 miles south of Los Alamos[21]. Oppenheimer later recalled that, while witnessing the explosion, he thought of a verse from the *Bhagavad Gita*, 'Now I am become Death, the destroyer of worlds.' He witnessed the power of the bomb which he had helped to unleash. That power was about to bring about the biggest triumph in the history of warfare by destroying the enemy's ability to make war and causing the tragic loss of many lives on their side.

The Dropping of the Atomic Bombs

On July 26, 1945, a warning was issued to Japan by the President Truman, the President of China, and the Prime Minister of Great Britain. This warning message was named the Potsdam Declaration and it called for the Japanese to surrender unconditionally or face "prompt and utter destruction.[22]" In a mere three days, Japan rejected the offer[23]. The United States then had to carry on with its plan to drop the atomic bombs on Japan. On August 6, 1945, the untested uranium bomb, Little Boy, was dropped on Hiroshima by the Enola Gay, the bomber named after the mother of the pilot, Colonel Paul Tibbets[24]. Hiroshima was chosen because there were no known American prisoners of war in that area[25]. At the successful detonation of the bomb, which

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[21] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 91

[22] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 95

[23] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 95

[24] "Bombings of Hiroshima and Nagasaki - 1945." *Atomicheritage.org*, Atomic Heritage Foundation, www.atomicheritage.org/history/

[25] "Manhattan Project." HISTORY, A&E Television Networks, 26 July 2017, www.history.com/topics/world-war-ii/the-manhattan-project. Accessed 3 Oct. 2018.

had more power than 20,000 tons of TNT[26], nearly 80,000 people were killed instantly. The death toll soon rose to 140,000, and later, almost 200,000[27]...

Despite this, the Japanese kept on fighting. Three days later, on August 9, the United States dropped the plutonium bomb, Fat Man, on Nagasaki. An estimated 40,000 people were immediately killed and the death toll increased later on[28]. The surviving victims of the bombings experienced great pain and loss. Upon the bombing of Nagasaki, the Japanese finally informed President Truman, of their intent to surrender on August 10, 1945[29]. Japan formally surrendered on August 14, 1945. The Japanese Instrument of Surrender was signed aboard the USS Missouri on September 2, 1945, which officially ended World War II[30].

When reports of the bombing came in, many nuclear scientists soon felt the heavy weight on their conscience. While becoming a national hero as the "father" of the atomic bomb, Oppenheimer soon suffered from deep depression as he realized that there was no defense mechanism against this deadly nuclear power[31]. He felt that the bomb was used on a Japanese enemy that was already essentially defeated[32]. "Oppenheimer's triumph was his successful leadership bringing the bomb project to completion in time to be used during the war. That was

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[26] Fox, J. A. "Atomic Bomb, World's Greatest, Hits Japs." *The Evening Star* [Washington, D.C.], 6 Aug. 1945, p. 1. *Chronicling America*, chroniclingamerica.loc.gov/lccn/sn83045462/1945-08-06/ed-1/seq-1.pdf. Accessed 3 Dec. 2018.

[27] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 51, 53, 54

[28] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 51, 53, 54

[29] "Manhattan Project." HISTORY, A&E Television Networks, 26 July 2017, www.history.com/topics/world-war-ii/the-manhattan-project. Accessed 3 Oct. 2018.

[30] Gosling, F. G. *The Manhattan Project: Making of the Atomic Bomb.* United States Department of Energy, 2010, pp. 97

[31] Bird, Kai, and Martin J. Sherwin. *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer*. Vintage Books, 2005.

[32] Bird, Kai, and Martin J. Sherwin. *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer*. Vintage Books, 2005, pp. 324

also his tragedy as he came to realize that the bombings were not necessary to end the war in August, " said Martin J. Sherwin, historian and co-author of Pulitzer winning biography *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer*, in a recent email interview with this author.

However, many people including Manhattan Project veterans and survivors of the Sino-Japanese War (1937-1945), believed that millions of lives around the world had been saved by the dropping of the bombs which ended the war. "I knew it was necessary. We simply saved a lot of lives, a lot of American lives. A lot of Americans would have been killed if we hadn't. So, I didn't have any second thoughts about dropping the atomic bomb. I thought it was the right thing to do[33]," said Dr. Bederson during the recent telephone interview with the author.

Xirui Xu, 97, who lives in Jiangsu, China, clearly remembers the event. In a recent telephone interview, she said, "First, we heard two huge atomic bombs were dropped on Japan by the Americans, and soon we heard Japan surrendered. The whole town turned into a carnival, celebrating the victory… No, I don't think Japan would have surrendered without the two atomic bombs. They had made life a hell for the Chinese for seven years, occupied our house and made us 'slaves without a home.'" A large Chinese population was wiped out by the Japanese invaders during the war. During the notorious Nanking Massacre alone, an estimated 200,000-300,000 people were killed[34].

The dropping of the bombs was necessary and inevitable under the circumstances. In spite of the tragedies, the nuclear weapon was the only way for the United States to "completely

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[33] Bederson, Benjamin. Telephone interview. 7 Oct. 2018.

[34] History.com Editors. "Nanking Massacre." *HISTORY*, A&E Television Networks, 9 Nov. 2009, www.history.com/topics/japan/nanjing-massacre. Accessed 16 Jan. 2019.

destroy Japan's power to make war[35]" and stop the war before more human lives could have been taken.

The Atomic Age

The beginning of the Atomic Age saw the conscientious involvement of the nuclear scientists in the effort to contain and abolish atomic weapons. Three days after America's victory, Oppenheimer was telling the U.S. President and Secretary Stimson that the U.S. had "no defense against the nuclear weapons" and implied that the bomb should be "made illegal[36]." Dr. Gruen and his colleagues were at the center of this movement. During the recent telephone interview with the author, he described, "There were several of us young scientists who got together at Oak Ridge and we sent a letter that we composed shortly after the bombs had been dropped. We sent a letter to about 150 prominent people, prominent in various fields of science, diplomacy, authors, artists and politicians, asking for their opinion. What the letter said is that now that we had atomic bombs in this world, we have to make sure that they are never to be used again[37]." "We must realize that the nuclear weapons we have today are a 1,000 times more powerful than the Hiroshima bomb… If there were to be a nuclear war today, it is very likely that we would not survive it as a human race. Our civilization would be destroyed. We must prevent a nuclear war from ever happening again because it is just too dangerous. We must rid

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[35] Fox, J. A. "Atomic Bomb, World's Greatest, Hits Japs." *The Evening Star* [Washington, D.C.], 6 Aug. 1945, p. 1. *Chronicling America*, chroniclingamerica.loc.gov/lccn/sn83045462/1945-08-06/ed-1/seq-1.pdf. Accessed 3 Dec. 2018.

[36] Bird, Kai, and Martin J. Sherwin. *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer*. Vintage Books, 2005, pp. 318-319

[37] Gruen, Dieter. Telephone interview. 1 Oct. 2018.

the world of nuclear weapons. We must do that. It is the only way that we can be sure they will not be used again[38]," said Dr. Gruen, advocating for world peace.

The use of the atomic bombs in 1945 led to other countries developing nuclear weapons, hence starting the unpredictable and dangerous Cold War era. In 1949, Russia achieved success with its first atomic bomb test, followed by the United Kingdom in 1954, France in 1960, and China in 1964[39]... According to Arjun Makhijani, President of the Institute for Energy and Environmental Research, "The world now [2003] has 2,000 metric tons of plutonium, enough to make about 400,000 nuclear bombs[40]." That is why many nuclear scientists, including the few surviving Manhattan Project veterans, believe that it is crucial to stop a nuclear war from ever happening.

In the 1980s and 90s, nuclear testing began to come to an end[41]. Since the last U.S. nuclear test in September 1992, "world-class science" is used to evaluate the condition of the U.S. nuclear weapons[42]. "For the past 20 years, the Stockpile Stewardship Program led by Los Alamos laboratory, has ensured the safety and reliability of U.S. nuclear weapons without full-scale testing[43]." The triumph of the Manhattan Project has been expanded during the Atomic

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[38] Gruen, Dieter. Telephone interview. 1 Oct. 2018.

[39] *CNBC*. 16 Mar. 2018, www.cnbc.com/2018/03/16/list-of-countries-with-nuclear-weapons.html. Accessed 14 Jan. 2019.

[40] Makhijani, Arjun. "Nuclear Targeting." *Nuclear Targeting*, May-June 2003, explore.proquest.com/document/1095774009?searchid=1537143996&accountid=66038. Accessed 5 Dec. 2018.

[41] Smith, D. Ray. "'75 Years of Creating Tomorrow' at Los Alamos National Laboratory." *Oak Ridger*, 15 Aug. 2017, www.oakridger.com/news/20170815/75-years-of-creating-tomorrow-at-los-alamos-national-laboratory. Accessed 15 Jan. 2019.

[42] Smith, D. Ray. "'75 Years of Creating Tomorrow' at Los Alamos National Laboratory." *Oak Ridger*, 15 Aug. 2017, www.oakridger.com/news/20170815/75-years-of-creating-tomorrow-at-los-alamos-national-laboratory. Accessed 15 Jan. 2019.

[43] Smith, D. Ray. "'75 Years of Creating Tomorrow' at Los Alamos National Laboratory." *Oak Ridger*, 15 Aug. 2017, www.oakridger.com/news/20170815/75-years-of-creating-tomorrow-at-los-alamos-national-laboratory. Accessed

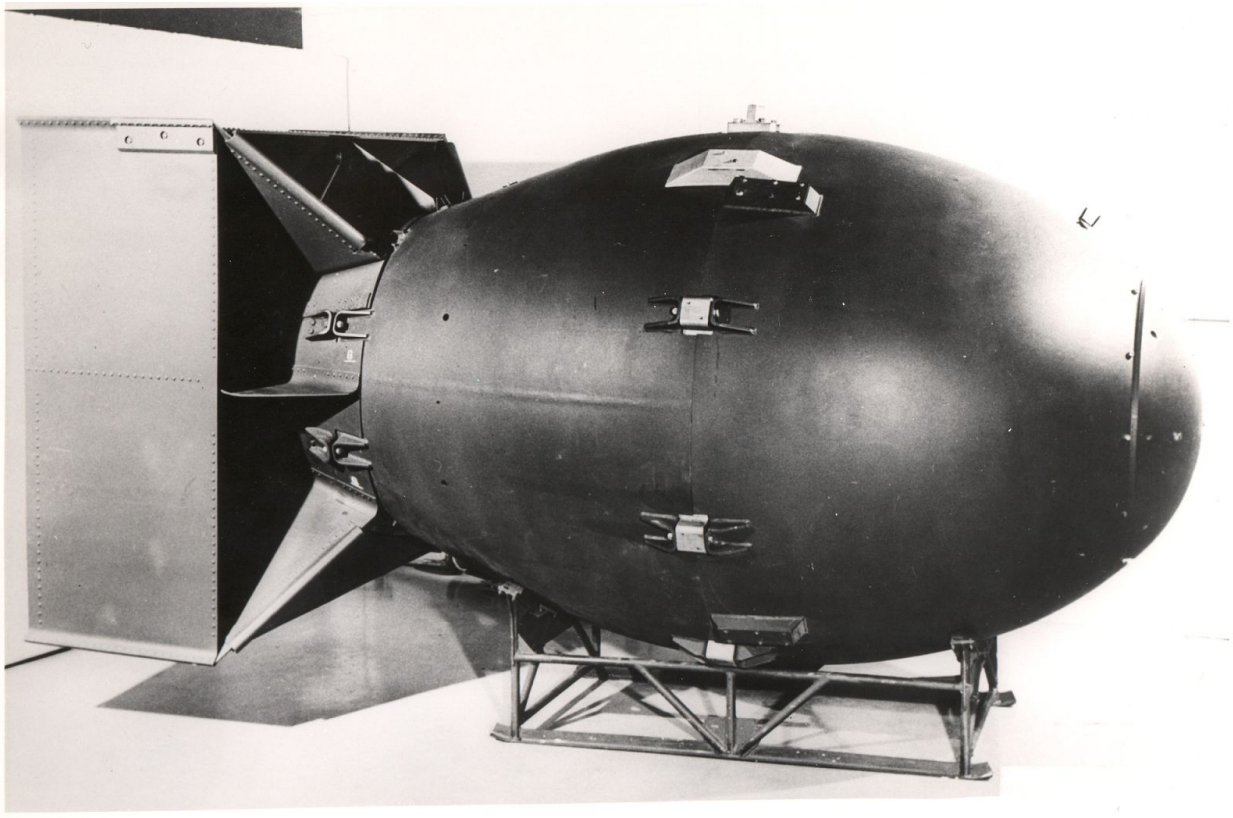
Age to contain nuclear power for the benefits of the world in areas of industrial and technological application, energy, space, and medical solutions. Since the 1980s, Los Alamos Laboratory has been pursuing areas including two of the world's most powerful lasers, studies of the human genome, alternative energy, Mars exploration, new drugs and nanotechnology[44].

Despite the inevitable tragedy under the historical circumstances, the triumph of the Manhattan Project saved the world from further torment of World War II, led the United States out of the war as one of the most powerful countries, and achieved significant scientific advances that have benefited the whole world.

Appendix A

15 Jan. 2019.

[44] Smith, D. Ray. "'75 Years of Creating Tomorrow' at Los Alamos National Laboratory." *Oak Ridger*, 15 Aug. 2017, www.oakridger.com/news/20170815/75-years-of-creating-tomorrow-at-los-alamos-national-laboratory. Accessed 15 Jan. 2019.



Fat Man. 1945. *Smithsonian Learning Lab*, learninglab.si.edu/resources/view/1952922. Accessed 11 Jan. 2019. This is an image of "Fat Man," or the plutonium bomb that was dropped on Nagasaki on August 9, 1945.

This is an image of “Fat Man,” or the plutonium bomb that was dropped on Nagasaki on August 9, 1945. This photograph was taken in 1945.

Appendix B

Little Boy Bomb. 1945. *Atomic Archive*, AJ Software & Multimedia, www.atomicarchive.com/Photos/Tinian/image3.shtml. Accessed 11 Jan. 2019.

Image of "Little Boy," or the uranium bomb, about to be loaded into the Enola Gay. Little Boy was dropped on Hiroshima on August 6, 1945.

Appendix C

Seven Manhattan Project scientists examining a radiometer. 13 Sept. 1945. *Albuquerque Journal*, 1 Dec. 2012, www.abqjournal.com/150365/manhattan-project-voices-retelling-story-of-bomb.html. Accessed 11 Jan.

Seven Manhattan Project scientists examining a radiometer on September 13, 1945 at the Trinity Site.

From left, Dr. Kenneth T. Bainbridge, of Harvard University; Dr. Joseph G. Hoffmann, of University of Buffalo; Dr. J. Robert Oppenheimer, of California; Dr. Louis H. Hempelmann, of Washington; Dr. Victor Weisskoff; Dr. Robert F. Bacher, Cornell University; and Dr. Richard W. Dooson, of California.

Appendix D

Trinity Test Mushroom Cloud. 16 July 1945. *Atomic Archive*, AJ Software & Multimedia, www.atomicarchive.com/Photos/Trinity/image16.shtml. Accessed 11 Jan. 2019.

Image of the Trinity Test mushroom cloud taken on July 16, 1945 at 5:29:45 AM.

Appendix E

Oppenheimer and Groves examine the remains of one the bases of the steel test tower. 13 Sept. 1945. www.atomicarchive.com/Photos/Trinity/image18.shtml. Accessed 11 Jan. 2019.

J. Robert Oppenheimer and Gen. Leslie Groves return to the Trinity Test site for news crews in September 1945.

Appendix F

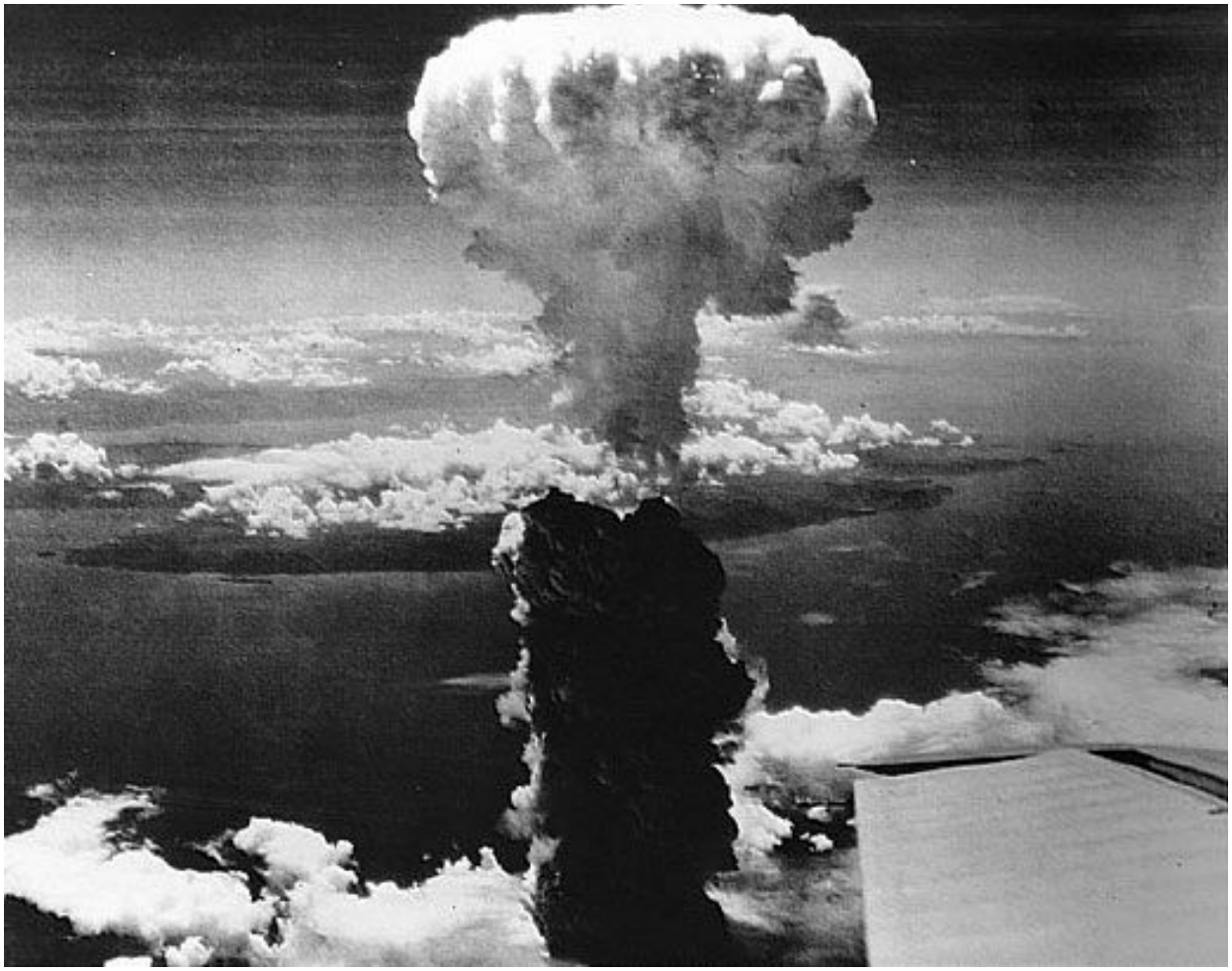
The aftermath of the explosion of the atomic bomb in Hiroshima, Japan. 1945.

Time, 25 May 2016, time.com/4346336/atomic-bombs-1945-history/.

Accessed 11 Jan. 2019.

Image of Hiroshima after the bomb was dropped. This picture shows the devastating effect of the atomic bomb and the extreme destruction it brought Japan.

Appendix G



Atomic Bomb Cloud over Nagasaki. 9 Aug. 1945. *Atomic Archive*, AJ Software & Multimedia, www.atomicarchive.com/Photos/Nagasaki/image1.shtml. Accessed 11 Jan. 2019.

Image of the mushroom cloud over Nagasaki, Japan on August 9, 1945.

Appendix H

Urakami Cathedral. 1945. *Atomic Archive*, AJ Software & Multimedia, www.atomicarchive.com/Photos/Nagasaki/image2.shtml. Accessed 11 Jan. 2019.

Image of the ruins of Urakami Cathedral, a prominent Nagasaki landmark. This image shows the effect of the atomic bomb on the city of Nagasaki.

Appendix I

Enola Gay Crew. *Atomic Archive*, AJ Software & Multimedia, www.atomicarchive.com/Photos/Tinian/image1.shtml. Accessed 11 Jan. 2019.

Image of the crew of the Enola Gay, the airplane that dropped "Little Boy" on Hiroshima, Japan on August 6, 1945.

From back row, left to right, Major Ferebee, Captain Van Kirk, Colonel Tibbets, Captain Lewis Staff Sgt. Caron, Sgt. Stiborik, Staff Sgt. Duzenbury, Pvt. 1st Class Nelson, Sgt. Shumard

Appendix J

Chicago Pile-1 Scientists. 1942. *Atomicheritage.org*, Atomic Heritage Foundation, www.atomicheritage.org/key-documents/fermi-chicago-pile-1. Accessed 16 Jan. 2019.

Image of the Chicago Pile-1 Scientists who worked on the first nuclear chain reaction. This image was taken in 1942.

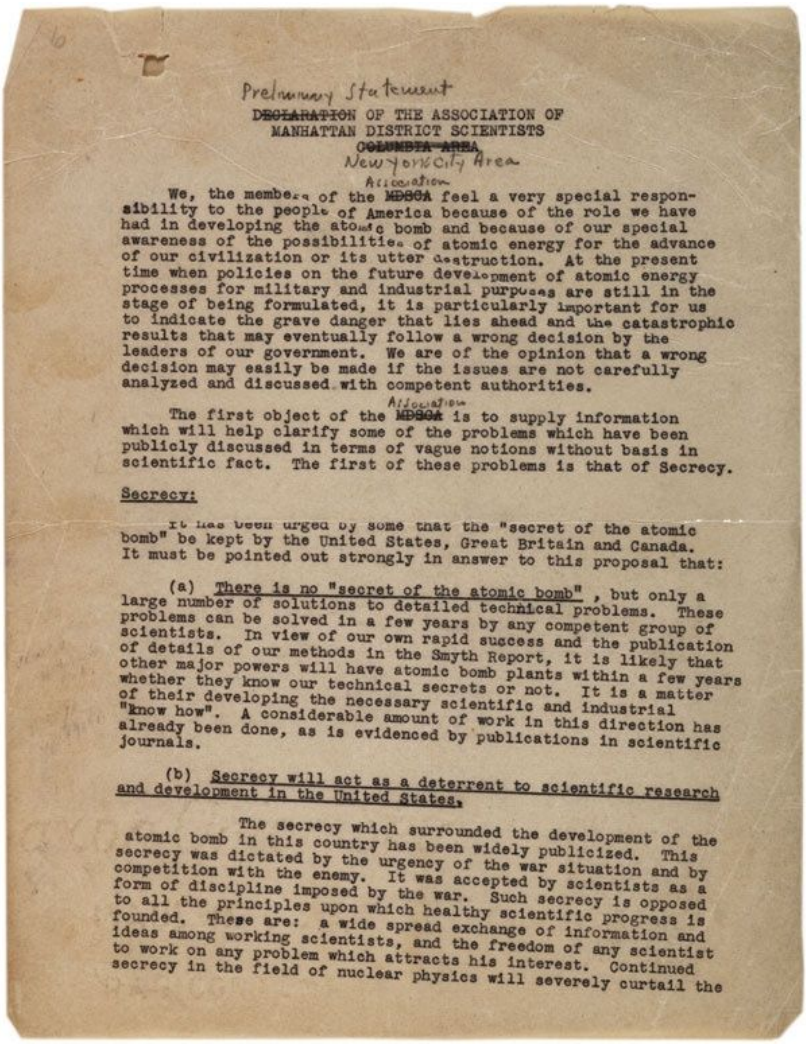
Back row, from left: Norman Hilberry, Samuel Allison, Thomas Brill, Robert Nobles, Warren Nyer, and Marvin Wilkening. Middle row: Harold Agnew, William Sturm, Harold Lichtenberger, Leona Woods and Leo Szilard. Front row: Enrico Fermi, Walter Zinn, Albert Wattenberg and Herbert L. Anderson.

Appendix K

Winston Churchill, Harry S. Truman, and Joseph Stalin at the Potsdam Conference in July 1945. July 1945. *TaraRoss.com*, 26 July 2016, www.taraross.com/2016/07/this-day-in-history-the-potsdam-declaration-and-the-end-of-world-war-ii/. Accessed 11 Jan. 2019.

British Prime Minister Winston Churchill, U.S. President Harry S. Truman, and General Secretary of the Soviet Union Joseph Stalin at the Potsdam Conference in Potsdam, Germany, in July 1945.

Appendix L



Preliminary Statement

~~DECLARATION~~ OF THE ASSOCIATION OF
MANHATTAN DISTRICT SCIENTISTS
~~COLUMBIA AREA~~
New York City Area
Association

We, the members of the ~~MDSCA~~ feel a very special responsibility to the people of America because of the role we have had in developing the atomic bomb and because of our special awareness of the possibilities of atomic energy for the advance of our civilization or its utter destruction. At the present time when policies on the future development of atomic energy processes for military and industrial purposes are still in the stage of being formulated, it is particularly important for us to indicate the grave danger that lies ahead and the catastrophic results that may eventually follow a wrong decision by the leaders of our government. We are of the opinion that a wrong decision may easily be made if the issues are not carefully analyzed and discussed with competent authorities.

Association
The first object of the ~~MDSCA~~ is to supply information which will help clarify some of the problems which have been publicly discussed in terms of vague notions without basis in scientific fact. The first of these problems is that of Secrecy.

Secrecy:

It has been urged by some that the "secret of the atomic bomb" be kept by the United States, Great Britain and Canada. It must be pointed out strongly in answer to this proposal that:

(a) There is no "secret of the atomic bomb" , but only a large number of solutions to detailed technical problems. These problems can be solved in a few years by any competent group of scientists. In view of our own rapid success and the publication of details of our methods in the Smyth Report, it is likely that other major powers will have atomic bomb plants within a few years whether they know our technical secrets or not. It is a matter of their developing the necessary scientific and industrial "know how". A considerable amount of work in this direction has already been done, as is evidenced by publications in scientific journals.

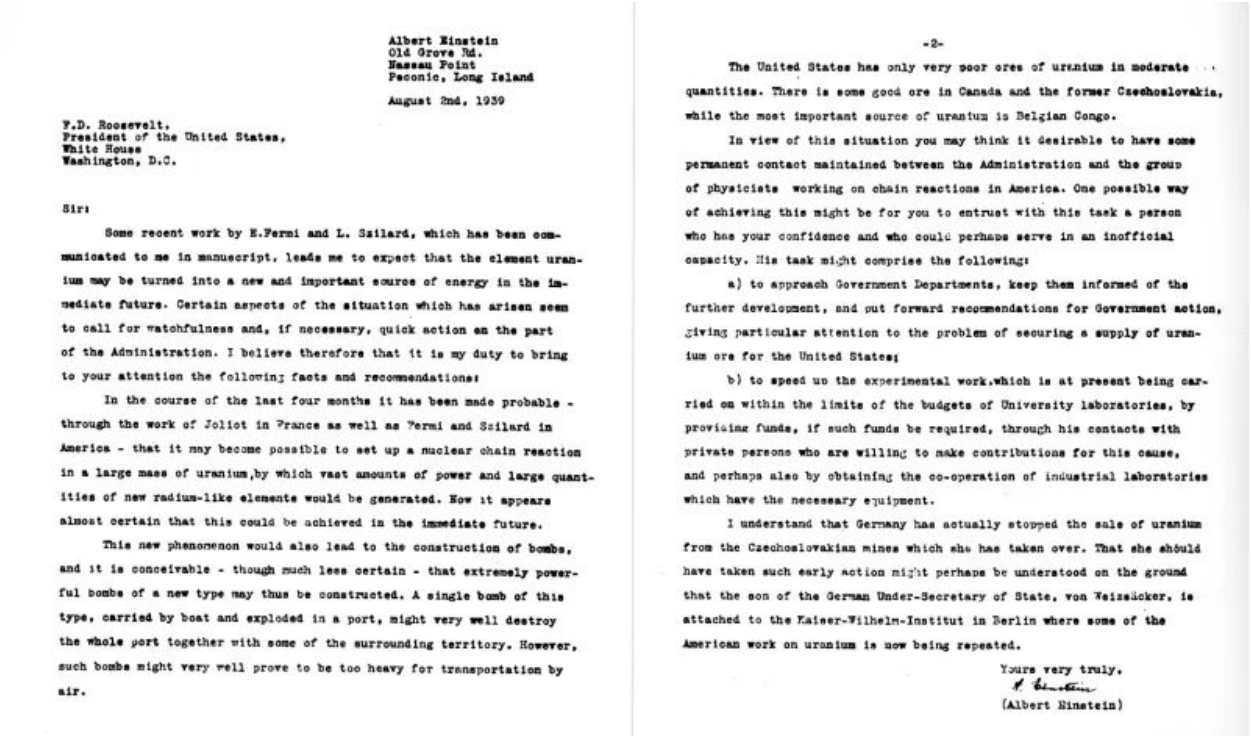
(b) Secrecy will act as a deterrent to scientific research and development in the United States.

The secrecy which surrounded the development of the atomic bomb in this country has been widely publicized. This secrecy was dictated by the urgency of the war situation and by competition with the enemy. It was accepted by scientists as a form of discipline imposed by the war. Such secrecy is opposed to all the principles upon which healthy scientific progress is founded. These are: a wide spread exchange of information and ideas among working scientists, and the freedom of any scientist to work on any problem which attracts his interest. Continued secrecy in the field of nuclear physics will severely curtail the

Bonner, Francis, and Irving Kaplan. "Preliminary Statement of the Association of Manhattan District Scientists." *Gilderlehrman.org*, Gilder Lehrman Institute of American History, www.gilderlehrman.org/content/manhattan-project. Accessed 16 Jan. 2019.

A draft of the Preliminary Statement of the Association of Manhattan Project Scientists, edited by Dr. Francis Bonner and Dr. Irving Kaplan, lead scientists who worked with Dr. Harold Urey in making the atomic bomb. The draft was released in 1945, just after the war.

Appendix M



Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd, 1939

F.D. Roosevelt,
President of the United States,
White House
Washington, D.C.

Sir:

Some recent work by E.Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:

In the course of the last four months it has been made probable - through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction in a large mass of uranium,by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

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The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source of uranium is Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an inofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States;

b) to speed up the experimental work,which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

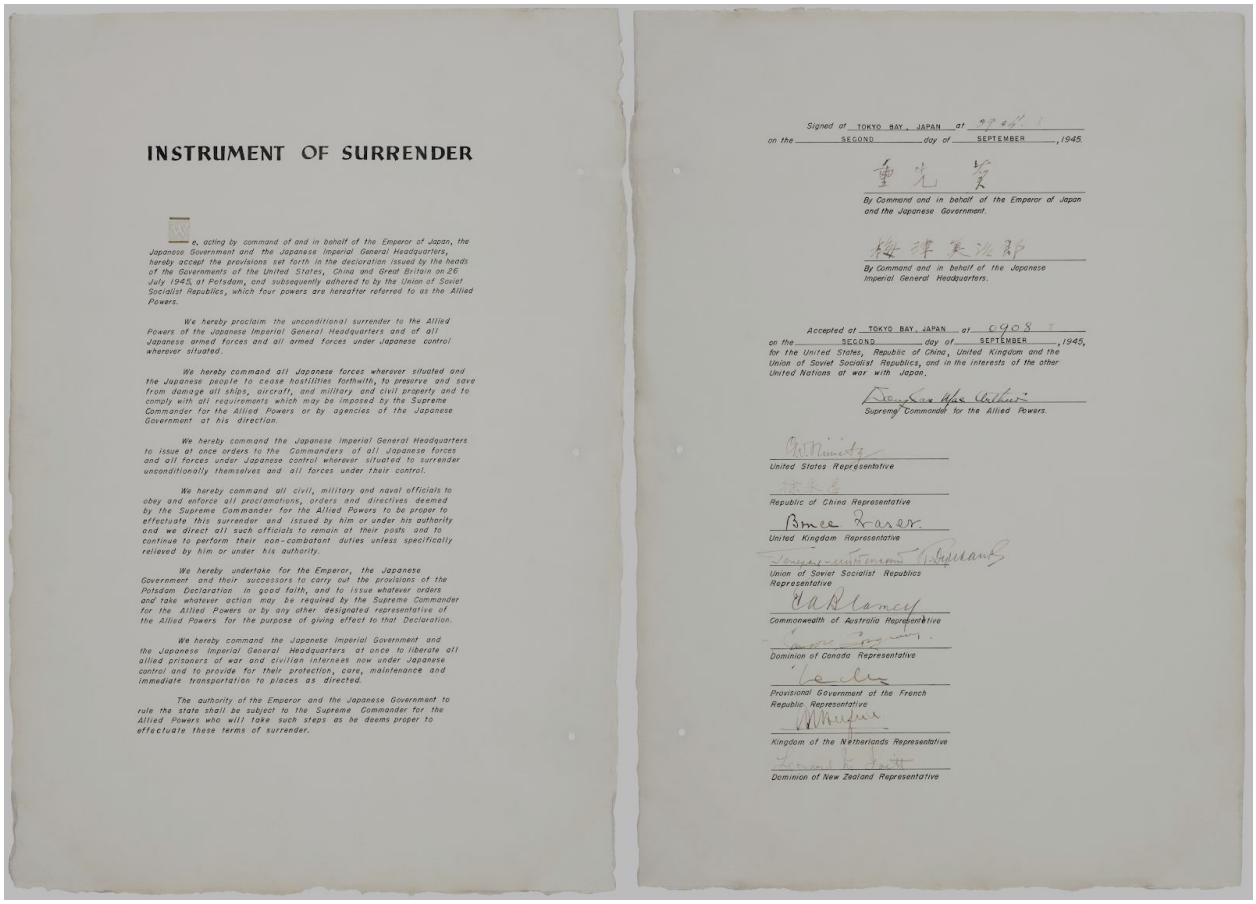
I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsäcker, is attached to the Kaiser-Wilhelm-Institut in Berlin where some of the American work on uranium is now being repeated.

Yours very truly,
A. Einstein
(Albert Einstein)

Einstein, Albert. "Einstein-Szilard Letter." Received by Franklin Delano Roosevelt, 2 Aug. 1939. *Atomic Heritage Foundation*, www.atomicheritage.org/key-documents/einstein-szilard-letter. Accessed 30 Nov. 2018.

The Einstein-Szilard Letter which was sent to President Roosevelt on August 2, 1939. This letter was important in convincing President Roosevelt to start researching into nuclear power.

Appendix N



INSTRUMENT OF SURRENDER

We, acting by command of and in behalf of the Emperor of Japan, the Japanese Government and the Japanese Imperial General Headquarters, hereby accept the provisions set forth in the declaration issued by the heads of the Governments of the United States, China and Great Britain on 26 July 1945, at Potsdam, and subsequently adhered to by the Union of Soviet Socialist Republics, which four powers are hereafter referred to as the Allied Powers.

We hereby proclaim the unconditional surrender to the Allied Powers of the Japanese Imperial General Headquarters and of all Japanese armed forces and all armed forces under Japanese control wherever situated.

We hereby command all Japanese forces wherever situated and the Japanese people to cease hostilities forthwith, to preserve and save from damage all ships, aircraft, and military and civil property and to comply with all requirements which may be imposed by the Supreme Commander for the Allied Powers or by agencies of the Japanese Government at his direction.

We hereby command the Japanese Imperial General Headquarters to issue at once orders to the Commanders of all Japanese forces and all forces under Japanese control wherever situated to surrender unconditionally themselves and all forces under their control.

We hereby command all civil, military and naval officials to obey and enforce all proclamations, orders and directives deemed by the Supreme Commander for the Allied Powers to be proper to effectuate this surrender and issued by him or under his authority and we direct all such officials to remain at their posts and to continue to perform their non-combatant duties unless specifically relieved by him or under his authority.

We hereby undertake for the Emperor, the Japanese Government and their successors to carry out the provisions of the Potsdam Declaration in good faith, and to issue whatever orders and take whatever action may be required by the Supreme Commander for the Allied Powers or by any other designated representative of the Allied Powers for the purpose of giving effect to that Declaration.

We hereby command the Japanese Imperial Government and the Japanese Imperial General Headquarters at once to liberate all allied prisoners of war and civilian internees now under Japanese control and to provide for their protection, care, maintenance and immediate transportation to places as directed.

The authority of the Emperor and the Japanese Government to rule the state shall be subject to the Supreme Commander for the Allied Powers who will take such steps as he deems proper to effectuate these terms of surrender.

Signed at TOKYO BAY, JAPAN at 0904
on the SECOND day of SEPTEMBER, 1945

By Command and in behalf of the Emperor of Japan and the Japanese Government.

By Command and in behalf of the Japanese Imperial General Headquarters.

Accepted at TOKYO BAY, JAPAN at 0908
on the SECOND day of SEPTEMBER, 1945,
for the United States, Republic of China, United Kingdom and the Union of Soviet Socialist Republics, and in the interests of the other United Nations at war with Japan.

Supreme Commander for the Allied Powers.

United States Representative

Republic of China Representative

United Kingdom Representative

Union of Soviet Socialist Republics Representative

Commonwealth of Australia Representative

Dominion of Canada Representative

Provisional Government of the French Republic Representative

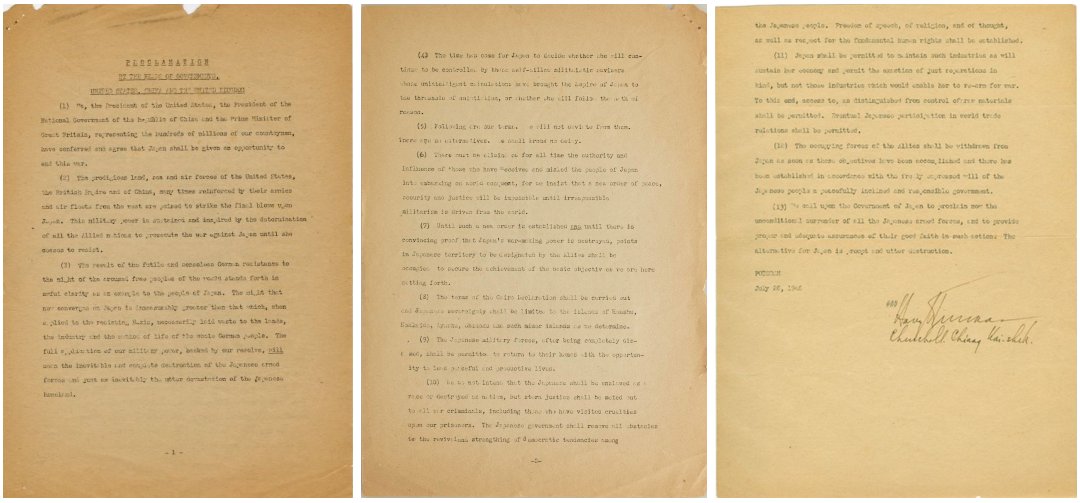
Kingdom of the Netherlands Representative

Dominion of New Zealand Representative

"Japanese Instrument of Surrender." 2 Sept. 1945. *Archivesfoundation.org*, National Archives Foundation, www.archivesfoundation.org/documents/japanese-instrument-surrender-1945/. Accessed 16 Jan. 2019.

Japan's Instrument of Surrender, signed by representatives of Japan and the Allied Forces aboard the USS Missouri on September 2, 1945.

Appendix O



PROCLAMATION
BY THE HEADS OF GOVERNMENTS
UNITED STATES, CHINA AND GREAT BRITAIN

(1) We, the President of the United States, the President of the National Government of the Republic of China and the Prime Minister of Great Britain, representing the hundreds of millions of our countrymen, have conferred and agree that Japan shall be given an opportunity to end this war.

(2) The prodigious land, sea and air forces of the United States, the British Empire and of China, many times reinforced by their armies and air forces from the west are poised to strike the final blows upon Japan. This military power is sustained and inspired by the determination of all the Allied nations to prosecute the war against Japan until she ceases to resist.

(3) The result of the futile and senseless German resistance to the might of the armed free peoples of the world stands forth in awful clarity as an example to the people of Japan. The might that now converges on Japan is immeasurably greater than that which, when applied to the resisting Nazis, necessarily laid waste to the lands, the industry and the method of life of the whole German people. The full application of our military power, backed by our resolve, will mean the inevitable and complete destruction of the Japanese armed forces and just as inevitably the utter devastation of the Japanese homeland.

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(4) The time has come for Japan to decide whether she will continue to be controlled by those self-willed militaristic advisers whose ruthless and unintelligent calculations have brought the empire of Japan to the threshold of annihilation, or whether she will follow the path of reason.

(5) Following are our terms. We will not deviate from them. There are no alternatives. We shall brook no delay.

(6) There must be eliminated for all time the authority and influence of those who have deceived and misled the people of Japan into embarking on world conquest, for we insist that a new order of peace, security and justice will be impossible until irresponsible militarism is driven from the world.

(7) Until such a new order is established and until there is convincing proof that Japan's warmaking power is destroyed, points in Japanese territory to be designated by the Allies shall be occupied to secure the achievement of the basic objectives we are here setting forth.

(8) The terms of the Cairo Declaration shall be carried out and Japanese sovereignty shall be limited to the islands of Honshu, Hokkaido, Kyushu, Shikoku and such minor islands as we determine.

(9) The Japanese military forces, after being completely disarmed, shall be permitted to return to their homes with the opportunity to lead peaceful and productive lives.

(10) We do not intend that the Japanese shall be enslaved as a race or destroyed as a nation, but stern justice shall be meted out to all war criminals, including those who have visited cruelties upon our prisoners. The Japanese government shall remove all obstacles to the revival and strengthening of democratic tendencies among

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the Japanese people. Freedom of speech, of religion, and of thought, as well as respect for the fundamental human rights shall be established.

(11) Japan shall be permitted to maintain such industries as will sustain her economy and permit the exaction of just reparations in kind, but not those industries which would enable her to rearm for war. To this end, access to, as distinguished from control of, raw materials shall be permitted. Eventual Japanese participation in world trade relations shall be permitted.

(12) The occupying forces of the Allies shall be withdrawn from Japan as soon as these objectives have been accomplished and there has been established in accordance with the freely expressed will of the Japanese people a peacefully inclined and responsible government.

(13) We call upon the Government of Japan to proclaim now the unconditional surrender of all the Japanese armed forces, and to provide proper and adequate assurances of their good faith in such action. The alternative for Japan is prompt and utter destruction.

FOURTH
July 26, 1945

Harry Truman
Churchill Chiang Kai-shek

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