



NE290D: Special Topics in Nuclear History, Politics, and Futures

Ending the War

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Introduction

Agenda

- ▶ 1945 Building the Bomb
- ▶ 1945 Ending the War

W7L13 Learning Outcomes

- ▶ Recall the major historical milestones in the investigation of nuclear weapons and describe the experiments that led to them.
- ▶ Organize the events on a timeline.
- ▶ Draw connections between the developments in 20th century physics and latter Manhattan project.



1945: Building The Bomb

Miro

Boards NE290D CUBES Demo

Timeline showing major milestones in nuclear science and technology from 1905 to 2000.

Key milestones include:

- 1905: Rutherford performs his plum pudding experiment.
- 1915: General relativity and the Einstein-Hilbert field equations published.
- 1920: Niels Bohr receives the Nobel Prize in Physics.
- 1925: Max Born receives the Nobel Prize in Physics.
- 1930: Werner Heisenberg receives the Nobel Prize in Physics.
- 1931: Niels Bohr receives the Nobel Prize in Physics.
- 1932: James Chadwick discovers the neutron.
- 1933: Albert Einstein receives the Nobel Prize in Physics.
- 1934: Otto Hahn and Fritz Strassmann discover nuclear fission.
- 1935: Enrico Fermi receives the Nobel Prize in Physics.
- 1938: Hans Bethe receives the Nobel Prize in Physics.
- 1939: Fermi receives the Nobel Prize in Physics.
- 1940: Leo Szilard and Edward Teller propose the atomic bomb.
- 1941: Fermi receives the Nobel Prize in Physics.
- 1942: Robert Oppenheimer and the Manhattan Project begin construction of the first atomic bomb at Los Alamos National Lab.
- 1943: Fermi receives the Nobel Prize in Physics.
- 1945: End of World War II, Hiroshima and Nagasaki bombed.
- 1946: Paul Dirac receives the Nobel Prize in Physics.
- 1947: The United Kingdom carries out their first nuclear weapon test in Monte Bello, Australia.
- 1948: Los Alamos National Lab founded.
- 1949: First hydrogen bomb test by the US.
- 1950: October 30th 1961: The Soviet Union detonates Tsar Bomba, the largest nuclear weapon tested at 50MT.
- 1952: The United Kingdom carries out their first nuclear weapon test in Monte Bello, Australia.
- 1953: Edward Teller and Stanislaw Ulam develop the Teller-Ulam design.
- 1954: August 29th, Soviet Union carries out their first thermonuclear test, RDS-37, or Joe-1.
- 1955: First atomic power plant in Calder Hall, UK.
- 1956: The United States produces its first plutonium.
- 1957: The first atomic power plant in the world begins operation at Obninsk, Russia.
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- 1971: The United States produces its first plutonium.
- 1972: The United States produces its first plutonium.
- 1973: The United States produces its first plutonium.
- 1974: India conducts its first nuclear explosion.
- 1975: India conducts its second nuclear explosion.
- 1976: India conducts its third nuclear explosion.
- 1977: India conducts its fourth nuclear explosion.
- 1978: India conducts its fifth nuclear explosion.
- 1979: India conducts its sixth nuclear explosion.
- 1980: India conducts its seventh nuclear explosion.
- 1981: India conducts its eighth nuclear explosion.
- 1982: India conducts its ninth nuclear explosion.
- 1983: India conducts its tenth nuclear explosion.
- 1984: India conducts its eleventh nuclear explosion.
- 1985: India conducts its twelfth nuclear explosion.
- 1986: India conducts its thirteenth nuclear explosion.
- 1987: India conducts its fourteenth nuclear explosion.
- 1988: India conducts its fifteenth nuclear explosion.
- 1989: India conducts its sixteenth nuclear explosion.
- 1990: India conducts its seventeenth nuclear explosion.
- 1991: India conducts its eighteenth nuclear explosion.
- 1992: India conducts its nineteenth nuclear explosion.
- 1993: India conducts its twentieth nuclear explosion.
- 1994: India conducts its twenty-first nuclear explosion.
- 1995: India conducts its twenty-second nuclear explosion.
- 1996: India conducts its twenty-third nuclear explosion.
- 1997: India conducts its twenty-fourth nuclear explosion.
- 1998: India conducts its twenty-fifth nuclear explosion.
- 1999: India conducts its twenty-sixth nuclear explosion.
- 2000: India conducts its twenty-seventh nuclear explosion.

Tools available: Boards, NE290D, CUBES Demo, Boards, Share, Hide highlighting on changes, 3 / 19

1945: Building The Bomb

1945 Apr 12: President Roosevelt dies and Harry S. Truman become president.

- ▶ 1945 Apr 13: President Harry Truman learns of the existence of atomic bomb development from Secretary of War Henry Stimson.
- ▶ 1945 Apr 27: The first meeting of the Target Committee to select targets for atomic bombing. Seventeen targets are selected for study: Tokyo Bay (for a non-lethal demonstration), Yokohama, Nagoya, Osaka, Kobe, Hiroshima, Kokura, Fukuoka, Nagasaki, and Sasebo¹
- ▶ Some of these are soon dropped because they had already been burned down.

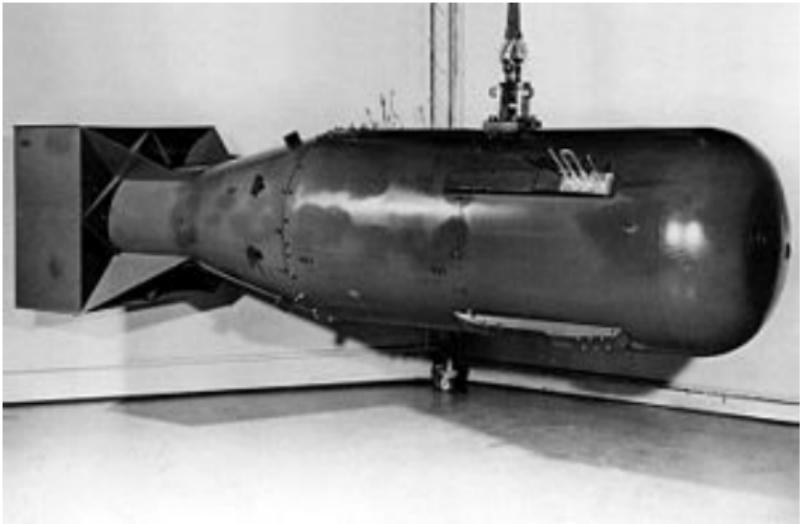


¹ <https://www.atomicheritage.org/history/timeline>

1945: Building The Bomb

1945 May: Little Boy is ready for combat use, except for the U-235 core

- ▶ It is estimated sufficient material will be available by 1 August.



¹<https://www.atomicheritage.org/history/timeline>

1945: Building The Bomb

1945 May 7: Nazi Germany surrenders to the Allies.

- ▶ 1945 May 25 464 B-29s raid Tokyo again, burning out nearly 16 square miles of the remaining city.
- ▶ Only a few thousand are killed, urban inhabitants have learned to flee fire bomb attacks quickly and escape the flames.
- ▶ Operation OLYMPIC, the invasion of Kyushu (the southern Japanese island), is set for November 1.



¹ <https://www.atomicheritage.org/history/timeline>

1945: Ending the War

1945 June: Scientists begin circulating Franck Report

- ▶ Report urges demonstration of the bomb prior to military use.
- ▶ June 1945 The Interim Committee, organized to guide the final conduct of the war and the post-war reconstruction and led by Secretary of State Designate James Byrnes, issues the recommendations that the atomic bomb be dropped as soon as possible, that an urban area be the target, and that no prior warning be given.



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1945: Ending the War

1945 July 16: At 5:29:45 a.m., as part of The Trinity Test, Gadget is detonated in Alamogordo, NM in the first atomic explosion in history.

- ▶ The explosive yield is 20-22 Kt (initially estimated at 18.9 Kt), vaporizing the steel tower.

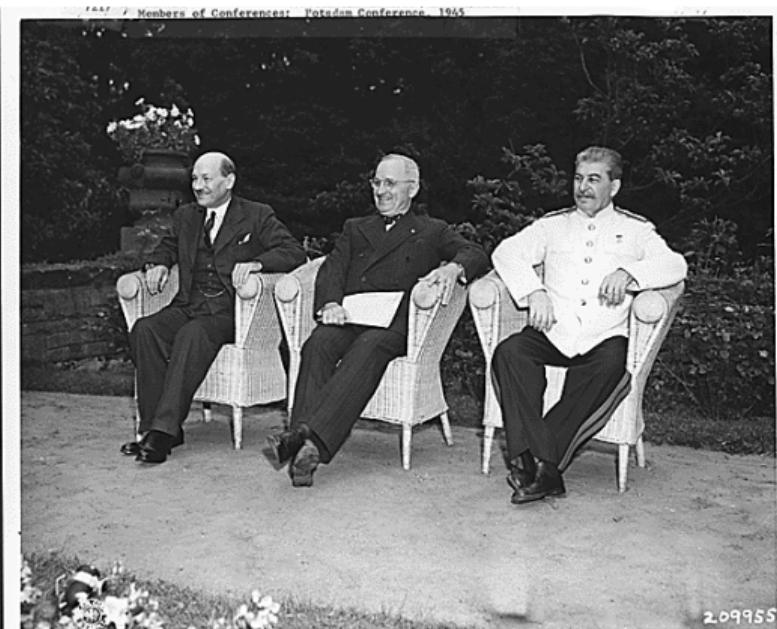


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1945: Ending the War

1945 July 24: President Truman discloses the existence of the atomic bomb to Stalin

- ▶ Meanwhile, General Leslie Groves drafts the directive authorizing the use of the atomic bombs as soon as bomb availability and weather permit.
- ▶ It lists the following targets in order of priority: Hiroshima, Kokura, Niigata, and Nagasaki.
- ▶ This directive constitutes final authorization for atomic attack, no further orders are issued.

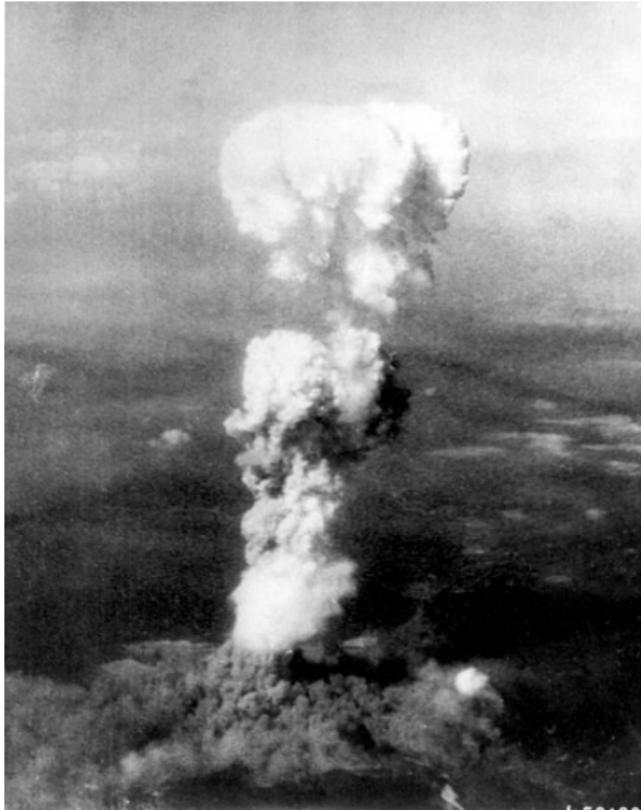


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1945: Ending the War

1945 Aug 6: First Use

- ▶ 0000: Final briefing, the target of choice is Hiroshima. Lt. Col. Paul Tibbets is pilot, Robert Lewis is co-pilot.
- ▶ 0245: Enola Gay begins takeoff roll.
- ▶ 0730: The bomb is armed.
- ▶ 0850: Flying at 31,000 ft Enola Gay crosses Shikoku due east of Hiroshima. Bombing conditions are good, the aim point is easily visible, and no opposition is encountered.
- ▶ 0915:17 Little Boy is released at 31060 feet.
- ▶ 0916:02 Little Boy explodes at an altitude of 1850 feet, 550 feet from the aim point, the Aioi Bridge, with a yield of 12.5-18 Kt (best estimate is 15 Kt).



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1945: Ending the War

1945 Aug 8: Back-channels Fail

- ▶ At Foreign Minister Togo's request, Soviet Ambassador Sato tries to persuade the Soviets to mediate surrender negotiations.
- ▶ Soviet Foreign Minister Vyacheslav Molotov cancels the meeting, then announces that the Soviet Union is at war with Japan effective the next day.
- ▶ Meanwhile, leaflet dropping, and warnings to Japan by Radio Saipan begin (Nagasaki does not receive warning leaflets until August 10).
- ▶ At, 2200, Fat Man is loaded on B-29 "Bock's Car".

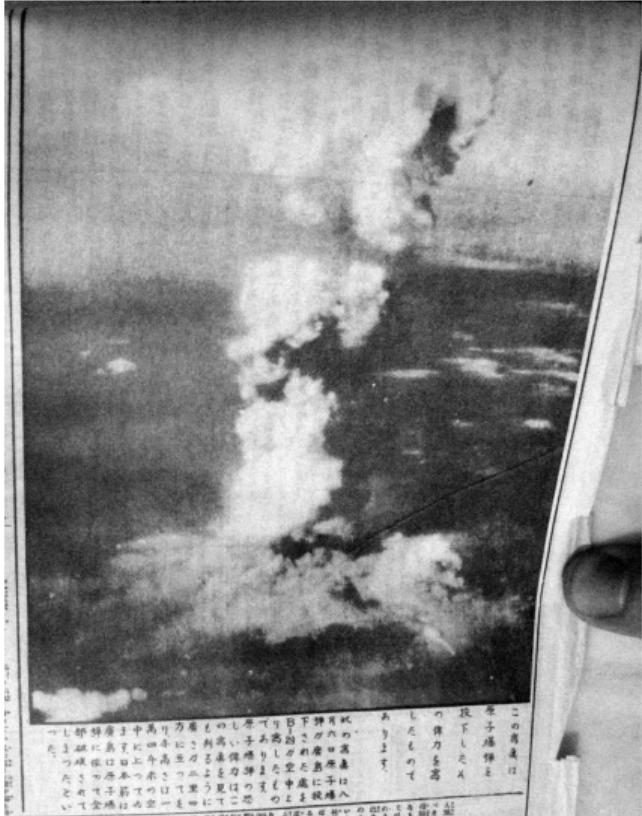


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1945: Ending the War

1945 Aug 9: Second Use

- ▶ Nagasaki is covered with clouds, but one gap allows a drop several miles from the intended aim point.
- ▶ Fat Man explodes at 1950 feet near the perimeter of the city, scoring a direct hit on the Mitsubishi Steel and Arms Works.
- ▶ Yield is 19-23 Kt (best estimate is 21 Kt).



この爆風は原爆投下後、瞬時に高さに匹敵する火球となり、その火球は直上に高さ約2キロメートルまで昇り、その後、火球は徐々に縮小して、最終的には直径約1キロメートルの火球となりました。この火球は、爆風とともに、周囲を包んでいた雲とともに、空を覆うように広がりました。

¹ <https://www.atomicheritage.org/history/timeline>

1945: Ending the War

August 10, 1945: Japanese civilian and military leaders are still unable to agree on accepting the Potsdam Declaration's surrender terms.

- ▶ Emperor Hirohito instead breaks the tradition of imperial non-intervention in government and orders that surrender be accepted, provided that the Emperor be allowed to retain his position.
- ▶ President Truman orders a halt to further atomic bombing until further orders are issued.



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1945: Ending the War

1945 Aug 14: Following leaflet bombing of Tokyo with surrender terms, Hirohito orders that an Imperial Edict accepting surrender be issued.

- ▶ At 2:49 p.m. (1:49 a.m. Washington time), Japanese news agency announces surrender.



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1945: Ending the War

1945 Aug 17: Oppenheimer warns Secretary of War Henry Stimson

- ▶ Atomic weapons would improve qualitatively and quantitatively over coming years.
- ▶ Adequate defenses against nuclear weapons would not be developed.
- ▶ The US would not retain hegemony over nuclear weapons.
- ▶ Wars could not be prevented even if better nuclear weapons were developed.



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1945: Ending the War

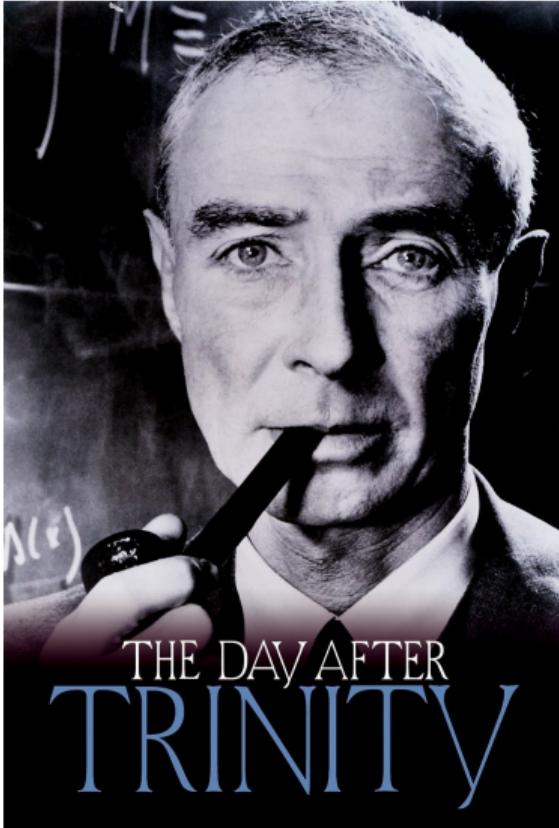
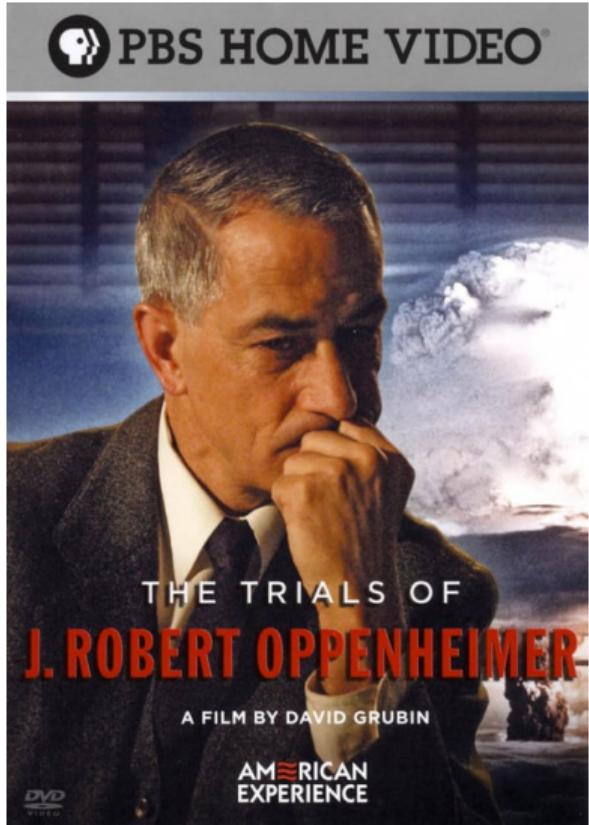
1945 Oct 16: Oppenheimer resigns as director of Los Alamos Laboratory, accepting a post at CalTech.

- ▶ 1945 Oct 17: Norris Bradbury takes over as director of Los Alamos Laboratory (a position he would hold for 25 years).



¹ <https://www.atomicheritage.org/history/timeline>

Discussion



Final Project Discussion

Option 1

Historical answers to modern problems.

With your newfound understanding of nuclear history and its impact across the 20th century, consider a problem facing the nuclear community that transcends a scientist, technical, economic, security-driven, etc., propose a solution to the present, for the future, based on the past. Write up your solution as a paper for one of the journals discussed.

Questions

1. Which modern-day problem facing the nuclear community will you choose?
2. How does this problem affect a single community (science, technical, economic, national security)
3. What is the historical analogue of said problem?
4. How was it solved in the past?
5. How can you model a present-day solution based on the historical analogue?



Final Project Discussion

Option 2

Tell me a nuclear bedtime story.

Given our discussions of the weaving of history, science, literature, and its impact on society, consider either adapting a work of literature to fit the scope of an important historical event in nuclear physics, nuclear engineering, or national defense such that a reader would be compelled to consider the weight or your theme.

Questions

1. What element of history will you select as the basis for your fiction?
2. What literary masterpiece will you select as the backbone for your adaptation?
3. What will be the themes?
4. What message do you wish to convey?
5. Who is your audience?

¹For more on storycraft, visit <https://screencraft.org/2019/06/25/the-ultimate-list-of-story-development-questions/>