

MC390: The Atomic Age and Beyond: The Interplay Between Nuclear Weapons and Nuclear Energy

Instructors: Robert Brathwaite; Sharlissa Moore

Class location: 339 Case Hall

Class meeting time: Tuesday/Thursday 3:00-4:20pm

Instructor office hours: Brathwaite-- Tuesday/Thursday 5-6:30pm;

Moore-- Tuesday 4:30–6:00 pm / Thursday 1:45–2:45 pm

Instructor email addresses: brathwa1@msu.edu ; moores60@msu.edu

Course Description:

Nuclear security has recently been highlighted in the media and the minds of policy-makers due to developments associated with North Korea's nuclear program. In spite of this, nuclear security rarely receives the attention of policy-makers, the general public, and young people that is warranted by the scope and magnitude of the threat. Recently, much attention has been afforded to existential threats related to climate change, but less to existential threats related to nuclear security. In addition, there is an increasing disconnect between people's understanding of technical and scientific issues associated with nuclear security, which has implications for political decision-making and public support aimed at mitigating known and emerging threats associated with nuclear weapons. Given this, the purpose of this course is both to generate greater awareness of the dynamics associated with nuclear security and to improve the level of understanding of the scientific and technological processes that pertain to the use of nuclear weapons and nuclear energy. In short, the course is focused on highlighting the connections and inherent tension between the development and deployment of nuclear weapons for national security purposes and the underlying scientific and technological developments that make that possible.

Activities

- We expect you to attend the extracurricular activities for this class, unless you provide a legitimate excuse at the beginning of the semester in writing.
 - Visit to the Cook nuclear power plant visitor center, date to be determined
 - January 31 at 6:30pm: Hidden Figures movie screening
 - April 4 at 6:30pm: Nuclear weapons movie screening

Guest speaker policies:

- *treat each speaker with respect, irrespective of their opinions.* Sometimes it seems like a speaker calling in on Skype cannot hear us, so just remember that talking/whispering during the talk is still distracting to everyone who is listening

and is sometimes still visible to the speaker. Even when you disagree with the speaker, remember to be respectful of him or her. This is excellent practice for engaging productively with people with whom we disagree.

- *take notes as the speaker is talking* so that you can remember and analyze what they said when you're writing your memos and final paper
- *engage with the speaker after the talk by asking questions*. We'll treat the Q&A as a qualitative interview. Spend some time thinking through how to phrase your question, as some questions might be sensitive or political. Do not be afraid to ask what is on your mind, but do keep in mind that we want to maintain a positive relationship with these speakers as they may return to speak to future classes.
- *engage in discussion and debrief* with the class/professor after the speaker leaves

Assignments and grading:

Class attendance & participation	20%	--
Midterm exam	20%	February 28
Two analytical essays	20% (10% each)	Friday February 8 11:59pm Friday April 5 11:59pm
Nuclear launch simulation	10%	Thursday at 3pm, February 26 on D2L
Cumulative final exam	30%	May 2 5:45 to 7:45pm

Essay on nuclear weapons, February 8:

This essay is focused on the role that nuclear weapons played in allowing the Cold War to develop. Specifically, take a position on whether the early nuclear policies of the United States after WWII were a contributing factor to allowing the Cold War to develop. In addition, discuss developments associated with civilian nuclear energy research after

WWII and how it influences the position you have taken. Also, discuss the implications of your argument in regards to whether the nuclear arms race was inevitable. Be sure to include a clear thesis statement early in the essay that indicates the positions you have taken. Formatting requirements: 1,500 words, double-spaced, Times New Roman font, 1-inch margins, include a title and your name. References should be in APA, Chicago, or MLA and citations should include author last names and the publication date.

Essay on nuclear energy policy, April 5:

Discuss the role that the federal government and the military have played in the development of the commercial nuclear energy sector over time. What have been the benefits, drawbacks, and neutral aspects of this relationship? What specific actors have played key roles in this process (e.g., individuals, institutions, senators etc.)? Be sure to include a clear thesis statement early in the essay that begins with “I argue that...” Formatting requirements: 1,500 words, double-spaced, Times New Roman font, 1-inch margins, include a title and your name. References should be in APA, Chicago, or MLA and citations should include author last names and the publication date (“Harvard style” is ideal).

Note

- Grading for this class will be done collaboratively.
- Prof. Moore out of town for a research trip to Washington, DC Feb 7, Prof. Brathwaite teaching
- Prof. Brathwaite out of town for a conference March 28, Prof. Moore teaching

Final exam

Thursday May 2 from 5:45–7:45pm

Class Attendance and Discussion

Attendance is required for this class, including showing up on time. If you miss more than 20% of the class, it will result in a failing grade in the class.

Where possible, you should notify me *before* class begins that you cannot attend and would like to be excused. Please send me an email with the reason you cannot attend class that day. Categories of excused absences include family emergencies, religious holidays, illnesses, job interviews that absolutely must conflict with class, and absences for participation in official university sports or clubs. Excuses for other categories of absences will be based on the instructor’s discretion. You are responsible for finding out what you missed in class, either by talking with me or a classmate.

Class participation refers to taking part in class activities, asking questions, not zoning out on your computer or phone, and making comments that demonstrate that you did the reading.

CLASS POLICIES:

Late Work and Extensions

Late work will not be accepted. When exceptional circumstances prevent you from completing an assignment on time, you may request an extension, and it will be granted where possible and appropriate. Unless exceptional circumstances permit, the extension should be requested ahead of time (i.e., not at the hour the assignment is due.) An extension is not a rolling deadline; we will reach a mutual agreement about a new due date that is achievable to you given the circumstances.

Academic Integrity, Plagiarism, and Cooperative Work

You should consider the ethical aspects of any action you take in the course; if you are in doubt of any decisions related to academic integrity, please just ask me first. We can meet the standard “do no evil” but should always work toward the more challenging goal of “do the right thing.” Plagiarism will not be tolerated on any assignment, including drafts, and may result in a failing grade, or a zero, on the assignment and/or the course. Note that verbatim text that is cited but does not have quotation marks around it is plagiarized text. You may not use course work you completed for another course to satisfy the requirements of this course. We will use Turnitin to check all papers for plagiarism. All assignments in D2L allow for multiple submissions; therefore you may submit your paper and view the Turnitin report and resubmit a new version. D2L will only retain the final version. Therefore, you are empowered to police your own plagiarism.

Collaboration on all assignments is allowed and encouraged. For example, you may—and should—discuss your ideas with your classmates, and you may exchange papers for feedback and/or proofreading. However, each assignment must be written by you and written in your own words; the text may not overlap with your classmates’ text.

MSU has a new Spartan Code of Honor, which states: “As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do.” See honorcode.msu.edu. Please also review the MSU Academic Honesty and Integrity

policies, especially the section on plagiarism:

<https://www.msu.edu/unit/ombud/academic-integrity/index.html>

Students with Disabilities

Michigan State University is committed to providing equal opportunity for participation in all programs, services, and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a verified individual services accommodation (“VISA”) form. Please present this form to me at the start of the term. Requests received after this date will be honored whenever possible.

This course requires active participation in class discussions, both in person and online. If this is a challenge for you, please discuss it with me at the beginning of the term.

Classroom Conduct

Everyone's experience and opinions will be valued in this class. Not everyone must agree, even with the instructor, however, differing points of view must be communicated respectfully. Students whose behavior is disruptive either to the instructor or to other students will be asked to leave the class.

JMC statement of values: “As Madisonians, we affirm the necessity of compassion, conscientiousness, and curiosity in our community. We acknowledge our academic and moral responsibility to always seek to learn from one another, approaching our scholarly endeavors with respect and humility. We understand that this process can be uncomfortable, and that it often requires challenging closely held beliefs. Nevertheless, we strive to always participate in discussions in good faith, and to build a community conducive to the intellectual growth of all.”

Diversity

This course is intended for students with a variety of backgrounds and interests. Diversity related, but not limited to, race, ethnicity, cultural background, gender, sexual orientation, perspective, and experience among students is one of the most enriching aspects of any educational environment and should be acknowledged in classroom discussions through respectful behavior toward one another.

Handling Emergency Situations

In the event of an emergency arising within the classroom, I will notify you of what actions that may be required to ensure your safety. It is the responsibility of each student to understand the evacuation, “shelter-in-place,” and “secure-in-place” guidelines posted in each facility and to act in a safe manner. You are allowed to

maintain cellular devices in a silent mode during this course, in order to receive emergency SMS text, phone or email messages distributed by the university. When anyone receives such a notification or observes an emergency situation, they should immediately bring it to my attention in a way that causes the least disruption. If an evacuation is ordered, please ensure that you do it in a safe manner and facilitate those around you that may not otherwise be able to safely leave. When these orders are given, you do have the right as a member of this community to follow that order. Also, if a shelter-in-place or secure-in-place is ordered, please seek areas of refuge that are safe depending on the emergency encountered and provide assistance if it is advisable to do so.

Have fun, love learning, develop your own definition of success, fail forward, and don't be afraid to ask for help when you need it

1930s

1. January 8

Core Concepts and Strategies Associated with Nuclear Weapons (associated with 1930s)

Discussion of core concepts associated with the production and use of nuclear weapons. Information to be covered includes; types of weapons of mass destruction (WMDs). Different types of nuclear weapons (strategic vs. tactical), and concepts associated with the use of nuclear weapons and nuclear deterrence (1st strike, 2nd strike, MAD, etc.)

Optional Reading:

- Documentary film "The Bomb," directed by Rushmore Denooyer and Kirk Wolfinger and produced by PBS in 2015. It's an hour and 54 minutes. It is available for free on Amazon Prime or \$4.99 to rent from Amazon or iTunes
- Deadly Arsenals: Nuclear, Biological, and Chemical Threats Second Edition by Joseph Cirincione, Jon B. Wolfsthal, Miriam Rajkumar – Chapter 3 (pg. 45 – 56)

2. January 10

Nuclear physics revolution in the early 1930s

We will discuss the groundbreaking developments in nuclear physics from 1895 to 1940 that enabled the development of atomic weapons. During this time period, x-rays and alpha, beta, and gamma radiation were discovered along with the concept of a half life, isotopes were discovered, the model of the atom evolved from primitive versions to deep understandings from the scientists Bohr and Heisenberg, electrons and neutrons and binding energy were discovered, Einstein developed the theory of relativity, and nuclear fission was discovered. Only about 50 years passed between the initial discovery of radiation and the development of nuclear weapons. Scientists Leo Szilard

and Albert Einstein recognized that these scientific achievements made the development of a weapon of mass destruction-- far more damaging than the use of chemical warfare during World War I-- possible, and quickly warned policy-makers.

Reading:

- Rhodes, R. (1987). Chapter 10: Neutrons In *The Making of the Atomic Bomb*. New York, NY: Simon & Schuster Paperbacks
- *Please watch the short video at the end as well:*
Spyrou, A. & Mittag, W. (2017, December 1). The science behind the first nuclear chain reaction, which ushered in the atomic age 75 years ago. *Smithsonian.Com*
<https://www.smithsonianmag.com/innovation/the-science-behind-first-nuclear-chain-reaction-180967375/>
- *Optional:* If you are looking for a more technical, in-depth look at the science, search the MSU library website for: Cameron Reed, B. (2014). *The history and science of the Manhattan Project*. Berlin: Springer

1940s

3. January 15

The Manhattan Project and nuclear physics

We will discuss the critical role that nuclear physicists and engineers played during World War II and the Pacific War via the Manhattan Project. Prominent physicists concerned about Nazism and Hitler's efforts to acquire nuclear weapons signed up for the project, led by brilliant theoretical physicist J. Robert Oppenheimer. Some scientists, such as Enrico Fermi, were more hesitant to participate in the development of weapons of mass destruction. The some incompensurate cultures between academic science and the military made the quest for the bomb both challenging and unique and went on to indelibly shape the scientific enterprise of the 20th and 21st centuries. Vannevar Bush, head of the Office of Scientific Research and Development (OSRD), a secretive research organized funded by Congress for civilian scientists at universities to develop new weapons and equipment, later went on to found the National Science Foundation.

Reading:

- Zachary, G. P. (1997). Chapter 9: "This Uranium Headache!" (1939–45). *Endless Frontier: Vannevar Bush, Engineer of the American Century*. New York: Free Press
- University of California Television. 2008. *The Moment in Time*. Online at <https://www.youtube.com/watch?v=xwpgmEvlRpM> (about 1 hour)

4. January 17

Weaponization of the Atom

The first plutonium bomb was ready for testing just months after Germany's unconditional surrender. While scientists were sure that the gun-type uranium bomb would work, the scientists were not certain that the plutonium implosion bomb, or 'the gadget' would work. Therefore, on July 16, 1945, the "Trinity Test" was undertaken, which demonstrated that the plutonium bomb (a prototype of Fat Man) worked.

Reading:

- Rhodes, R. (1987). Chapter 18: Trinity. In *The Making of the Atomic Bomb*. New York, NY: Simon & Schuster Paperbacks

5. January 22

Deployment of the Bomb and Beginning of the Cold War

Class discussion focuses on the early political and military policies and actors associated with the first deployment of atomic weapons at the end of WWII. In addition, we discuss how tensions associated with nuclear weapons and other issues were instrumental in laying the foundation for the origins of the Cold War.

Reading:

- Joseph Cirincione, *Bomb Scare: The History & Future of Nuclear Weapons*, New York, NY: Columbia University Press (2007); (pgs. 1 - 20).
- Carole K. Fink, *Cold War: An International History*, Boulder, CO: Westview Press (2014): 53 - 89.
- Deborah Welch Larson, *Origins of Containment: A Psychological Explanation*, 1st ed. (1985): 3 - 23.

1950s

6. January 24

Emergence of Nuclear Arms Race

Class material focuses on the the nuclear arms race and emergence of nuclear weapons programs in other countries. Particular attention is focused on the development of the hydrogen bomb, beginnings of the the nuclear arms race, and organizational and social impact that the nuclear arms race begins to have in the United States.

Reading:

- Ronald Powaski, *March to Armageddon: The United States and the Nuclear Arms Race, 1939 to the Present*, New York, NY: Oxford University Press (1987): 46 - 59.
- Lynn Eden, *Whole World on Fire: Organizations, Knowledge, & Nuclear Weapons Devastation*, Ithaca, NY: Cornell University Press (2004): 172 - 188.
- Alex Wellerstein, "From Classified to Commonplace: The Trajectory of the Hydrogen Bomb Secret," *Endeavour* 32:2 (2008): 47 - 52.

7. January 29

Post-war creation of the National Science Foundation: Political scientists versus autonomous scientists

We will discuss the creation of the National Science Foundation by Vannevar Bush and the fight between Dr. Bush and Senator Kilgore for autonomy over scientific research and the national labs, while Bush and other physicists vied to keep the science funding secured by WWII. All post-war science policy is founded on the premises and debates of this time period. Stanford becomes the MIT of the West.

Reading:

- Zachary, G. P. (1997). Chapter 10: The endless frontier. In *Endless Frontier: Vannevar Bush, Engineer of the American Century*. New York: Free Press
- Dennis, M. A. (2004). Reconstructing sociotechnical order: Vannevar Bush and US science policy. In Jasanoff, S. (Ed.) *States of Knowledge: The co-production of science and the social order*. London, Routledge, pp. 225–253.
- *Optional*: Science the endless frontier: A report to the president by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945 <https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm>

8. January 31

1950s: Atoms for Peace and Post-war Nuclear Energy Programs

We will discuss Eisenhower's Atoms for Peace speech and the dual-use nature of nuclear technologies for weapons versus energy. We will discuss the creation of the light water reactor for nuclear submarine propulsion, and the molten salt reactor for the Air Force, and discuss how the light water reactor became path dependent even though it is difficult to argue that it was the superior technology. We will discuss the creation of the US Atomic Energy Commission to promote and develop a civilian nuclear power industry.

Reading:

- John Krige, "Atoms for Peace, Scientific Internationalism, and Scientific Intelligence," *Osiris, 2nd Series, Vol. 21, Global Power Knowledge: Science and Technology in International Affairs* (2006): 161-181.
- Selections from the documentary: PBS/ Manifold Productions. (2014). Rickover: The birth of nuclear power. Available for rent for \$3.99. Beginning through 1 hour and 6 minutes in is required. Full documentary (about 2 hours) suggested

9. February 5

Epistemic communities of nuclear physicists and their activism against the bomb

We will discuss an early example of an epistemic community of nuclear physicists worried about the use of the weapons they created, somewhat analogous to climate scientists who work together to communicate the scientific consensus to policymakers. We will discuss the Bulletin of the Atomic Scientists and the Doomsday Clock, Pugwash, Union of Concerned Scientists, and Scientists for Social Responsibility: all social movement organizations composed of scientists worried about the implications of the Manhattan Project. Additionally, looking toward the future, is an analogue developing among biological scientists working in areas with applications to biological weapons; genetic engineering; and gene editing technologies, such as CRISPR? What is the social responsibility of scientists for the ways in which their work is applied in the world?

Reading:

- Veys, L. (2013). Joseph Rotblat: Moral Dilemmas and the Manhattan Project. *Physics in Perspective*. 15: 451–469
- Russell-Einstein Manifesto <https://pugwash.org/1955/07/09/statement-manifesto/>
- It is two minutes to midnight: <https://thebulletin.org/sites/default/files/2018%20Doomsday%20Clock%20Statement.pdf>
- Stein, R. (2018, November 29). Science summit denounces gene-edited babies claim, but rejects moratorium. *NPR*. <https://www.npr.org/sections/health-shots/2018/11/29/671657301/international-science-summit-denounces-gene-edited-babies-but-rejects-moratorium>

10. February 7

Massive Retaliation and Beginnings of the Missile Race

Class Discussion focuses on the emergence of Eisenhower's "New Look" policies and the impact of NATO's MC-48 doctrine to defend Europe. In addition, technical developments associated with ICBMs and nuclear propulsion are discussed.

Reading:

- Marc Trachtenberg, *A Constructed Peace: The Making of the European Settlement 1945-1963*, Princeton, NJ: Princeton University Press (1999): 146 - 200.
- MC-48 Document

11. February 12

Science policy guest speaker from DC, to be determined

1960s

12. February 14

Emergence of MAD and Debates Regarding Nuclear Retaliation

Class discussion focuses on the political and military implications of mutually assured destruction. Attention is given to critiques associated with the policies of massive retaliation, the emergence of the SIOF (Single Integrated Operational Plan), and influence of Thomas Schelling on nuclear strategy.

Reading:

- Ronald Powaski, *March to Armageddon: The United States and the Nuclear Arms Race, 1939 to the Present*, New York, NY: Oxford University Press (1987): 60 - 73.
- Elbridge A. Coby, "The United States and Discriminate Nuclear Options in the Cold War," in *On Limited Nuclear War in the 21st Century*, eds. Jeffrey A. Larsen and Kerry M. Kartchner, Palo Alto, CA: Stanford University Press (2014): 49 - 79.
- Thomas C. Schelling, *The Strategy of Conflict*, Cambridge, MA: Harvard University Press, (1960): 1 - 20.

13. Feb 19

Cuban Missile Crisis and Nuclear Launch Protocols

Class discussion focuses on the Cuban Missile Crisis and how the Cold War changes in response to the dangers of nuclear war. In addition, information associated with nuclear launch protocols is discussed to highlights issues associated unauthorized use and command and control.

Reading:

- Marc Trachtenberg, *A Constructed Peace: The Making of the European Settlement 1945-1963*, Princeton, NJ: Princeton University Press (1999): 352 - 402.
- Charles R. Loeber, *Building the Bombs: A History of the Nuclear Weapons Complex*, Ann Arbor, MI: University of Michigan Press (2002): 149 - 162.
- Bruce Blair, "Strengthening Checks on Presidential Nuclear Launch Authority," *Arms Control Today* (Jan./Feb/ 2018).

14. Feb 21

Guest Speaker: Major General (ret.) Robert Latiff - US Air Force

15. February 26**Nuclear launch simulation**

Note: 3-page memo due on Feb 21

Reading:

- No Readings Assigned

16. February 28**Midterm Examination**

March 5 and 7 spring break

1970s**17. March 12****Arms Control and the Emergence of Detente in the Cold War**

Class Discussion focuses on the beginnings of strategic arms control. Particular attention is given to the Non-Proliferation Treaty (NPT), Partial Test-Ban Treaty (PTBT), and implications of the Strategic Arms Limitations Talks (SALT). In addition, we cover material regarding the how the character of the Cold War changes due to attempts at arms control.

Reading:

- Forest E. Waller Jr., "Strategic Nuclear Arms Control," in *Arms Control: Cooperative Security in a Changing Environment*, ed. Jeffrey A. Larsen, Boulder, CO: Lynne Rienner (2002): 99 - 117.
- Carole K. Fink, *Cold War: An International History*, Boulder, CO: Westview Press (2014): 149 - 173.
- Michael A. Levi and Michael E. O'Hanlon, *The Future of Arms Control*, Washington, DC: Brookings Institution Press (2005): 139 - 164.

18. March 14**Energy systems in crisis: Tension between security implications of oil and environmental opposition to nuclear power**

In the late 1960s and early 1970s, public faith in technology as automatic social progress began to falter. Counter-culture movements called into question the rationale. Additionally, Balough (1993) finds that nuclear energy experts themselves began to fight over the safety of nuclear power. As that debate was released into the public sphere, it shook public trust in nuclear power as well. At the same time, a number of events gave

rise to environmental consciousness. The Atomic Energy Commission was eventually divided into the Nuclear Regulatory Commission and the Department of Energy to separate technology advocacy and development from safety and regulation. In 1968, the famous Earthrise photo Bill Anders took from the Apollo spacecraft reminded people of the beauty and fragility of “Spaceship Earth.” The Arab oil embargo of 1973 brought attention to the need for a national energy policy, leading to the creation to the precursor to the Department of Energy. The National Environmental Policy Act of 1970 was one of the first pieces of environmental legislation. The public became somewhat disillusioned with military science. Numerous social movements formed to oppose nuclear power plant siting cases. Tension grew between nuclear power as unsafe versus the need for alternative energy to displace fossil fuel consumption.

Reading:

- Wills, J. (2006.) Preface and Chapter 5: Living alongside the machine. In *Conservation fallout: Nuclear protest at Diablo Canyon*. pp. 118–152. Reno: University of Nevada Press
- Balogh, B. (1993). Selections from Chapter 8: Nuclear experts everywhere: the challenge to nuclear power, 1960-1975. In *Chain Reaction: Expert Debate and Public Participation in American Commercial Nuclear Power 1945-1975*. pp. **221–240 and 285–301**. Cambridge: Cambridge University Press

1980s

19. March 19

Nuclear power plant accidents: Three Mile Island in 1979 and Chernobyl in 1986

Reading:

- Introduction, Chapter 1, Normal Accident at Three Mile Island and examine the graph on pg. 394, Perrow, C. (1999). *Normal Accidents: Living with High-Risk Technologies*. Cambridge: MIT Press
- Chernobyl accident from the World Nuclear Association <http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx>
- *Optional:* Steinhauser, G., Brandl, A., & Johnson, T. (2014). Comparison of the Chernobyl and Fukushima nuclear accidents: A review of the environmental impacts. *Science of the Total Environment*. 470-471: 800–817

20. March 21

Nuclear Weapon Developments in Other Countries

Class discussion focuses on the diffusion of nuclear weapons technology to other countries. By the 1960's the number of nuclear armed states increased from three to five, and by the end of the 1970's the number of nuclear armed states would stand at eight. Specific attention is given to the development of nuclear weapons programs in South Africa, Pakistan, and China.

Reading:

- Nicola Horsburgh, *China and the Global Nuclear Order: From Estrangement to Active Engagement*, New York, NY: Oxford University Press (2015): 58 - 76.
- Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security* 26:2 (2001): 45 - 86.
- Zafar Khan, *Pakistan's Nuclear Policy: A Minimum Credible Deterrence*, New York, NY: Routledge (2015): 19 - 37.

21. March 26

Cold War Endgame (Rising Tensions and Close Calls)

Class discussion focuses on the increase in tensions between the US and Soviet Union after the end of the 1970's. Particular attention is given to the defense build-up during Pres. Ronald Reagan's first term and the development of the Strategic Defense Initiative (SDI). In addition, we discuss how the heightened tensions between the US and USSR leads to an increase in misperception and miscalculation that makes nuclear deterrence very unstable.

Reading:

- "The Soviet War Scare" *President's Foreign Intelligence Advisory Board* (February 15, 1990).

Post- cold war

22. March 28

ITER and research on fusion at the national laboratories

Guest speaker: Michael Murillo

Reading:

- In preparation for Dr. Murillo's talk, you should watch this video:
<https://www.popularmechanics.com/science/energy/a23829/fusion-explainer-kurzgesagt/>
- And peruse the ITER website
<https://www.iter.org/>

23. April 2

Proliferation and nuclear energy class

We will discuss the ways in which nuclear energy can lead to proliferation: research reactors, uranium enrichment (centrifuges and laser), plutonium stockpiles, scientific researchers. We will also discuss IAEA weapons monitoring.

Reading:

- Ferguson, C. (2011). Chapter 4: Proliferation. In *Nuclear Energy: What Everyone Needs to Know*. New York: Oxford University Press

24. April 9

Post-Cold War and Nuclear Proliferation

Class discussion is focused on how developments associated with US nuclear strategy to deal with the Post-Cold War international security environment. Particular attention is given to the idea of “limited nuclear war” and the ongoing problem associated nuclear proliferation.

Reading:

- Brad Roberts, *The Case for U.S. Nuclear Weapons in the 21st Century*, Palo Alto, CA: Stanford University Press (2016): 11 - 50.
- Thomas G. Mahnken, “Future Scenarios of Limited Nuclear Conflict,” in *On Limited Nuclear War in the 21st Century*, eds. Jeffrey A. Larsen and Kerry M. Kartchner, Palo Alto, CA: Stanford University Press (2016): 129 - 143.
- Gordon Corera, *Shopping for Bombs: Nuclear Proliferation, Global Insecurity, and the Rise and Fall of the A.Q. Khan Network*, New York, NY: Oxford University Press (2006): Introduction and 241 - 251.

25. April 11

The Future of Nuclear Weapons: Danger or Hope?

Class discussion focuses on what the future holds when it comes to issues associated with nuclear weapons. Some scholars argue that future nuclear conflict is likely to have a regional dimension, which is governed by dynamics of nuclear deterrence that differs significantly from those developed during the Cold War. In addition, we explore the arguments of those who hope the future leads to the elimination of nuclear weapons as well as those that believe they still have utility in the 21st Century.

Reading:

- Brad Roberts, *The Case for U.S. Nuclear Weapons in the 21st Century*, Palo Alto, CA: Stanford University Press (2016): 51 - 80.
- Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict*, Princeton, NJ: Princeton University Press (2014): 1 - 12.

- Matthew Kroenig, *The Logic of American Nuclear Strategy: Why Strategic Superiority Matters*, New York, NY: Oxford University Press (2018): 15 - 38.

26. April 16

Guest speaker: Sarah Pozi

27. April 18

Yucca Mountain & nuclear waste storage challenges

The only country that has managed to site and construct a nuclear waste storage repository is Finland. France, Germany, the United States, South Africa, and other countries are struggling to overcome public opposition and scientific uncertainty related to waste management. In the United States, the proposal for Yucca Mountain has been arguably the most contentious case. Australia and Russia are both considering building repositories that would accept waste from other countries.

Reading:

- Zhang, S. (2017, March 21). The White House Revives a Controversial Plan for Nuclear Waste. *The Atlantic*. Online at <https://www.theatlantic.com/science/archive/2017/03/yucca-mountain-trump/519972/>
- Solomon, B. D., Andr n, M., & Strandberg, U. (2010). Three Decades of Social Science Research on High-Level Nuclear Waste: Achievements and Future Challenges. *Risk, Hazards & Crisis in Public Policy*, 1(4), 13–47. <https://doi.org/10.2202/1944-4079.1036>
- Curry, A. (2017, October). What lies beneath. *The Atlantic*. Online at <https://www.theatlantic.com/magazine/archive/2017/10/what-lies-beneath/537894/>

28. April 23

Nuclear Power: A Failed Renaissance?

In the early 2000s, concern about climate change and interest in new, updated designs for nuclear power led to discussions about a Nuclear Renaissance. Unlikely advocates of nuclear power arose, such as one of the founders of Greenpeace, Patrick Moore. However, Germany chose to shut down its nuclear power plants in the face of public opposition, and the accident at the Fukushima Daiichi nuclear power plant in Japan again stirred up fear of the risks of nuclear power in terms of human health and safety but also in terms of the large costs to society of an accident and the cross border effects of ocean contamination by radiation. Finally, in 2017, one of two nuclear power plants under construction (VC Summer in Georgia) was canceled after \$9 billion was already spent.

Reading:

- Onishi, N. (2011, June 24). “Safety Myth” Left Japan Ripe for Nuclear Crisis. *The New York Times*. Retrieved from <http://www.nytimes.com/2011/06/25/world/asia/25myth.html>
- Pritchard, S. B. (2012). An Envirotechnical Disaster: Nature, Technology, and Politics at Fukushima. *Environmental History*, 17(2), 219–243. <https://doi.org/10.1093/envhis/ems021>
- Plumer, B. (2017, July 31). U.S. Nuclear Comeback Stalls as Two Reactors Are Abandoned. *New York Times* <https://www.nytimes.com/2017/07/31/climate/nuclear-power-project-canceled-in-south-carolina.html>

29. April 25 The future of nuclear energy: Development of advanced reactors and the loss of US international nuclear energy leadership

We will discuss promising “Generation IV” nuclear power plant technologies. This grouping of designs offers wide-reaching promises, such as the inability to meltdown (because of the use of fuel that is already liquid), passive safety technologies, potential to use nuclear waste as a fuel, the reduction of water use and use of new coolants and more. China has purchased a reactor from Bill Gates’ company, Terrapower, and is the first country to build a Generation IV nuclear power plant. Canada announced in the summer of 2018 that it will purchase a molten salt load-following reactor from UK company Moltex. Meanwhile, Russia is signing MOUs with countries in Africa and the Middle East to sell them outdated reactors. It seems increasingly likely that the United States will abandon nuclear power, but with it, the US will abandon its leadership role and higher nonproliferation standards for the sale of nuclear materials to other countries.

Reading:

- Advanced Nuclear 101 (Third Way): <http://www.thirdway.org/report/advanced-nuclear-101>
- Bill Gates’ Ted Talk, February 2010: Innovating to zero! https://www.ted.com/talks/bill_gates
See also: <https://terrapower.com/>
- Abdulla, A., Ford, M. J., Morgan, M. G., & Victor, D. G. (2017). A retrospective analysis of funding and focus in US advanced fission innovation. *Environmental Research Letters*, 12(8), 084016. <https://doi.org/10.1088/1748-9326/aa7f10>