IAFF 3180W—Nuclear Weapons Technology & Security Policy (10 Aug 2015)

1. Instructor: Murray Snyder, CAPT, USN (Retired), PhD, Professor, Mechanical and Aerospace Engineering, snydermr@gwu.edu, Science and Engineering Hall # 2870 (enter through SEAS Student Services), Office Hours 12-2pm TWTh (other times by appointment).

2. Graduate Teaching Assistants:
Needa Malik, nmalik1@gwmail.gwu.edu, OH TBD
Diane Stevenson, dstevenson@gwmail.gwu.edu, MT 3-5pm

3. Goals:

This course will provide students with a basic orientation to the technology, policy and politics associated with nuclear weapons. Students will gain an understanding of the scientific breakthroughs and technologies related to nuclear weapons. They will also gain an understanding of the policy implications and political dynamics affecting the acquisition and potential use of nuclear weapons. This is a Writing in the Disciplines (WID) course.

4. Textbooks and or other required material:

(1) Richard Rhodes, *The Making of the Atomic Bomb*, 25th Anniversary Edition, Simon & Schuster, 2012, ISBN 1451677618
(2) Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb*, Simon & Schuster, 1996, ISBN 0684824140
(3) Lawrence Freedman, *The Evolution of Nuclear Strategy*, 3rd Edition, Palgrave Macmillan, 2003, ISBN 0333972392
(4) Albert B. Reynolds, *Bluebells and Nuclear Energy*, Medical Physics Pub Corp, 1996, ISBN 0944838634
(5) Graham Allison, *Nuclear Terrorism—The Ultimate Preventable Catastrophe*, Holt Paperbacks, 2005, ISBN 0805078525

5. Course Learning Objectives.

1. Explain the physics of nuclear fission and fusion and know the commonly used fissionable material in nuclear weapons. Explain how fissionable material is obtained. Explain how Deuterium ^{2}H and Tritium ^{3}H are obtained and used in fusion weapons.
2. Explain the construction of gun-type and implosion atomic bombs and what type of fissionable material is required for each. Explain why plutonium cannot be used in gun-type weapons.
3. Explain how a fusion weapon works and the need for a fission trigger.
4. Understand the nuclear power fuel cycle and the potential for diversion of nuclear material to a clandestine nuclear weapons program.

5. Explain current concepts of nuclear deterrence and prevention of nuclear proliferation in the 20th and 21st centuries. Explain the difference in capabilities and desires of the primary nuclear weapons states (US, Russia, China, UK, France) versus those of the secondary nuclear weapon states (Israel, India, Pakistan, North Korea, and, potentially, Iran).
6. Explain the development and application of Mutually Assured Destruction and other advanced nuclear deterrence concepts.
7. Explain the role of the nuclear test ban and nuclear non-proliferation treaties in limiting the expansion of nuclear states and the size of nuclear weapons stockpiles.
8. Explain the potential for and prevention of nuclear terrorism by non-state actors.
9. Explain methods available for the control and detection of special nuclear material. Complete a laboratory demonstration on nuclear material detection using NRC supplied sources and detection equipment.
10. Students will write frequently and intensely to improve overall understanding of the assigned subject material.
11. Attend at least two Elliott School Nuclear Policy Talks or similar events (e.g. Sandia Technology, Policy, and National Security event).

6. Grading:

ESIA NPT et al. attendance	10%
Midterm Exams (2, each 20%)	40%
Nuclear Technology and Deterrence Paper[1]	40%
Peer Review Committee participation	10%
Conference paper submission & acceptance[2]	5% (Extra Credit)

7. Peer Review Committees

Each Peer Review Committee will be composed of 6-7 students moderated by a GTA. Peer Review Committees will meet twice during the semester. Students in a given Peer Review Committee, where possible, will be reviewing unrelated deterrence paper topics. Individual students will review the draft papers for all member of their committee and will provide constructive feedback and suggestions for improvement. GTA will assign a grade to each participant based upon their efforts to provide constructive and useful comments.

[1] Detailed Grading Rubric will be provided separately.
[2] Center for Strategic and International Studies, Project On Nuclear Issues, Washington, DC, Winter Conference 9-10 Dec 2015