

History and Physics Make Great Partners

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What would happen if a nuclear physicist who is interested in history and a military historian who wonders what makes nuclear weapons explode decided to have lunch one day? Out of this lunch, the two of us developed a tandem course titled "War and Peace in the Nuclear Age," a title used in a TV series on PBS.

We gained approval from our department heads and prepared a 490 course that could be taken for history credit (History 490) or Physics credit (Physics 490). The texts we selected and required of both history and physics students were: John Newhouse, *War and Peace in the Nuclear Age*, Richard Wolfson, *Nuclear Choices* and Russell Akridge, *Supplementary Physics Notes*.

The decision was made that a certain body of knowledge would be required of both history and physics students. The physics students needed to have the basic historical knowledge to relate their discipline to the historical events and the history students needed the conceptual knowledge necessary to have an idea of how weapons and nuclear reactors work. To insure this knowledge, the physics tests were two-thirds physics and one-third history and the history tests were the reverse. We both gave a midterm and a final. We also made the decision that the course would not be tightly structured. This gave us a chance to spend more time on material the students found particularly interesting or was of interest because of current events. This lack of a strict timetable worked well.

We both also required a major paper that the students would explain to the class so both physics and history students could benefit from the other's research. The class learned more frightening things about the Savannah River Site than any of us wanted to know.

The physics component studied the isotope structure of the atomic nucleus, paying particularly attention to the nuclei of uranium, plutonium, hydrogen,

helium, lithium, beryllium and carbon since these nuclei are the more important ones used by nuclear reactors and weapons. By counting the numbers of neutrons and protons in the nucleus, and by being familiar with static electricity, we determined why some nuclei are stable and others are radioactive. We distinguished between (1) fission reactions, used in nuclear reactors and atomic bombs and (2) fusion reactions used in hydrogen bombs.

History and physics were mixed when we looked at the uranium and plutonium bombs developed in World War II and how they worked. We also studied the development of nuclear reactors and how they work to understand both nuclear propulsion and to distinguish between the light water reactors used by the United States, the heavy water type used by Canada, and the carbon type used by the USSR. Particular emphasis was placed on why the methods used in the U.S. are far safer than those used by the Soviets and, now, many of the ex-Soviet states. The class then designed their own hydrogen bomb. We were unable to obtain the plutonium and tritium to make it work so the campus is still here. Finally, samples of radioactive materials in very small amounts were made available for the students to see.

In the history component, we began with a brief history of the major discoveries in radioactivity, then emphasized the importance of the letter Albert Einstein addressed to President Roosevelt in 1939 that would have much to do with launching the Manhattan Project (code name for the development of an atomic bomb). The various historical aspects of the project

were discussed and we spent time trying to understand the factors that went into President Truman's decision to drop the weapon on Japan.

We looked at the development of the Cold War, George Kennan and containment, and NSC 68 (National Security Council Memorandum) which, although never officially adopted, provided much of the basis for US nuclear policy relating to the Soviets and we traced these policies and their changes from the Truman administration into the 1990's. The development of the weapons and methods for their delivery were also traced. This focus addressed organizations and weapons systems such as the Strategic Air Command, intercontinental ballistic missiles, and nuclear powered submarines.

demonstrate the mood of the people and the way nuclear weapons were viewed. One of the classics is *Atomic Cafe*, a collection of films including the scene where Bert the Turtle demonstrates "duck and cover." Bert says that is what everyone should do when the bomb goes off. The other all time classic that shows much more than might be expected is *Dr. Strangelove, Or How I Learned to Stop Worrying and Love the Bomb*. Peter Sellers (three roles), George C. Scott, and Sterling Haden as General Jack D. Ripper are all superb. "MR PRESIDENT, WE CANNOT ALLOW A MINE SHAFT GAP."

Several books were recommended that the students found useful. Richard Rhodes has written two, *The Making of the Atomic Bomb* and *Dark Sun*:

One final note: we were accepted for and attended a Chautauqua program at the New York Museum of Natural History in 1993 titled *The Atomic Bomb in History and Culture* that greatly added to our ability to teach the course.

The course has been a wonderful experience for both of us. We are not sure who learned the most, the students or the professors. We hope the success of our adventure in team taught classes will encourage others to try the same thing. Working with other faculty members is both educational and highly rewarding. •

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These three things - manned bombers, ICBMS, and submarine launched ballistic missiles - makeup what US policy makers call the "triad" (if one or two are destroyed, the other will survive). We placed particular emphasis on policy making and the efforts since World War II to reach agreements on nuclear proliferation, SALT (Strategic Arms Limitation Talks), and START (Strategic Arms Reduction Talks) which, of course, are ongoing.

The course was not limited to the United States and the Soviet Union. We also looked at nuclear development and policy in Great Britain, France, Israel, China and others.

A nice thing about this course (or courses) is the availability of great videos. *The Making of the Atomic Bomb* and *The Making of the Hydrogen Bomb* are very good. *The World At War* volume titled *The Bomb* discusses the bomb, the decisions to use it, and the bomb's relation to decisions on post-war settlements. *Radio Bikini* is an excellent account of the atomic bomb tests in the Pacific in 1946. But most fun are the videos that can be used to

The Making of the Hydrogen Bomb that are must reading for anyone interested in this topic. *By the Bomb's Early Light* by Paul Boyer is an excellent introduction to American attitudes toward the bomb. For example this appeared on a valentine card for 1946: "Won't you be my little geranium/until we are both wiped out by uranium?" There are many works on the development of U.S. and Russian policy. Particularly interesting are memoirs by Henry Kissinger and Anatoly Dobrynin's, *In Confidence*.

We have an additional resource of great value for this course. Dr. John Weinstein is Chief of Policy and Programs for the Nuclear Command and Control Staff in Washington. Dr. Weinstein taught here in the late 1970's and early 1980's and has kept in touch. We had him come down and talk about various aspects of nuclear planning, his experiences in the Soviet Union as a member of one of the teams sent to witness the destruction of Soviet missiles, and some methods of preventing accidental usage of these weapons.