Monterey Institute of International Studies
A Graduate School of Middlebury College

Graduate School of International Policy & Management
NPTG 8612 Nuclear Treaty Verification in a Virtual World
Spring 2014

Date/Time:

DATE	TIME	ROOM
Jan 31	**10:00 AM -1:50 PM**	**Morse A101**
Feb 14	**10:00 AM -1:50 PM**	**Morse A101**
Feb 28	**10:00 AM -1:50 PM**	**Morse A101**
March 14	**10:00 AM -1:50 PM**	**Morse A101**
April 4	**10:00 AM -1:50 PM**	**Morse A101**
April 18	**10:00 AM -1:50 PM**	**Morse A101**
May 2	**10:00 AM -1:50 PM**	**Morse A101**
May 14 : Final protocol/procedure due		

Instructor: Dr. Ferenc Dalnoki-Veress
Contact: jdalnokiveress@miis.edu
Credits : 2
Office Hours: Thursday 10-12 PM (please email Wednesday night for an appointment)

Prerequisites: There are no prerequisites in this course. However, completion of Science and Technology for Nonproliferation and Terrorism Studies (IPOL 8559) is highly desirable. **It is also useful for you to bring a laptop computer to class.** Unfortunately, we cannot provide one for you. All students must attend all classes. If you cannot attend make sure that you email me at least one day prior to the class and give a legitimate reason.

Course Objectives:

Upon completion of this course, you will be able to
- Understand the basics of the science and technology used to verify nuclear weapons reduction treaties. The focus will be on dismantlement of nuclear weapons but the technology will largely apply to most nuclear verification schemes.
- You will understand some of the complications in designing verification protocol, and appreciate the roles of the parties involved.

Required and Optional Materials:

The main reference for the course is the National Academy of Science study entitled *Monitoring Nuclear Weapons and Nuclear-Explosive Materials: An Assessment of Methods and Capabilities* published in

2005 and downloadable free of charge at http://www.nap.edu/catalog.php?record_id=11265. Other supplementary readings will be provided throughout the course.

Course Description:

This course is a highly interactive course for the advanced student. Students will be required to complete several short assignments and to write a short research paper on an allocated, practical aspect of the verification of nuclear arms control and to participate in a virtual class simulation to simulate the inspection of a nuclear weapon state by a non-nuclear weapon state (similar to the UK-Norway Initiative (UKNI) performed by the governments of Norway and the United Kingdom). A nuclear weapon state has the duty under article 1 of the NPT to prevent the transfer of proliferation sensitive information from a nuclear weapon state to a non-nuclear weapon state. In addition, all states have a responsibility under article 6 of the NPT to be serious about negotiating the disarmament of nuclear weapon states. There is tension because the act of verification at the very least needs to verify that the weapon being dismantled is actually a nuclear weapon. However, determining whether a weapon *is* a nuclear weapon may require knowing technical details which are proliferation sensitive. Therefore, utmost care must be applied to design the protocol so that no sensitive data can be transferred.

As members of a fictional non-nuclear weapon state and nuclear weapon state, you will be asked to design a verification regime and a dismantlement protocol in order to verify the complete dismantlement of a nuclear weapon. At the same time you must ensure that no proliferation sensitive data will be transferred from the host party (HP) to the inspecting party (IP). The technique used will be a form of virtual reality known as Avatar-based Virtual Reality, where you will interact with each other as avatars in a virtual world to determine appropriate protocol for verifying the dismantlement of nuclear weapons.

The course will proceed in three parts:

PART 1: LECTURE COMPONENT

The lecture component of the course will start by discussing verification approaches in general and how these have been historically applied. We will then have a series of technical lectures focusing on the technology that will allow the verification of nuclear weapons stocks, confirmation of nuclear weapons elimination, and the prohibition of weapon remanufacture and assembly. The lectures will review some of what was discussed in NPTG 8559. Then at the end of this first section, a scenario will be presented where a fictional non-nuclear weapon state will verify the dismantlement of a nuclear weapon in a facility of a fictional nuclear weapon state. The idea in PART 2 is to design and carry out the verification protocol to carry out the authentication and the dismantlement of a nuclear weapon in a virtual facility.

Then, all students will be divided up into the HP and IP and assigned avatars (the characters in a virtual world) where each party will have their own virtual room. Being in this virtual room will be the only way that students of the same party will be able to interact with each other which will be done exclusively through chat and in-world presentations. The students will not know who is on the IP or HP teams and we expect students to abide by this ground rule. The reason for this is that we want the students to get to know each other as avatars and to interact only as avatars where you will all have an important professional role in the disarmament process. Therefore, all activities in the Virtual World, known as *in-world*, are considered to be *in-play*.

The virtual world application that we will use is *OpenSim,* which is similar to the well-known application *Second Life* but is completely open source. You will be free to use any viewer you like but I have been experimenting with the viewer known as Phoenix-Firestorm (don't be put off by the funny sounding names, I assure you this is a quite serious application and Avatar-based virtual world simulations are used in everything from simulating emergency and military situations, to surgeries, to a doctors learning proper bed-side manners).

PART 2: IN-WORLD SIMULATIONS

The next part will take place entirely in-world. In fact, you will be encouraged not to be physically in class but you will be expected at that time to interact with your peers in a virtual planning facility to determine the most appropriate verification procedure. My avatar will transfer between the two virtual planning facilities to facilitate some of the discussions. ***I will not tolerate students not participating. If you cannot be virtually present then let me know in advance in writing because I need to know that each team will get the proper support from all members.***

In addition to my avatar, I have also invited people who have worked on nuclear weapon protocol to support each team, so don't be alarmed if an unknown avatar appears in your virtual room and gives advice. As has been the custom of the UKNI, all communication between the two parties will be facilitated entirely by letters between the two virtual governments. The day of the actual inspection will be the only time that avatars of the IP and HP will actually meet. Finally, once the procedure has been mutually determined you will be asked to proceed with the full simulation of the secure dismantlement of a nuclear weapon in a virtual facility.

PART 3: FINAL PRESENTATIONS

The final section of the course will be to carry out presentations of your directed studies. This will be a chance for all students to learn about specific stages of nuclear weapon verification.

Course Format and Expectations:

The course will be based on a lecture and simulation component. Students will be given specific readings each class and are expected to be prepared to discuss them in class. **Students are expected to be evaluated based on their participation in class and in the simulation component and presentations.**

This course will have several components:

- A review of the technologies used for nuclear weapon verification and elimination
- A presentation on aspects related to nuclear treaty verification and nuclear weapon disarmament
- The simulation of the inspection of a fictional nuclear weapon state by a non-nuclear weapon state to verify the dismantlement of a virtual nuclear weapon

You will be asked to:

- Participate in class and *in-world*

- After completion of the verification procedure submit a written document describing the procedure in detail and keep a detailed log of your activities in-world.
- Complete assignments when requested
- Give final presentation on research

Research Presentation:
Each student will give a presentation on one aspect of nuclear treaty verification (details given in class). Final presentations will be an opportunity for students to learn about different components of the verification chain. Students must give a presentation no longer than **15 minutes** in length to the class. Students may use slides if desired, but they must be provided to the instructor ahead of time. The dates of the final presentations will likely be in the final days of the course.

Simulation Component:
Each team is expected to keep detailed logs of the activities at planning meetings and throughout the negotiations and internal discussions. These are an important component of your grade. As well, you are expected to produce a final document of the actual verification procedure that you have mutually determined by May 14'th. This is expected not to be a long document but should provide enough information for the detailed simulation to be repeated. Finally, every student will also be expected to complete a short assignment focused on your experience as avatars during the final inspection phase.

Attendance and Participation:
As noted in the Monterey Institute *Academic Policies and Standards Manual*, "all students are expected to attend class regularly." Please inform me if you will be missing a class (even if the attendance in virtual). Regular absences will have a negative effect on your grade. Additionally, students are expected to complete class readings before class has begun and to participate in class discussions. It is clear from the requirements that the grading is heavily weighted towards class participation.

Testing and Grading**:

1) Your grade will be based on the following performance:

Short Written Assignments and Quiz	15%
Class Participation	15%
In-world Participation	15%
Final Verification Protocol Design and Log Notes	35%
Individual Presentation	20%

2) Letter grades will be based on the following performance:

A: 90-100% (Excellent)
B: 80-89%   (Good)
C: 70-79%   (Satisfactory)
D: 60-69%   (Poor)
F: 0-59%   (Fail)

Grades will be awarded with plus and minus designations when the student's numerical score is in the very top or bottom end of the grade ranges described above.

A and A+ 4.00 grade points per credit.
A- (minus) 3.67
B+ (plus) 3.33
B 3.00
B- 2.67
C+ 2.33
C 2.00
C- 1.67
D+ 1.33
D 1.00
D- 0.67
F (Fail) 0.00
P (Pass) Credit for course, no grade points.
NP (No Pass) No grade points or credit.
I (Incomplete) No grade points or credit.
W (Withdrawal with permission) No grade points or credit.
AU (Audit) No grade points or credit.
IP (In Progress) No grade points or credit.

3) Except for grades of "I' and "IP" (see Sections 4.3 and 4.5 in the Academic Standards and Policy Manual), all grades are considered final when reported by a Faculty Member at the end of a semester or marking period. A change of grade may be requested **only** when a calculation or recording error is discovered in the original assignment of a course grade or when a decision is made by the Faculty Member to change the grade as a result of the disputed academic evaluation procedure (set forth in Section 4.1.1 of the Academic Standards and Policy Manual). Grade changes necessitated by a calculation or recording error must be reported within a period of six months from the time the grade is awarded. **No grade may be changed as the result of a re-evaluation of a student's work or the submission of supplemental work** following the close of a semester or marking period.