The Role of Technology in National Security
Spring 2020

Course: BIOD 760-002
Day: Thursday
Time: 1920-2200
Room: VM 475
Campus: Arlington

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Office hours: Thu at 1830 or after class

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“Solving a problem simply means representing it so as to make the solution transparent.” -- Herbert Simon
COURSE DESCRIPTION

The role technology plays in current national security strategies and plans is enormous and fundamentally shapes global wealth and power. Not since the development of the atomic bomb has such great technological change impacted so much in the national security realm. From the ability to wage war by pinpointing a human target from thousands of miles away with an unmanned aerial vehicle, to the ability to disrupt a nuclear program with a computer virus, to the ability to genetically engineer a highly virulent pathogen that could inflict millions—these all represent ways in which technology has fundamentally altered the landscape of the national security space. The pace of this technological change and the corresponding changes among the institutions that develop technology and spur innovation demand that national security professionals understand the relationship of technology to security and be conversant in the relevant functional technological domains.

Given this criticality, this course provides a broad conceptual overview of the implications of technology for national security as well as a basic understanding of the scientific and technical issues at the center of current national security challenges. In particular, we will review the roles, responsibilities, and relationships of key technology stakeholders; how technology is evaluated and developed within organizations responsible for acquisition and planning; the importance of science and technology intelligence assessments to address technological proliferation issues; and selected technology functional areas that undergird both critical capabilities and external threats that are reflected in national security strategies and implementation plans.

COURSE OBJECTIVES

Students should be able to do the following upon completion of the course:

1) Identify and describe the roles, missions and functions of the key stakeholders in technology development in the US national strategic enterprise and their relationship to technological innovation, advanced development and production.

2) Describe the fundamental tenets of an acquisition process that identify and provide technology for validated military needs, and the progression from managed scientific research to engineering and manufacturing development for final production of military systems.

3) Describe the processes by which intelligence assessments characterize globalized technology and support strategies to mitigate proliferation threats.

4) Understand, define and categorize critical technology areas and their importance for national security.

5) Understand the key debates in the field as they relate to the adoption of new technologies- Ethical implications, dangerous diffusion, rapid adaptation, the
chicken and the egg- technology or requirements. Review, analyze and critique the current literature on course subject matter from a basic technical vantage point and be able to communicate the various viewpoints captured in the literature.

6) Write clearly and effectively to produce (1) clear and insightful assessments about technology in national security drawn from evidence-based reasoned arguments as well as (2) logically ordered and quantifiable plans of action that address a relevant national security technical threat or capability shortfall.

7) Collaborate within a working group to develop and deliver a presentation that clearly communicates an issue of technology in national security, the assessed challenges related to that issue, proposed solutions and timeline to address the challenge, the impact from acting on this issue, and the implications for national security strategy.

CLASS FORMAT

The course is divided into core sections that describe: (1) technology strategies and development processes of national security stakeholders, (2) globally interdependent technology functional areas, (3) technologies at the forefront of security issues, and (4) future national security technology landscapes. Our standard class format will consist of half of class having a lecture that emphasizes key areas of technology and security within the given reading and class topic. The other half of class will consist of a structured discussion of one to three overarching questions that I will provide about the week’s material, in order to engage in an interactive deliberative process. My intent is to ensure that the classroom learning experience is a dynamic process where you will also have an opportunity to present questions on the lecture material and engage one another. Pending availability, we may have guest speakers throughout the course who are renowned in their respective fields and have extensive practical experience in their areas of expertise.

Important note. The nature of the work that I do in addition to my teaching responsibilities sometimes necessitates travel or other commitments that I cannot escape and that may require a schedule shift. Your flexibility and understanding is thus greatly appreciated. On the first day of class, we will determine if make-ups will be conducted in person on Friday or via GMU webex.

CLASS DELIVERABLES AND POLICIES

You are not required to have a technical or science background to take this course. All the fundamentals will be dealt with in the readings and class instruction. While it may help you with some of the core technical concepts, everything that you will need to know for success in this course will be covered in class. Further, it is not my objective to overburden you with reading assignments. Rather, I want you to be in a position to clearly define the key issues in the reading, speaking thoroughly and intelligently about its content and most importantly,
leverage the reading throughout the rest of the class and for your class deliverables (as described below).

Reading assignments will have a target workload of about 130-150 pages (on average) per a week, in some cases longer, in others less. You will not be required to purchase any texts; reading will be posted on Blackboard. Please note: you must check Blackboard regularly; additional reading assignments may be posted as current events unfold. I am committed to providing you with the most germane material for this course, and will be continuously reviewing the current literature for appropriate updates (I ask you to do the same).

There are two (2) solo written deliverables for this class and one (1) group presentation.

**Memoranda**

- The first writing assignment is a threat and gap analysis memorandum. This should address a particular issue within one of the critical technology and security functional areas that demonstrates either a threat to national security or a gap in the United States’ technical capability. The memorandum should be approximately five (5) to six (6) pages in length, double-spaced, and serve as an analytical treatment of the issue. This assignment will count as twenty-five percent (25%) of your grade. This should be a fact and detail-driven document listing the citations and references used to bolster your arguments. It is not a “requirements” recommendation. In short, you are providing an assessment of an identified threat or capability gap in terms of the impact to national security, but you are not providing a solution to the threat or gap. The purpose of this document is to make an argument for the reader that a technology-based issue exists, affects national security strategy and policies, and provides a basis for action on the part of a policymaker. This piece should draw upon course reading and additional relevant research you add. You should approach the assignment as if you were a subject matter expert and your audience to be “informed generalists”—from other analysts to senior government officials (Popular Science level presentation of material).

- Your second writing assignment will require you to produce a requirements and implementation memorandum (approximately five (5) to six (6) pages in length). This assignment will count as twenty-five percent (25%) of your grade. You will draw from your analysis memo and draft a requirements and implementation strategy that recommends an action by a relevant senior US policymaker (e.g. Under or Assistant Secretary, Senior Director or Senior Scientist). The memorandum should draw upon the course’s reading and any additional relevant research you wish to add to make specific recommendations as to why and how (or why not) the US should afford
greater (or less) attention to the issue you are reviewing, provide specific actions the US should take, and the rationale for the recommendation.

- In contrast to the first writing assignment, this memorandum should focus more on recommendations and solutions than analysis. The requirements memorandum will preferably build upon the work that you did in the threat and gap analysis memorandum, however a different topic may be selected if mutually agreed to at least two weeks before the memo is due.

**Group Proposals**

- The last two (2) classes will be focused on a group proposal. This assignment will count as forty percent (40%) of your grade. The class will be divided into three- six groups (depending upon class size), and the groups will be assigned on Lesson 9 of the course. You will be building upon the type of work in the two memoranda, though as a team and with much more depth on a new topic of your group’s choice. Each group will be responsible for the following: 1) setting forth a strategy and policy issue along one of the core technology and security areas; 2) assess a national security threat related to this area and the related gap; 3) establish the solution or the “requirement” that will be needed to meet the assessed technological capabilities gap; 4) present that solution and rationale with respect to policy goals as well as the timeline required to develop the solution and the roles in the community of interest; and 5) set forth the pros and cons of the implications for national security related to your solution. Each group will be responsible to brief their respective presentations. So as to ensure that no group gets an unfair preparation advantage for time, each group will be required to submit your initial proposals the day before Lesson 13 of class. I will determine the order of presentations for the last two weeks by Lesson 12, and let the class know the order of presentations at that time. After the presentations and comments from competing proposals, you will be provided the opportunity to finalize your proposal and submit by Tuesday of finals week.

- I will want to see a short (no longer than one page) Term of Reference of your group proposal no later than lesson 10, and I will want a status update (no longer than one page) on your efforts by Lesson 11. The objective of this tracking effort is to ensure that each group remains on track with their work, and also that you do not end up one week before the presentation is due trying to pull it all together—this is meant to be a deliberate effort throughout the duration of the second half of the course. The core objectives of this exercise are for you to apply your learning of the course material in a realistic demonstration of a technology development process reflecting a national security strategy. I do not want you to get bogged down in trying to replicate the acquisition process for any one organization.
CLASS PARTICIPATION

This class is a discussion seminar. Thoughtful and constructive class participation is a part of the assessment criteria for the course. Students are expected to come to class fully prepared to engage in a critical analysis of assigned readings. Effective class participation is reflected by:

- Demonstrated command of assigned material as well as the assumptions and implications inherent in the readings.
- Identification and synthesis of key issues in the formulation of reasoned judgments that are presented in class.
- Respectful yet probing examination of other students’ contributions to class discussions.

Deadlines are important; written assignments are due by 10:00 p.m. the day before class. I expect your written assignments to be delivered on schedule. Late submissions without prior approval will be lowered by one letter grade every 24 hours late. Soft copy pdf is preferred. Always make sure that someone else reviews your work before it is submitted.

We are all expected to be on time, remain for the duration of the class, stay engaged and not leave the classroom except for emergencies. The use of email and mobile phones is explicitly prohibited during class, though may be used and checked during class breaks. Class attendance is mandatory; any absence or lateness must be noted in advance with the instructors. This is done because not only is all of our time valuable, but because of the need to ensure the best, most respectful learning environment for all course participants, especially any guest speakers that may join us and who will be volunteering their time and energy in support of our learning experience. If absence from class is unavoidable, then the student will write a short summary on the key points and implications of that week’s reading assignments and submit in an email to me prior to the next week’s class.

GRADING POLICY

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EVALUATION

Final grades will be based on the following:

- Memoranda: 50% (25% each)
- Group Project: 40% (10% initial submission/15% presentation/15% final)
- Class Participation: 10%

EMAIL COMMUNICATION

Students must activate their Mason email accounts to receive important University information, including messages related to this class. Please use your Mason email and include POGO 750-B04 in the subject of any message you are emailing to Prof. Hare.

OFFICE OF DISABILITY SERVICES

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu.

OTHER USEFUL CAMPUS RESOURCES

- Writing Center: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu
- University Libraries: Ask a Librarian http://library.gmu.edu/ask
- Counseling and Psychological Services (CAPS): (703) 993-2380; http://caps.gmu.edu

UNIVERSITY POLICIES AND HONOR CODE

The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university affairs. You may also review the University Policy web site, http://universitypolicy.gmu.edu/

Faculty in the Schar School have zero tolerance for academic dishonesty and will strictly enforce Mason’s honor code. Information on the university honor code can be found at http://academicintegrity.gmu.edu/honorcode/.

STUDENT EVALUATIONS

An informal mid-term review of the course will be considered in order to make any needed adjustments. A final course evaluation will be administered in class.
I. TECHNOLOGY STRATEGIES AND PROCESSES AMONG NATIONAL SECURITY STAKEHOLDERS

Lesson 1 (Jan 23): History, Technology and Security—an Overview

We will begin the course in the past. The relevance of technology for security is not new; it is as ancient as civilization and warfare. Throughout history, there are a myriad of examples that demonstrate how technology development and superiority have made the difference in both the security of a nation or community of nations, as well as outcomes in battle. This class will take a very brief tour through this historical context to base our understanding of the relationship between the scientific & technical community and the national security community in the US and other countries to demonstrate how technology has both supported or been influenced by national policies. We will also review course expectations and the class format, and work through in greater detail the relationship between each section of the class, as well as expectations for group work.

Learning Objectives:

1) Summarize several critical historical examples of the relationship between technology and security, and how these examples determined the future direction of national security and security relationships.

2) Explain the historical framework that defines the relationship between technology and security.

3) Describe technology developments and periods that have impacted the enduring relationship between the scientific and national security policy communities.

4) Explain how historical examples shape future considerations about technology prioritization in national security frameworks.

Class Readings:


**Supplemental readings:**


**Lesson 2 (Jan 30): Technology and National Security—Roles, Missions and Functions**

We will begin the modern day analysis with an overview of key stakeholders in the technology and national security arena with an emphasis on understanding the distinct role, mission, function, and technology priorities of each actor. This class will work through understanding these priorities in the context of national and departmental strategies, and the implications of these priorities for relevant United States Government stakeholders as well as resource allocations.

**Learning Objectives:**

1) Define the relationship between technology and national security, and identify the key stakeholders within the United States Government in the technology and national security arena.

2) Distinguish amongst each of these technology stakeholders and the distinct role, mission and function each has in the technology and national security paradigm.
3) Identity the critical technology and security functional areas that are emphasized in national and department strategic guidance, and assess relevance of these core functional areas.

4) Define key national and departmental technology development priorities, and how these map against each of the functional areas of emphasis, as well as realistic probabilities for success.

5) Assess the relationship between technology priorities and other areas of geographic and functional criticality that are defined within national and departmental strategies.

**Class Reading:**
  [https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/national_security_s_and_t_strategy.pdf](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/national_security_s_and_t_strategy.pdf)
- FY19 Administration Research and Development Priorities – August 17, 2017  
- DoD Research and Engineering Enterprise, May 1, 2014.  
- 2014-2018 DOE Strategic Plan, **pp. 13-19.**  
- 2015 DHS Science and Technology Directorate Strategic Plan, **pp.6-13:**  
Lesson 3 (Feb 6): Acquisition Processes, Intelligence, and Proliferation—Key Concepts

This class will examine the process by which national security stakeholders obtain technology as exemplified by the defense acquisition process: from basic scientific research through advanced development, prototype testing and production. We will closely review how this process serves to enhance capabilities for end users such as the warfighter, how acquisition requirements are established and informed by intelligence assessments of national security threats and the proliferation of technology. We will examine the role of science and technology intelligence in particular and the scope of technology proliferation beyond just weapons of mass destruction and nation state actors.

Learning Objectives:

1) Define the key components and timelines of the acquisition cycle including how technical requirements are created and vetted.

2) Understand how “technology” from an acquisition perspective breaks down into science and technology, engineering & manufacturing development, and operations & maintenance as well as the different categories of funding for these acquisition steps.

3) Examine the role of the intelligence community in understanding foreign technological development.

4) Understand how scientific and technical intelligence analysis informs WMD non-proliferation strategies and military acquisition processes.

Written Assignment Due: None. Guidance provided for assessment memo.

Class Reading:


- President’s budget submission (as much as you can absorb)


Supplemental reading:


II. CORE TECHNOLOGIES GLOBALLY INTERDEPENDENT

Lesson 4 (Feb 13): Nuclear Technology

Nuclear technology presents some of the most promising potential solution sets to a host of security challenges for all countries. Nuclear power is an effective alternative energy source for propulsion, heat and electricity as well as a source of immense destructive power when weaponized. The potential benefits of safe civilian use versus the fear of irresponsible and aggressive weapons use are what shape the national security issues of nuclear energy. The development of nuclear technology is fraught with potential risk and the continued challenges from state and non-state nuclear technology proliferation. This class will examine the capabilities and promise of nuclear technology, how this presents unique solution for United States technological security challenges, as well as the unique threats from nuclear proliferation.

Learning Objectives:

1) Define the different aspects of nuclear technology, to include a basic understanding of nuclear fusion and fission, and the application of this technology to civilian and military use.

2) Understand the basic technologies associated with the nuclear fuel cycle, nuclear reactors, and nuclear weapons.

3) Understand the key proliferation concepts derived specifically from all technologies involved in the fabrication of a nuclear weapon.

4) Understand the different national and international mechanisms in place to address nuclear technology challenges.

Written Assignment Due: Analysis question for the first memo.

Class Readings:


- McGoldrick, Fred, “Limiting Transfers of Enrichment and Reprocessing Technology: Issues, Constraints, Options,” Belfer Center for Science and
Lesson 5 (Feb 20): Space Technology

Thirty years ago, there were only a small number of countries that had the capacity to access space and deploy systems in space. While the number of nations that can do this successfully is still relatively limited, the proliferation of rocket propulsion, ballistic missile, and satellite technologies presents unique national security challenges that must balance military threats with private sector commercial development. This class will examine these contemporary tensions including the appropriate role for government, with an examination of the core technologies involved in space access and exploitation plus proliferation risks.

Learning Objectives:

1) Understand the fundamental technologies required for space access and activity.

2) Describe the dual-use application of rocketry for ballistic missile and space launch vehicles and the corresponding implications for proliferation.

3) Assess the potential national security strategies that call for an expanded private sector role in space access and commercial development including regulatory issues.

Class Readings:

Lesson 6 (Feb 27): Energy and Security

As energy resources continue to be either scarce or geopolitically constrained, the importance of developing alternative sources of energy in geographically accessible areas is not simply a market imperative, but a security consideration. The development of alternative energy technologies seeks to incorporate efficiency, safety, economic competitiveness, and low environmental impact. This class will examine these efforts, the importance of technological advances in alternative energy development in national security, and the challenges in providing high efficiency technologies at scalable rates.
Learning Objectives:
1) Consider non-traditional security analysis models for assessing energy security issues.
2) Describe different alternative energy technologies being implemented and considered, and their promise or challenges.
3) Understand methods and challenges with measuring energy security.
4) Explore the linkage between energy stability and international security.

Written Assignment Due: First Memorandum. (10 p.m. on 26 Feb)

* Mid term Survey

Class Readings:

Supplemental Reading:
Lesson 7 (Mar 5): Net-Centric and Cyber Warfare

The role of information sharing in its broadest sense in national security is not new. What has transformed exponentially since the end of World War II, and in particular in the past twenty years, is the absolute requirement that technological platforms related to national security information be robust, current and protected. The interconnected manner, in which our world operates, to say nothing of our United States Government systemic integration, underscores not only the importance of technological development in information platforms, but also the absolute requirement that these systems are kept secure. In addition, technology has driven the introduction of new tools and mechanisms into our strategic communications, data storage, and control systems. This class will explore these linkages, the threat posed by cyber-attacks to our information technology infrastructure, and the way in which information technology has radically altered the way in which we approach security matters.

**Learning Objectives:**

1) Explain and define net-centric warfare and its relevance in shaping our security priorities.

2) Describe the significance of net-centric operations to improve the ability of multi-national coalitions to synchronize operations in a conflict.

3) Define cyber-security, its future criticality and its relationship to new forms of capabilities development and gap analysis.

4) Describe various ways in which information technology is used in cyber security and warfare in cyberspace.

**Written Assignment Due:** None. Guidance provided for requirements memo.

**Class Readings:**


Supplemental Reading:


### III. CORE TECHNOLOGIES APPLIED UNILATERALLY

#### Lesson 8 (Mar 19): Autonomous and Unmanned Systems in Warfare

The national security community derives significant strategic, tactical, and scientific value from unmanned systems and is actively supporting further development and acquisition of more systems, especially in the defense department. Additionally, several other agencies have recognized the need to rapidly develop and deploy more unmanned systems in support of ongoing civil and law enforcement operations. The fast-paced changes in the technology and the breadth of applications have also brought about policy and strategy questions regarding safety and the ethical uses of unmanned systems.

**Learning Objectives:**

1) Understand the basic technical underpinnings of unmanned vehicles and the distinction of autonomous systems and robotics.

2) Understand the strategic, tactical, and economic forces that are driving the development of unmanned systems.

3) Describe some of the ethical dilemmas and challenges to established norms that may be generated by sending unmanned systems or robots into battle.

**Written Assignment Due:** None.

**Class Readings:**


Lesson 9 (Mar 26): Social Media and Disaffected Populations

While the Internet and social media have led to an arguably much more informed society, they have also become powerful tools of insecurity. In early 2011, several governments in the Middle East and North Africa were toppled by citizens who were mobilized via social media platforms. The United States Congress has even initiated an investigation to determine the extent to which Russian actors have manipulated social media to influence the 2016 U.S. elections. As a result of events such as these, many governments have called for stronger controls on social media in their country. However, democratic governments must be careful not be seen as blocking citizens from freely accessing information and common tools online.
Learning Objectives:

- Understand how non-state actors have exploited social media to overcome organizational and training challenges in a secure manner.
- Understand how nation-states exploit social media to conduct destabilizing operations.
- Understand the threats that social media pose to fragile regimes.

Written Assignment Due: Second memorandum. (10 p.m. on Mar 25) Group assignments and guidance provided for group project.

Class Readings:


Supplemental Reading:

IV. EMERGING NATIONAL SECURITY TECHNOLOGIES AND LANDSCAPES

Lesson 10 (Apr 2): Biotechnology and Nanotechnology

The changes in biotechnology are occurring at an extraordinary rate, affording tremendous opportunity for mitigating many of the health threats faced by both civilian populations and uniformed personnel. At the same time, the risks from emerging pandemic threats is rising—a trend exacerbated by globalization and the rise in naturally occurring biological threats. Coupled with the increased ability to produce extremely virulent pathogens with a reduce level of scientific sophistication, the promise and challenge from these rapid advances in bioscience have been extraordinary. At the same time, the ability to manipulate materials on atomic and molecular scales to produce tailored materials and devices may offer novel engineered applications for national security and is the focus of considerable public and private sector research. As with many technologies that are in an early phase of development, there is uncertainty about the misuse of these new technologies without fully understanding the effects of unforeseen nanotechnology applications. In this class, we will look at these competing pressures and the potential promise and risk from nanotechnology in the national security realm. This class will examine these changes and advances, the significance of the biotechnology and nanotechnology revolution and both the opportunities this presents for new technical capabilities that enhance national security, as well as the potential threats from proliferation.

Learning Objectives:

1) Describe the recent changes in biotechnology and the significance of these changes for national security considerations.
2) Distinguish between the challenges of naturally occurring and man-made biological threats.
3) Describe the science and technology and research and development fundamentals in developing biotechnology capabilities.
4) Define the threat posed by the nexus between biotechnology capability and proliferation.
5) Describe the multi-disciplinary nature of nanotechnology from scientific discoveries to engineered devices.
6) Describe nanotechnology and its potential applicability in broad terms to the national security arena.
7) Assess the costs and benefits of government-sponsored investments in nanotechnology research and the potential security implications.
8) Describe the national and international regulatory challenges associated with nanotechnology development and the corresponding security impact.
**Written Assignment Due:** One page TOR for group project.

**Class Readings:**


**Supplemental Reading:**

Lesson 11 (Apr 09). Swarms and Crowds

In 1978, Nobel laureate Thomas Schelling began to make researchers aware of the micro level motives of crowd behavior. More recently, technologists have begun to explore how the behaviors of swarms and crowds can lead to micro, or specific, actions. Agent-based models, swarm intelligence, and crowd sourcing are all concepts that leverage the behavior of large, interacting agents or communities to solve social and, more specifically, security problems. Crowdsourcing techniques have been used to improve disaster response operations. Swarms of drones are being developed to overcome enemy air defenses. Can the swarms and drones be controlled such that they achieve the desired effects and do not act independently when unwarranted?

Learning Objectives: TBD

Written Assignment Due: Group presentation status update.

Class Readings:


Supplemental Reading:


Lesson 12 (Apr 16): National Security Technology Futures

This class takes a look at the possible directions of many converging technologies into the future as well as new organizational structures within and between the research and national security communities that are altering how technology is developed and governed. While not making predictions of future technologies, we will explore where future global national security challenges are driven by technological change and how globalized science and technology communities are shaping how technology is developed and redefining proliferation and dual-use. Many of the specialized technology topics from earlier weeks will be revisited in this more comprehensive technology futures context.

Learning Objectives

1) Understand and describe the trajectory of various national security relevant technologies into the future.

2) Understand the multidisciplinary nature of future technology applications drawn from various and converging scientific disciplines.

3) Understand the changes in the relationships between national security stakeholders and the globalized science and engineering communities that foster innovation and develop new technology.

4) Describe the threats and opportunities posed from the global introduction of new technological platforms, and the ethical questions surrounding potentially unintended consequences of revolutionary technical capabilities.
Class Reading:


- Singer, P.W., Presentation to Cycon US 2017 [https://www.youtube.com/watch?v=g1ImFmQrqiA&index=10&list=PLtUuPz3a0Gz8dibTzZ-eAuLMHM1mprrpt](https://www.youtube.com/watch?v=g1ImFmQrqiA&index=10&list=PLtUuPz3a0Gz8dibTzZ-eAuLMHM1mprrpt)

Supplemental Reading:

Lesson 13 (Apr 23): Group Presentations—Part One

This class will be devoted to the first of the group presentation. We will review the group presentation in class, to be followed by an in class assessment.

Written Assignment Due: All final group first round draft. (10:00 p.m. 18 Apr)


This class will be devoted to the second round of the group presentations to be followed by an in class assessment. We will also conclude the course and follow up with a review of the class.

Written Assignment Due: Final report. Wed, May 7 10:00 p.m.