**INTA 4803/8803SG
Critical Infrastructures
(formerly Networks, Infrastructures, and Security)**

Spring 2019
Weds, 3:00 – 5;45 pm, 136 Habersham

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This syllabus is current as of December 30, 2018. It will be subject to change as opportunities or circumstances arise.

**Course Description**:

A more networked world has emerged since the end of the Cold War. Political, military, social and economic conflict, cooperation, and well-being are increasingly affected by the pervasive presence and availability of dense and large-scale networks.

We will generalize “security” beyond that of protection from malicious actors to include other forms of protection and assurance: safety, survivability, sustainability, resilience, reliability, response, renewal, robustness, and recovery.

We define infrastructures as large scale networks for creating and delivering goods and services, and 10-20 of these have been deemed so important that they have been declared Critical Infrastructures (CI). Among these are civil aviation, banking and finance, electric power, oil and gas, water and sewage, highways, bridges etc., and communications infrastructures ranging from telephony to the public media to the Internet of Things. For vast numbers of people and organizations around the world, CIs operationally define modern civilization and globalization.

Most of the physical infrastructures have information infrastructures deeply embedded in them. Some have gotten to the stage where the physical infrastructures may be increasingly seen as being built around the information infrastructures. As such the vulnerabilities and insecurities that plague information infrastructures are inherited by the physical infrastructures. The course will thus necessarily include an overview of the landscape of cyber security.

The class as a whole will consider three case studies in detail: (1) The CI dimensions of the 9/11 attacks, arguably the most important national and international security event since World War II; (2) civil aviation; and (3) electric power grids. Other CI will be studied as substantial student projects.

We expect to have about a half dozen guest presentations from people with real world responsibilities for the well being of critical infrastructures.

**Learning objectives**:

This course has three major learning objectives.. The first objective is to build content knowledge, developing a picture of both the ‘trees and the forest’ for specific areas of critical infrastructure. This content knowledge includes:

* Defining and categorizing the different types of critical infrastructures embedded in and operationally define modern society
* Identifying weaknesses in different infrastructures, including those vulnerabilities and access points that malicious actors could exploit
* Look to the well being of CI beyond concerns of security, including other forms of protection and assurance: safety, survivability, sustainability, resilience, reliability, response, renewal, robustness, and recovery
* Describing connection points and dependencies linking different critical infrastructures
* Assessing the degree to which certain groups of critical infrastructures operate as networks, with the attendant strengths, weaknesses and uncertainties inherent in complex dynamic systems.

Our class will give emphasis to operating in a challenging and less certain context than you are used to. This will include a fairly strong form of “flipping” where the students will take ownership of a substantial part of the content and conduct of the class. Working under that uncertainty is an important part of stretching you in all of the ways listed above.

**Common Sources**:

***The 9/11 Report, The National Commission on Terrorist Attacks Upon the United States,*** New York Times edition, St. Martin's Paperbacks, 2004. (Any edition will do.)

Ted Koppel, ***Lights Out: A Cyberattack, A Nation Unprepared, Surviving the Aftermath***, Crown, NY, 2015.

Judith Rodin, ***The Resilience Dividend, Managing disruption, avoiding disaster, and growing stronger in an unpredictable world***, London, 2015.

Bruce Schneier, ***Click Here to Kill Everybody: Security and Survival in a Hyper-connectedd World***, Norton, NY, 2018.

Video: “Eye in the Sky” (full length feature movie)

Readings will be designated by an identifying letter and a number, e.g., Chapter 4 of Rodin will be designated as R4.

Each student should identify a small number of media sources (broadcast, printed, social, other?) that regularly cover massively disruptive events involving CI and follow those throughout the semester. Starting with the third week, the final 15-20 minutes of every class will be devoted to discussing relevant events and developments that have arisen in the preceding weeks.

**Grading**:

Grading will be based on a combination of individual and group assignments. The breakdown is as follows:

25% Class participation, including weekly statements (to be explained).

20% Short writing and presentation assignments to be given over the course of the semester.

50% Team deliverables associated with the total effort of the “flipped” team coverage of focused topics. How this will be subdivided will be worked out in class.

5% Final exam

Reminder: Georgia Tech operates on an honor system.

**Weekly Schedule**:

Week 1

Jan 10: What we hope to accomplish in this course and how we are going to

do it. Discussion of various kinds of infrastructures and the spectrum of resilience and other characteristics of their well-being.

Assignments for this week (preparation for following week’s class):

Reading: 9/11 Commission Report Chapters 1-3 (9/11:1-3); Rodin Intro, R1.

Writing: Find at least 3 lists of “critical infrastructures” and bring them to class next week. Start by looking at the DHS web site.

Week 2

Jan 16: 3-4 pm, Einstein talk in SC Ballroom. Strongly recommended. Our class will reassemble in one of the small rooms near the ballroom at 4:10.

What we hope to accomplish in this course and how we are going to

do it. Selection of topics for small teams to look at the aftermath of 9/11. Choices for weekly media coverage.

Assignments for this week:

Reading:: 9/11:4-5; R2-R4

Writing: One page ‘personal bio sketch’ (to be discussed in class).

CI lists due

Week 3

Jan 23: Class discussion of the make-up of, and resilience in the Civil Aviation Infrastructure. How could the disaster of 9/11 have been avoided or lessened?

End class with a discussion of recent CI events and issues. We will spend the last 15-20 minutes of the remaining classes of the semester in this way.

Personal bio sketches due

Reading: 9/11:6-7. R5-R7

Week 4

Jan 30: A discussion of all of the ways critical infrastructures showed up in the events surrounding 9/11. Status reports for the post-9/11 teams.

Initial discussion of semester-long projects.

Reading: 9/11: 8-10, R8-R10

Week 5

Feb 6: Reports of the post-9/11 teams

Reading: Finish the 9/11 Commission Report, R11

Week 6:

Feb 13: The electric power infrastructures. Discussion of semester projects.

Reading: Koppel, Part I, Cyberattack (pp 3-92) (KI)

Feb 13: Tom Fanning, CEO Southern Company, will speak on the resilience of the regional electric power grid.

Reading: Koppel, Parts II and III, A Nation Unprepared and Surviving... (pp 93-250) and annotated bibliography for resilience of electric power grids.

Due: Annotated bibliography on power grid risks

Week 7

Feb 20: Discussions and proposals for the semester projects.

Due: One page proposals

Week 8

Feb 27: Very high tech global security infrastructures

View “Eye in the Sky”

Work on semester projects!

Week 9

March 6: Visiting lecture and discussion by GDOT Commissioner Russell McMurry on the destruction and reconstruction of the I85 bridge.

Due: Annotated bibliography on roads and bridges risks

Week 10

March 13: Visiting lecture and discussion by Jessica Gibson, FEMA. Seismic and other natural catastrophic threats to critical infrastructures and responses.

Readings on responding to seismic and other catastrophic threats

Week 11

March 20 Spring Break

Week 12

March 27: “U.S. Payments System as a Critical Infrastructure” Team from

 the Atlanta Federal Reserve Bank

Project status reports and evaluation assignments

 Reading: KI p. 3-92), Cyberattack

Week 13

April 3: The electric power infrastructures. Discussion of semester projects.

Reading: Koppel, Parts II and III, A Nation Unprepared and Surviving... (pp 93-250) and annotated bibliography for resilience of electric power grids.

Week 14

April 10: Tom Fanning, CEO Southern Company, will speak on the resilience of the regional electric power grid.

Project final presentations (4). All project papers are due. Copies to all graders.

Week 15

April 17: Last class day. Project final presentations. (4). All grading essays for the first 4 projects are due today.

Final Exam – This will be a take-home exam. Assigned time possibly used for the last couple of project presentations, or review and grading of all projects.

Allow 3 classes for student projects, or 2 classes with some projects mixed with other classes. Do we do the self grading exercise? Maybe have a unit/panel with another student as respondent/critique?

1 class for “Eye in the Sky” and network centric warfare (better term for the infrastructure). See if we have student expertise in class. Maybe do this in Feb, right after 9/11 classes as it relates to international terrorism.

2 classes on electric power. One for Koppel (April 3), one for Fanning (April 10)

2-3 classes on civil engineering infrastructures: Cindy Lee and Dennis.

2 classes on banking and finance: Phil G?, AFRB, Andy Ozment

3 classes on FEMA type problems: local (Atlanta public safety, first responders etc, After Feb 6); national (Gibson), international (Bell, Mar 6 or later).

Have all final project topics selected before the end of February. Go through a proposal vetting process in class. Count the proposal effort as a short presentation? or part of the 50% The 50% should include the respondent/critique effort for another student’s project.

Above would fill the rest of the semester.

Possible visitors:

Jessica Gibson, FEMA (possibly 2 subjects?)

Cindy Lee, CEE

Atlanta Federal Reserve Team (same as last year?)

Dennis Lockhart, public CE-type infrastructures

Andy Ozment, Goldman-Sachs

Robert Bell, CIP in NATO

Atlanta panel on public safety etc., especially as related to the Super Bowl

\*Post-9/11 team subjects. (2-3 people each), All to be delivered Week 5, Feb 6.

Landscape of the CA infrastructure, including the computer networks.

The cost of 9/11 to the CA infrastructure and what has been put into the CA infrastructure since then. (3 people)

The impact and costs outside of the CA infrastructure. (3 people)

A “map” and history of DHS.