

GEORGE MASON UNIVERSITY
Volgenau School of Engineering

SYST 680/OR 680/ECE 670: Principles of C4I

Fall 2017
Syllabus

Course Summary

People have studied Command and Control (C2) for centuries in the context of military operations. Over the past twenty-five years, researchers have extended C2 studies and thinking to include the contributions and role of communication, computer, and intelligence, (C4I) technologies in support of command and control. Additionally, C4I studies are now an integral part of disaster and emergency response management, and are being applied other complex operations. This course will provide engineering students with an appreciation of the complexities involved in the design, development of enterprise-wide C4I systems. The scope will include military command and control, as well as the theory, application and practice including C4I technologies and the design of C4I applications.

Course Goal

The course will provide students with a balanced overview of the basic principles of C4I (Command, Control, Communications, Computers, & Intelligence). The successful student will understand the complex relationship that exists among the engineering, psychological, and social issues that make up the design, development, deployment, and application of C4I systems.

Instructor

Name: Dr. Tom Clemons

Email: tclemons@gmu.edu (preferred method of communication)

Phone: (703) 993-5886

Office: Engineering Building Room 2226

Office Hours: Wednesdays 2-4 pm or by appointment.

Prerequisites:

Required: ECE 528 - Introduction to Random Processes in Electrical and Computer Engineering, or OR 542 - Operations Research: Stochastic Models.

Learning Outcomes

- Evaluate the elements of a C4I architecture, describe their major interfaces, and communicate key information through prevailing formats.
- Apply fundamental methods of analysis and evaluation used in designing C4I systems and assessing their performance.
- Develop and assess C4I architecture to meet defined mission requirements using systems engineering tools and processes.
- Synthesize a mission concept through a development team project.

References and Readings:

- Alberts, D. & Hayes R. (2006) Understanding Command & Control Command and Control Research Program, Washington D.C.
- Maxwell, D. & Tucker, C. (2014) “Refining The Intelligence Cycle: Adapting to an Era of Population-Centric Security Challenges”, in Human Geography: Socio-Cultural Dynamics and Challenges to Global Security, USGIF Monograph Series Volume 1, 2014.
- Alberts and Hayes (2006) Power to the Edge, DoD CCRP, Washington D.C.

Course Schedule

Date	Topic	Reading Assignment
Aug 30	Class Intro and Lesson 1: Overview of C4I Systems Engineering & Command Intent	Alberts & Hayes – C-2 Chapters 1-4
Sep 6	Lesson 2: C2 Fundamentals, Enduring Principles, and Conceptual Models	Alberts & Hayes Chapters 5-10
Sep 13	Lesson 3: Military Decision Making Process/Operational Planning	FM101-5
Sep 20	Dan Maxwell Guest Lecture: Intelligence Processes	Maxwell & Tucker (2014)
Sep 27	Lesson 4: Decision making in uncertainty	Clemon – Structuring Decisions Clemon - Making Choices
Oct 4	Lesson 5: Decision Support Modeling for C2	Clemon – Value of Information
Oct 11	Lesson 6: Representing Knowledge - Data and Information Management	
Oct 18	Lesson 7: Communication Systems	
Oct 25	Lesson 8: Computer Networking - Part 1	
Nov 1	Lesson 8: Computer Networking - Part 2	
Nov 8	Lesson 9: Situational Awareness - Sensing and target detection	
Nov 15	Lesson 10: Estimation/Information Fusion	
Nov 22	No Class --- Thanksgiving Break	
Nov 29	Lesson 11: Implications of Advanced Technology: Issues and Opportunities – Artificial Intelligence	Group Presentations
Dec 6	Lesson 12: Challenges to C4I – Cyber/Propaganda and Deception	Group Presentations
Dec 13	Final Exams Due	Exam

Performance-based Assessments and Grading:

1. Homework (30%):

You learn the material through homework and practice. I will assign homework weekly except during exam weeks and is due at the beginning of class the following week. Unless you make prior arrangements, I will not accept late homework. You must show your work to achieve full credit. I will give partial credit for incorrect solutions.

2. Paper Presentation (10%):

Students will select a topic from the syllabus and present a review of a technical paper covering that topic. A 20-minute presentation will be a case study to augment lesson material that week.

3. Final Exam (30%):

The course will include a final at the end of the year. The exams will be closed book, and timed. You must show your work to achieve full credit. I will give partial credit for incorrect solutions.

4. Design Project (30%):

Students will develop and assess a design of a C4I system

I will assign final grades as follows:

A/A-:100-93, 92-90%, **B+/B/B-:** 89-87, 86-83, 82-80%, **C+/C/C-:** 79-77, 76-73, 72-70%, **F:** < 70%

Course Expectations/Policy

1. Blackboard: I will use Blackboard for all course logistics. I expect students to have access and be able to use the system before classes start. Blackboard is accessible via the MyMason portal at <https://mymasonportal.gmu.edu/>. The “resources” link at the bottom of the portal page provide instructions for using the Blackboard system. Failure to access the system due to lack of knowledge on Blackboard is not an excuse for missing classes, late assignments, or failing course deliverables.
2. Class attendance: Class attendance is essential. Information will be presented that will not necessarily be in the book, and is certain to be needed in course assignments.
3. Inclement weather: Check the Announcements area for the course for updates.
4. Electronic devices (such as laptops, cell phones, etc.): Please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class. Such disruptions show a lack of professionalism and may affect your participation grade.
5. Correspondence: Mason Email is the official method of communication. Students must check their GMU email messages on a daily basis for course announcements, which may include reminders, revisions, and updates.
6. Homework: Students are encouraged to interact on homework assignments, but your write-up must be your own. Assignments provide practical, hands-on experience with the ideas presented in the course. Late assignments, when properly justified, will receive reduced credit in accordance with the late assignment policy (below in this document). I will reward no points for homework turned in after I have posted solutions.
 - a. Changes to assignment dates and scheduling provided below are possible. I will post changes to Blackboard through email. It is the students’ responsibility to keep abreast of any changes.
 - b. Students will submit all course deliverables electronically. I have already provided the schedule for these deliverables in this syllabus. That said, there is some flexibility for students to request changes, but you must make these requests well in advance. Should any scheduled event affect a student’s participation in class activities and assignments, it is the student's responsibility to coordinate with me prior to the event.
7. Computing: Volgenau School Computing Resources has answers to many questions about school systems on their web site: <http://labs.vse.gmu.edu> and will try to help you if have problems connecting to school computing systems. However, they will not provide assistance with general computing questions or course assignments. If you have any questions about how to use software to complete your assignments, please refer to the following document: <http://labs.vse.gmu.edu/uploads/FacultyFAQ/StudentWelcome.pdf>

Other resources that you may find helpful may be found at:
<http://ctfe.gmu.edu/teaching/student-support-resources-on-campus/>

School Policies

University Policies

Students must follow the university policies. [See <http://universitypolicy.gmu.edu>].

Academic Integrity

Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See <http://oai.gmu.edu>].

Honor Code

Students must adhere to the guidelines of the George Mason University Honor Code [See <http://oai.gmu.edu/mason-honor-code/>].

MasonLive/Email (GMU Email)

Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account. [See <https://masonlivelogin.gmu.edu>].

Patriot Pass

Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Blackboard, University Libraries, MasonLive, myMason, Patriot Web, Virtual Computing Lab, and WEMS. [See <https://password.gmu.edu/>].

Responsible Use of Computing

Students must follow the university policy for Responsible Use of Computing. [See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing>]. Students are expected to follow courteous Internet etiquette.

University Calendar

The course follows the university calendar that includes holidays, withdrawal dates, and exam schedules. [See <http://registrar.gmu.edu/calendars/fall-2017/>].

- **Religious Holidays:** A list of religious holidays is available on the University Life Calendar page (<http://ulife.gmu.edu/calendar/religious-holiday-calendar/>). Any student whose religious observance conflicts with a scheduled course activity must contact the Instructor at least 2 weeks in advance of the conflict date in order to make alternative arrangements.

Students with Disabilities

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu>].

Student Services

University Libraries

University Libraries provides resources for distance students. [See <http://library.gmu.edu/distance>].

Writing Center

The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. [See <http://writingcenter.gmu.edu>].

You can now sign up for an Online Writing Lab (OWL) session just like you sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment! Learn more about the [Online Writing Lab \(OWL\)](#) (found under Online Tutoring).

Counseling and Psychological Services

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu>].

Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights. [See <http://registrar.gmu.edu/privacy>].