OR 683 / SYS 680 / ECE 670
Principles of C4I

Instructor: Daniel T. Maxwell, Ph.D.
Location: Nyugen Engineering Building Room 2608
Time: Tuesday 7:20-10:00

I. Objective

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 must be addressed in the design, development, deployment, and application of C4I systems.

II. Course Theme

Command and Control (C2) has been studied for centuries in the context of military operations. Over the past twenty-five years C2 studies and thinking has been extended 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."

The course will consist of a mixture of lectures, guest speakers, and practical exercises intended to provide students with an appreciation of the multi-disciplinary nature of the C4I domain and some strategies for meeting C4I challenges presented when providing engineering support for complex systems of systems.

III. Readings

a. Sweeney, M. (2002) *An Introduction to Command and Control,* Naval Post Graduate School, Monterey. (Available on Kindle)
b. Alberts, D. & Hayes R. (2006) *Understanding Command & Control* Command and Control Research Program, Washington D.C.
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.
d. Alberts and Hayes (2006) *Power to the Edge,* DoD CCRP, Washington D.C.

e. Maxwell & Davis (2013) "*Value Focused Metrics for Emergency Management Planning",* with David F. Davis, Defence Research and Development Canada Centre for Security Science, Reports DRDC CSS 2013 – 021,022,023.

IV. Course Outline (By Week)

	Principles of C4I	Reading Assignment
Date	**Topic**	
Aug 30	Class Intro and Overview of C4I Systems Engineering & Command Intent (Dr. Hieb)	Alberts & Hayes – C-2 Chapters 1-4
Sep 6	C2 Fundamentals, Enduring Principles, and Conceptual Models (1 of 2)	Alberts & Hayes Chapters 5-8
Sep 13	C2 Fundamentals, Enduring Principles, and Conceptual Models (2 of 2)	Alberts & Hayes Chapters 9-10
Sep 20	Intelligence Processes	Maxwell & Tucker (2014)
Sep 27	Situational Awareness / Information Fusion / Computational Models of Uncertainty	Sweeney Chapters I-IV
Oct 4	a. Decision Making and Decision Support Modeling for C2 b. Introduce Project	Sweeney Chapters V-VIII
Oct 11	No Class – (Columbus Day)	Alberts and Hayes PTTE
Oct 18	Operational Planning Processes and Frameworks	Alberts and Hayes PTTE
Oct 25	Introducing Network Centric Concepts -- "Power to the Edge"	Alberts and Hayes PTTE
Nov 1	a. David Alberts Guest Lecture on Agility b. Measuring C4I Effectiveness	Maxwell & Davis (2013)
Nov 8	Issues in Data and Information Management	Project Work
Nov 15	Implications of Advanced Technology: Issues and Opportunities	Project Work
Nov 22	C2 Concept Development and Experimentation	Project Work
Nov 29	Implications for C4I Systems Design and Engineering in the future (2- Group Presentations)	Review / Project Work
Dec 6	Review / Hand out Final Exams (3- Group Presentations)	Review
Dec 13	Final Exams Due	Exam

Instructor Availability

The instructor will be available for assistance before and after class, or by appointment. Call (703) 409-7828 to arrange a time.

V. Grading Policy

a. Homework 30%
b. Class Participation 10%
c. Case Study / Project Presentation & Report – 30%
d. Final exam – Take Home 30%

VI. Supplemental Readings:

a. Command and Control – Agility

i. Alberts (2011) *The Agility Advantage* DoD CCRP, Washington D.C.
ii. Brehmer, B. (2005) *The Dynamic OODA Loop: A New Basis for Development of C2 Systems,* Swedish National Defence College.
iii. Brehmer, B. (2014) "Command Without Commanders" *Proceedings of the 14th ICCRTS,* Washington D.C.

b. Risk and Uncertainty

i. Savage, Sam. *The flaw of averages: why we underestimate risk in the face of uncertainty.* Hoboken, New Jersey: John Wiley & Sons Inc, 2009. Print ISBN: 978-0-471-38197-6

ii. Anything by Paul Slovic

c. Planning and Decision Making

i. Klein, G. (1998) *Sources of Power: How People Make Decisions,* MIT Press, Cambridge
ii. Kahneman, D. *Thinking Fast and Slow,* Farrar, Strauss & Giroux, 2011 Print ISBN978-0-374-27563
iii. Keeney, R. (1992) *Value Focused Thinking,* Harvard Press, Cambridge.

d. Complexity

i. Dörner, Dietrich. *The logic of failure: recognizing and avoiding error in complex situations*. Basic Books, 1996. Print. ISBN: 978-0-201-47948-5

e. Architectures

i. Spewak, S. (1992) *Enterprise Architecture Planning,* Wiley Press, New York

ii. Anything that explores the Zachman Framework

iii. Wisnosky, D. (2006) *DoDAF Wizdom,* Wizdom Systems, USA.

f. Intelligence

i. Charters, David, Stuart Farson, and Glenn Hastedt. *Intelligence analysis and assessment*. Great Britain: Frank Cass & Co. Ltd, 1996. Print. ISBN: 0-7146-4249-5

ii. Clark, Robert. *Intelligence analysis: a target-centric approach*. 2nd. Washington, DC: CQ Press, 2006. Print. ISBN: 978-1-933116-93-8

iii. Lowenthal, Mark. *Intelligence: from secrets to policy*. 3rd. Wasington, DC: CQ Press, 2006. Print. ISBN: 1-933116-02-1

g. **Disaster Planning and Assessment**

i. Rubin, Claire (Ed.) *Emergency Management: The Amercian Experience 1900-2010,* 2012, CRC Press.
ii. Pine, John, *Technology in Emergency Management,* 2007, Wiley.