Version of February 7, 2013

**Defense Analysis (Spring 2013)**

***SAIS 660.776***

***Wednesday, 1830-2030/6:30 PM – 8:30 PM, Rome 205***

**Adjunct Professor Mark F. Cancian**

**Course description**

Concept. This course explores the connection between quantitative analysis and policy formulation. The course will cover many types of analyses, not only the classic kinds of defense analysis – cost-effectiveness and combat models – but also budget, manpower and cost analyses. Although aimed at students going into national security positions, the analytical methods and approaches covered in the course are broadly applicable.

The purpose is not to make quantitative analysts of students but to make them intelligent consumers of analytical products. Why bother with quantitative analysis? Because in policy debates some numbers beat no numbers every time. Without some appreciation of quantitative techniques, policy analysts are at a severe disadvantage.

The intention is practical and concrete, to aid in making better decisions in the real world. The course aims to be directly useful in a student’s next job and in getting that job.

Structure. The course uses case studies, historical examples, readings and exercises to investigate how quantitative analysis is used in deciding major policy issues. Teaching is through a combination of lecture and discussion. Virtually every class has a case, “caselette”, or exercise to give students a chance to apply to a concrete situation both their own experience and what they learned from the readings.

Sessions are grouped into four general areas: analysis and policy, analysis of conflict, major systems acquisition, and financial issues.

There are no prerequisites. Some knowledge of military history and defense policy can be moderately helpful, but previous course experience shows little connection between such knowledge and the final grade. No prior knowledge of quantitative analysis is needed nor are any special mathematical skills required. However, a high level of discussion participation will be expected of every student.

Course themes:

* Good analysis can produce insights that inform decision making … and decision makers want help.
* Analysis is accessible to everyone, not just those with quantitative analysis degrees.
* What is inside a number is not always obvious; it is important to understand what a number consists of.

## Assumptions about model inputs drive the outputs.

* Multiple analyses, not a single number, illuminate an issue.
* Analysis does not produce certainty but it can clarify choices.
* Policy analysis without quantitative analysis is sterile.

**Administrative Instructions**. These will be discussed in detail at the first class. Here’s a synopsis.

Electronic sources. This course will make extensive use of Blackboard and the ERES system.

Professor’s notes.These will be provided before each class to explain the purpose of the readings and how to approach that week’s discussion exercise.

Readings.No texts to buy, no packet of readings. Readings are mostly on ERes and total about 100 pages of fairly dense material each week. They include many classics in the analytical world and cover the breadth of the literature – governmental organizations like GAO, think tanks like RAND and Institute for Defense Analyses, academic commentators. Readings also include some dissenting literature that questions fundamental assumptions.

Grading

(1) Class participation (20% of final grade). Participation is important and expected.

(2) Two two-page memos (20% of final grade each, total 40%). These are structured as a memo to a senior official analyzing a real-world problem.

(3) Final examination (40% of final grade), 3 hours, essays and problems covering the semester’s material.

Collaboration. Collaboration is encouraged in preparing for class and in problem solving in class. However, the papers and exam must be individual efforts.

Contact information

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Office hours: Before class

At office by appointment

Course prerequisites: None

Auditors: Auditors are allowed BUT they must be prepared every week so they can participate in the discussion.

**1. Introduction: Analysis and Leadership**

Purpose: To discuss the role of analysis in decision-making and the implications that has for the quality of decisions, the responsibilities of senior policy officials, and civil-military relations.

## First 45 minutes of class: Course description, requirements, overview

## Elements:

* How, and how much, to relay on the judgments of line organizations
* The appropriate role of resources in decision-making
* The leader’s role: oversight v. advocacy, leadership v. management, referee v. player
* Information and analysis as levers of bureaucratic power

## Readings:

* Enthoven and Smith, How Much is Enough?, p.1-8, 31-47, 60-72, 113-116 [single file on ERes]
* Tarpgaard, Peter T., “McNamara and the Rise of Analysis in Defense Planning”, Naval War College Review, autumn, 1995, p.67-87
* Lawrence J. Korb, The Fall and Rise of the Pentagon, ch. 3 “A New Kind of Secretary of Defense”, esp. p. 81-92

Cases (distributed in class): Canceling the Crusader Howitzer; Measuring Progress in Iraq

**2. What is analysis and how is it done?**

Purpose: To discuss how analysis works, the process by which it is conducted, and the tradeoffs involved.

##### Elements:

##### The analysis process dissected – inputs, assumptions, data, model structure, asking the right question

##### The history of Operations Research/Systems Analysis

* How the process of analysis can affect the outcome
* The relationship between analysts and decisionmakers
* Keeping score – picking the right measures of effectiveness
* How model structure affects the result

Readings:

* Analysis for Public Decisions (Third Edition), E.S. Quade, p.13-97, 127-170 (not on ERes)
* Models, Data and War, GAO, Ch. 2 and Appendix I
* Fundamentals of Naval Operations Analysis, Garrett and London, 1970, p.1-18

###### Case: The United Kingdom’s Strategic Defense Review of 1998 (“The Strategic Defense Review Process”; “Future Military Capabilities” with Annex A and B, -- in one file on ERes and at

<http://www.mod.uk/NR/rdonlyres/65F3D7AC-4340-4119-93A2-20825848E50E/0/sdr1998_complete.pdf> )

**3a. Analysis Case Study: Strategic Mobility**

Purpose: To apply our discussion of the analysis process to a real world example.

Reading: The Art of Case Analysis, Robert Ronstadt, p.1-22

Strategic Mobility, Background Note, US Naval War College

Case: “Congressionally Mandated Mobility Study (CMMS)” and “CMMS Update”

Reference: “Statement of BG Michelle D. Johnson, USAF, on the Mobility Capabilities and Requirements Study”, July 13, 2010

**3b. Communicating in the Bureaucracy/Writing Effective Memos**

Purpose: To discuss what makes an effective memo, in preparation for the first paper assignment.

Reading: Assignment Pentagon, (2d edition), Perry M. Smith, p.38-88

Tongue and Quill, Staley, p.21-86 [Not on ERes]

“Some Thoughts on Writing”, Professor Eliot Cohen

The Visual Display of Quantitative Information, Edward Tufte, p.9-51

**ANALYSIS OF CONFLICT**

4. **Analyzing a Campaign**

## Purpose: To consider the assumptions built into campaign scenarios and models, and their effects on policy and budgets.

## Elements:

## Assumptions about campaign structure and their implications

* + Decisions about where, who, and how to fight
  + Victory conditions and conflict termination
  + Warning, deployment, and the outbreak of conflict
  + Campaign phases
  + Conventional campaigns and counterinsurgency campaigns
* Implications of these assumptions for budgets and force structure

## Readings:

* “Conventional Campaign Analysis of Major Regional Conflicts”, Frostic and Bowie, in P. Davis, New Challenges for Defense Planning, RAND, 1994
* “Capabilities for Major Regional Conflicts”, Davis, Hillestad and Crawford, in Khalilzad and Ochmanek, Strategy and Defense Planning for the 21st Century
* Joint Operational Planning, Joint Pub 5-0, 2006, “Phasing”, p.IV-32 – IV-38
* Counterinsurgency Warfare – Theory and Practice, David Galula, Praeger, 1963 p.107-135 and U.S. Army Handbook of Counterinsurgency Guidelines for Area Commanders, 1966, p.25-29 (both contained in a single file on ERes)

Exercise: Gaffney v. Adams: Alternative Approaches to a Conventional Conflict in Korea5**. Combat Models: What are they and how do they work?**

## Purpose: To examine the structure, dynamics and assumptions inside combat models – a nontechnical discussion –, how these affect outcomes, and how outcomes affect policy.

## Elements:

## Lanchester’s equations made easy

* Firepower scoring
* Campaign combat models
* Rate of advance calculations
* Overview of TacWar – the most common combat model

Readings:

* Aircraft in Warfare, Lanchester, FW, ch. 5 and 6 (“The Principle of Concentration”)
* US Ground Forces and the Defense of Central Europe, Wm Mako, Appendix A (p.105-125)
* “The Laws of Combat? Lanchester Reexamined”, J.W.R. Lepingwell, International Security, Summer, 1987, p.89-135
* The Military Applications of Modeling, John Battilega and Judith Grange, editors, p.7-74 (particularly 63-74)
* Optional: Military Modeling for Decision Making, Wayne Hughes, Jr. editor, Ch 4, “Ground Battle Models” (p.162-177), and ch. 6 “Joint Modeling and Analysis” (p. 192-205)

###### Exercise (outside class): Simple model of Lanchester attrition laws (on ERes as Excel file)

###### Case: Planning the Counteroffensive in Operation Desert Storm (1991)

**6. Wartime Operations: Attrition**

Purpose: Using a simple mathematical formula, to gain insight into the dynamics of attrition and then to consider their policy implications

Elements:

* The mathematics of attrition
* Applying the mathematics to operational situations and understanding the implications of the result

## -- Attrition in ground and air combat

-- Naval barrier operations

-- Air defense intercepts

-- Munitions accuracy (CEPs)

Readings:

* Probability Without Tears, D. Rowntree, p. 1-74 [not on ERes]
* Army Ground Forces: The Procurement and Training of Ground Troops, p.181-225
* Williamson Murray Strategy for Defeat: The Luftwaffe 1933-1945 (also, revised version, Luftwaffe) ch. V (optional), VI, Appendix 2 and 3 (p. 209-263, 341-343) [ch. VI on ERes]
* Ambrose, S., Citizen Soldiers, ch. 11 “Replacements and Reinforcements” (p.273-289)
* Optional: Memphis Belle (video)

Case: Recruiting for the Waffen SS

**7. Force Structure: What do we have and why do we have it?**

Purpose: To discuss why nations maintain armed forces and the factors that shape their design

Elements:

* Review of force structure by service
* Issues in counting – what counts, what does not, and why it makes a difference
* Peacetime v. wartime demands on military forces
* Threats – nations, timelines, weapons
* Forward deployments and rotation bases
* “Tooth-to-tail” – how much combat power, how much support
* Allies and Host Nation Support (HNS)

Readings:

* “Force Development in the Longer Term”, Ruskell, RUSI Seminar Report, 1998
* Quadrennial Defense Review Report, Feb 2010, p.39-47
* Sustaining U.S. Global Leadership, Jan 2012, esp. “Primary Missions of the U.S. Armed Forces” <http://www.defense.gov/news/Defense_Strategic_Guidance.pdf>
* How Much is Enough?, Enthoven and Smith, p. 132-142 in ch. 4 “NATO Strategy and Forces”
* “New Principles for Force Sizing”, Davis and Kugler, in Khalilzad and Ochmanek, Strategy and Defense Planning for the 21st Century
* Driving in the Dark: Ten Propositions about Prediction and National Security, Danzig, Center for a New American Security, 2011, esp. p.5-17 (on ERes and <http://www.cnas.org/drivinginthedark>)

Case: The United Kingdom Strategic and Security Review of 2010: Why did the forces get smaller? (MOD fact sheet; chapter 2 “Defense sections 2.1 to 2.A.17) on ERes and at <http://www.mod.uk/DefenceInternet/DefenceNews/DefencePolicyAndBusiness/StrategicDefenceAndSecurityReviewPublished.htm> and <http://www.direct.gov.uk/prod_consum_dg/groups/dg_digitalassets/@dg/@en/documents/digitalasset/dg_191634.pdf>

**8a. Force Structure (Cont)**

###### Purpose: To apply in a practical exercise the insights into force structure design from class #7

Readings:

* U.S. Navy Program Guide 2012, US Navy, 2012, Introduction (“Meeting Today’s Challenges and Preparing for the Future”), skim Appendix A “Crisis Response and Combat Actions”. [Sections 1- 6 give details on each ship type, if you need this for background.] <http://www.navy.mil/navydata/policy/seapower/npg12/top-npg12.pdf>
* Excerpts from CBO and CRS shipbuilding reports (3 pages). Full reports are at <http://www.cbo.gov/sites/default/files/cbofiles/attachments/07-25-12-NavyShipbuilding_0.pdf> and <http://assets.opencrs.com/rpts/RL32665_20110228.pdf>

###### Exercise: Navy Force Structure Exercise -- Designing a Navy

WEAPONS ACQUISITION

**8b. Weapons Acquisition: How can analysis help us decide what to buy?**

Purpose: To discuss how quantitative (and non-quantitative) considerations go into generating requirements for new acquisition systems

Elements:

* Analysis v. politics in setting requirements
* Threat analysis
* Scenario development
* Analysis of alternatives
* Impact of performance specifications

Case: “Trident: Setting the Requirements” (KSG case C15-88-802.0)

Readings:

* New Weapons, Old Politics, Thomas L. McNaugher, Brookings Institution, 1989, Ch. 5 (p.123-150)
* DOD Instruction 5000.02 “Operation of the Defense Acquisition System”, Enclosure (2) “Procedures and Enclosure (7) “Resource Estimation”  
  <http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf>

Info video of Trident launch on course web site

**9. What is cost and how do we measure it?**

Purpose: To discuss the different ways to measure cost, the different ways of developing a cost estimate, and how different costing procedures produce different results.

Elements:

* Why estimating costs on large military and civilian projects is so difficult
* Types of costs: fly away, unit procurement, total program, life cycle
* Types of estimates: parametric (top down), work breakdown structure (bottom up)
* Learning curves
* Average v. marginal costs
* Overhead and production rates

Readings:

* Arming America, J. Ronald Fox, p.153-169
* Analysis for Public Decisions, (Third Edition), E.S. Quade, p.108-123 (section on cost)
* Defense Management Systems College Teaching Notes
  + “Introduction to Cost Analysis”
  + “Cost Estimating Methodologies”
  + “Application of Learning Curve Theory to Systems Analysis
* Cost Considerations in Systems Analysis, GH Fisher, RAND, 1970, p.120-130

Cases: V-22 Costs – A Debate; Selected Acquisition Report (SAR)

**10. Cost Growth: What is it and why does it happen?**

Purpose: To consider what constitutes cost growth, what causes cost growth, and the ethical questions that arise.

Elements

* Defining and measuring cost growth
* Causes of cost growth
* Contract structure and its effect on cost
* Ethical dimensions – when does optimism become, in effect, a lie?

Readings:

* An Analysis of Weapons System Cost Growth, RAND, 1993, p.1-53 [Not on Eres, but at <http://www.rand.org/pubs/monograph_reports/2006/MR291.pdf>]
* Is Weapon System Cost Growth Increasing?, RAND, 2007, p.xv-xxi (summary)
* Augustine’s Laws, Norman R. Augustine (1986), p.101-131
* Defense Facts of Life: The Plans Reality Mismatch, Franklin C. Spinney, Westview Press, 1985, p.125-168
* “Ethics and Advocacy in Forecasting Public Policy”, Martin Wachs, Business and Professional Ethics Journal, Vol. 9, No. 1 & 2, 1990, p.141-157
* Lying: Moral Choice in Public and Private Life, Sissela Bok, Pantheon, 1978, p.11 (bottom)-16

## Exercise: What does a V-22 cost? [Handed out in class #9]

## Case: “Black Hole”, Government Executive, April 2001 w/ excepts from Dept. of Transportation IG Reports, 10 Feb 2000 and 29 Nov 2000; (for background, see [www.massdot.state.ma.us/highway/TheBigDig.aspx](http://www.massdot.state.ma.us/highway/TheBigDig.aspx))

**11. Cost-Effectiveness: Using Analysis to Make Tough Choices**

Purpose: To consider the elements of a cost-effectiveness analysis.

Elements: Defining effectiveness quantitatively (static v. dynamic comparisons), equal cost v. equal effectiveness analyses, assumptions imbedded in scenarios, the difficulties in forecasting capabilities, choices in picking Measures of Effectiveness

Readings:

* A History of Cost Effectiveness, E.S. Quade, 1971, RAND (22 pages)
* Fundamentals of Naval Operations Analysis, Garrett and London, 1970, p.161-173, 182-185
* Models, Data and War, p.38-48
* Limitations of a Cost Effectiveness Approach to Military Decision-Making, E.S. Quade, 1963, RAND (12 pages)
* A Critique of Cost Effectiveness, E.S. Quade, 1975, RAND (7 pages)
* Concepts of Cost for Use in Studies of Effectiveness, David Novic, 1957, RAND

Case: Study of the V-22 by the Institute for Defense Analyses (in transcript of Senate Hearing 101-934, FY 1991)

Background: [www.boeing.com/rotorcraft/military/v22](http://www.boeing.com/rotorcraft/military/v22); [www.navair.navy.mil/v22/](http://www.navair.navy.mil/v22/)

Financial issues

12. **Budgets as strategy: Uncovering the story behind budget numbers**

Purpose: To consider the defense budget from a variety of financial and historical perspectives.

Elements:

* Top line budget measures (% of federal budget, % of GDP, current dollar, constant dollar, budget projections)
* Composition of the budget (by function, Major Defense Program, appropriation, service shares)
* Historical trends
* Defense budgets of other nations
* Problems of cross-national fiscal comparisons
* Sector impact

Readings:

* Introduction to Budgeting, John Wanat, p.88-104, 159-170
* Analysis of the FY2014 Defense Budget Request, Center for Strategic and Budgetary Assessments (also at [www.csbaonline.org](http://www.csbaonline.org)) [publication data pending]
* DoD FY 2014 Budget Request Overview, ch. 1-4, 6 [<http://comptroller.defense.gov/Budget2014.html>]
* Defense Death Spiral, Franklin C. Spinney, unpublished monograph/briefing,   
  <http://www.pogoarchives.org/labyrinth/01/05.pdf>

Case: National Defense Budget Estimates for the FY2014 Budget (Comptroller budget backup data), Publication expected March 2013, (Assigned sections will be in one file on ERes, full document at <http://comptroller.defense.gov/defbudget/fy2014/FY14_Green_Book.pdf>

ch. 1 (overview, tables 1-2,1-4,1-7), 2-1 (total DOD only), 3-2, 5 (definitions, tables 5-1,5-2,5-4,5-10, 5-11,5-12), 6 (tables 6-1,3,5,16 (last page only),17 (last page only),18 (last page only) ), ch. 7 (tables 7-2,5).

Note: These readings will be updated to reflect the FY 2014 budget when these materials become available in March 2013.

13**. Deciding who does what -- Active duty military, reservists, civilians and contractors**

Purpose: To analyze the characteristics of the four kinds of manpower, their implications for cost and usage, and their resulting effects on national security policy.

Elements:

* Characteristics of the four kinds of manpower: active duty military, reserve military, government civilian, civilian contractor
* Strengths, weaknesses, and policy implications of each type
* Full costing – including retirement, recruiting, allowances, support
* Achieving a balance among the different types of personnel
* Defining “core” governmental activities

Readings (many individual readings but not large in total volume):

Active v. reserve military:

* Commission on the National Guard and Reserves, Second Report to Congress, March 1, 2007, p.7-18
* Structuring US Forces After the Cold War: Costs and Effects of Increased Reliance on the Reserves, CBO, 1992, Ch. 2, “Issues Involved in the Mix of Active and Reserve Forces”,
* Comprehensive Review of the Future of the Reserve Component, DoD, 2011, p.15-34

Military v. government civilian

* DOD Force Mix Issues: Greater Reliance on Civilians in Support Roles Could Provide Significant Benefits, GAO, 1995 (NSIAD-95-5), p.10-29

Government civilian v. contractors:

* Privatization—Toward a More Effective Government, President’s Commission on Privatization, March 1988, p.1-5, 129-142
* D. Kettl, Sharing Power, The Brookings Institution, p.1-65 [not on ERes]

Contractors v. military (a single .pdf file on ERes):

* Logistics Support for Deployed Military Forces, CBO, 2005, p.ix-xvi (summary), p.1-26

Case: Forces for Homeland Security