

# Understanding Military Technology 2002

## Syllabus

SAIS 660.774, Thursday 0800-1000, Rome 200

### Purpose

This course aims to develop students' ability to analyze military technology, that is: to identify and comprehend the central technical facts; to discern patterns in the evolution of such technologies; to understand how component technologies become parts of larger systems; to explore how military organizations vary in their exploitation of the same basic technologies; and finally, to appreciate the nature of technological interaction among competing organizations. The course also aims to teach students how to present technical matters to a lay audience clearly and concisely, orally and in writing, and to develop various group work skills. Strategy & Policy is not a prerequisite, but strongly recommended. No technical background required.

### Course requirements and grading

Student work will center on a Defense Science Board task force simulation. Students will be divided into groups of four: each group will have a combination of collective and individual assignments. Grading will be as follows: 25% class participation; 25% individual assignments (one briefing and one memorandum); 50% collective work. There will also be one pass/fail quiz in week #5. There will be no final exam, but depending upon student interest there may be a field trip.

#### **1. Concepts** (24 January)

##### **General readings**

J. F. C. Fuller, Armament and History (New York: Charles Scribner's Sons, 1945), Chapter 1, "Armament and History," pp. 1-23. 23 pages.

#### **2. Design philosophy** (31 January)

##### **General readings**

James L. Adams, Flying Buttresses, Entropy, and O-Rings: The World of an Engineer (Cambridge: Harvard University Press, 1991), Chapter 4, "Design and Invention: The Concept," pp. 78-105. 28 pages.

**Case: tank design 1940-43**

J. A. I. Agar-Hamilton and L. C. F. Turner, The Sidi Rezeg Battles 1941 (London: Oxford University Press, 1957), Ch. 3, "Tank and Anti-Tank: November 1941," pp. 31-58. 28 pages.

Constance McLaughlin Green, Harry C. Thomson, and Peter C. Roots, The Ordnance Department: Planning Munitions for War (Washington, D.C.: Office of the Chief of Military History, 1955), pp. 275-301. 27 pages.

### **3. Tradeoffs** (7 February)

#### **General readings**

Winston S. Churchill, The World Crisis, 1911-1914 (New York: Charles Scribner's Sons, 1926), Ch. 6, "The Romance of Design," pp. 125-49. 25 pages.

**Exercise: designing an aircraft carrier;** to be distributed

### **4. Innovation** (14 February)

#### **General readings**

Thomas P. Hughes, American Genesis: A Century of Invention and Technological Enthusiasm (New York: Penguin Books, 1989), Ch. 3, pp. 96-137. "Brain Mill for the Military." 42 pages.

Martin van Creveld, Technology and War (New York: Free Press, 1989), Ch. 15, "The Invention of Invention," pp. 217-32. 16 pages.

Henry Petroski, The Evolution of Useful Things (New York: Vintage Books, 1992), Ch. 2, "Form Follows Failure," pp. 22-33. 12 pages.

#### **Cases: the laser guided bomb; "Window"**

P. Deleon, "The Laser Guided Bomb: Case History of a Development," Santa Monica: RAND, 1974 (R-1312-1-PR). 60 pages.

Reginald V. Jones, The Wizard War (New York: Coward, McCann & Geoghegan, 1978), Chapter 33, "Window," pp. 287-99. 13 pages.

### **5. Measure/countermeasure** (21 February)

#### **General readings**

Edward Luttwak, Strategy: The Logic of War and Peace (Cambridge: Harvard University Press, 1987), Introduction, Chs. 1, 5-7, "The Conscious Use of Paradox in War," "The Technical Level," "The Tactical Level," "The Operational Level," pp. 3-17, 73-117. 60 pages.

#### **Case: Antisubmarine Warfare in the North Atlantic**

John Keegan, The Price of Admiralty, Chapter 4, "The Battle of the Atlantic," pp. 251-315.

## **6. Obsolescence & technological surprise** (28 February)

### **General readings**

Martin van Creveld, Technology and War, Chapter 5, "Irrational Technology," pp. 67-78. 12 pages.

Wayne Hughes, Fleet Tactics: Theory and Practice (Annapolis, MD: Naval Institute Press, 1986) Chapter 8, "The Trends and Constants of Technology," pp. 200-15. 16 pages.

Clayton M. Christensen, The Innovator's Dilemma (New York: HarperCollins, 1997), Chapter 1, "How Can Great Firms Fail? Insights from the Hard Disk Drive Industry," pp. 33-68.

### **Cases: The 75 and Jutland**

Robert M. Ripperger, "The Development of the French Artillery for the Offensive, 1890-1914," Journal of Military History 59 (October 1995): 599-618.

Nicholas A. Lambert, "'Our Bloody Ships' or 'Our Bloody System'? Jutland and the Loss of the Battle Cruisers, 1916," Journal of Military History 62:1 (January 1998): 29-56.

## **7. Invisible technologies** (7 March)

### **General readings**

Find a description of radar, being prepared to identify the basic concept, plus the following terms: frequency, beam width, bands, Doppler effect, pulse, continuous wave, synthetic aperture, sidelobe. In addition to various sources on the Web, see P. S. Hall *et al.*, Radar (London: Brassey's, 1991) or the entries in Trevor N. Dupuy, International Military and Defense Encyclopedia (Washington: Brassey's, 1993), or best of all, Rebecca Grant, "The Radar Game: Understanding Stealth and Aircraft Survivability."

Alan Beyerchen, "From radio to radar: Interwar military adaptation to technological change in Germany, the United Kingdom, and the United States," in Williamson Murray and Allan R. Millett, eds., Military Innovation in the interwar period (Cambridge: Cambridge University Press, 1996), pp. 265-99. 35 pages.

### **Case: training superiority and training surprise**

Defense Science Board task force report on "Training Superiority and Training Surprise," January, 2001. <http://www.acq.osd.mil/dsb/trainingsuperiority.pdf>

## **8. Systems engineering** (14 March)

### **General readings**

Thomas P. Hughes, Rescuing Prometheus (New York: Pantheon Books, 1998), Chapters 1,3, 7, pp. 3-14, 69-140, 301-306.

Robert Pool, Beyond Engineering: How Society Shapes Technology (New York: Oxford University Press, 1997), Chapter 8, "Managing the Faustian Bargain," pp. 249-77.

### **Briefings: DSB progress reports**

## **9. The unromantic stuff: logistics, command, control, and communications** (28 March)

### **General readings**

James A. Huston, The Sinews of War: Army Logistics, 1775-1953 (Washington, DC: Office of the Chief of Military History, 1966), Chapter 35, "Some Principles of Logistics," pp. 655-68. 14 pages.

Gus Pagonis, Moving Mountains: Lessons in Leadership and Logistics from the Gulf War (Boston: Harvard Business School Press, 1992), pp. 199-220. 22 pages.

Kenneth Allard, Command, Control, and the Common Defense, rev. ed. (Washington: National Defense University, 1996), Chapter 6, "Tactical Command and Control of American Armed Forces: Problems of Modernization," pp. 151-92. 43 pages.

Thomas P. Oakley, Command and Control for War and Peace (Washington, DC: National Defense University Press, 1992), Chapters 1-2, "The Broad View of Command and Control," "C2: Process and System," pp. 3-54. 52 pages.

Scott M. Britten, "Directing War from Home," and William B. McClure, "Computers and Controlling War," in William C. Martel, ed. The Technological Arsenal: Emerging Defense Capabilities (Washington, DC: Smithsonian, 2001), pp. 199-240.

**Note: no class on April 4th**

## **10. Low tech vs. high tech** (11 April)

### **General readings**

Arthur C. Clarke, "Superiority," in Expedition to Earth (New York: Harcourt, Brace & World, 1970), pp. 92-104. 13 pages.

George Raudzens, "War-Winning Weapons: The Measurement of Technological Determinism in Military History," Journal of Military History 54 (October 1990): 403-33. 31 pages.

**Case: electronic warfare in Vietnam**

John D. Bergen, Military Communications: A Test for Technology (Washington, DC: Center of Military History, 1986), Chapters 16-17, "North Vietnamese and Viet Cong Communications," "The Electronic Battlefield," pp. 367-408. 42 pages.

**12. DSB briefings** (18 April)

**13. DSB briefings** (25 April)