AIR WAR COLLEGE

AIR UNIVERSITY

Officer Education: Preparing Leaders for the Air Force of 2035

by

John W. Pearse, Colonel, USAF

A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

15 February 2009

DISCLAIMER

The views expressed in this academic research paper are those of the author and do not reflect the official policy or position of the US government or the Department of Defense. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.

Contents

Illustrations

Biography

Colonel Pearse was previously assigned as the Chief of Defensive Plans, Combined Air Operations Center Nine, RAF High Wycombe, United Kingdom.   Colonel Pearse earned a Bachelor of Science degree in Military History and was commissioned from the United States Air Force Academy (USAFA) in 1988. He graduated from the US Air Force Weapons Instructor Course in 1996. He earned a Master of Airpower Arts and Sciences degree from the Air Force School of Advance Air and Space Studies in 2003. Colonel Pearse served as Commander of the 14th Fighter Squadron, Misawa Air Base, Japan.

The very essence of leadership is that you have to have a vision.
Notre Dame President, Theodore Hesburgh

Man's flight through life is sustained by the power of his knowledge.
Quotation on the USAFA Eagle and Fledglings Statue

Introduction

Learning Gap?

On May 10, 1940, military forces from Germany attacked the combined forces of Great Britain and France. Despite the advantages of 3,740,000 troops to the German's 2,760,000 and 3,254 tanks to the German's 2,574, British and French forces in France were defeated in six weeks.[1] Historians argue the French failed to anticipate the shape of the next war, failed to develop adequate equipment in the face of the German blitzkrieg and failed to adapt to German tactics after hostilities started.[2] Unfortunately, the military leaders of France provided a catastrophic example of an institution failing to anticipate and prepare for future war.

The current Air Force Leadership Development Model released in 2004 lists *creating and demonstrating vision* as a core leadership competency. Air Force leaders are expected to "clearly define and express a future for the group/organization based on both environmental (external) factors and Air Force institutional (internal) requirements."[3] In addition, Air Force leaders are expected to demonstrate adaptability and flexibility in order to deal with the unexpected.

The exponential increase in information combined with rapid advancements in technology makes predicting future military capabilities precarious. The United States

---

[1] Eliot A. Cohen and John Gouch, *Military Misfortunes: The Anatomy of Failure in War* (New York: The Free Press, 2006), 201.
[2] Ibid., 229-230.
[3] Air Force Leadership Development Model, from Air Force Senior Leader Management Office, Jan 2004, http://leadership.au.af.mil/af/afldm.htm.

experience in Iraq and Afghanistan, with the rise of non-state actors that function in networks adapting commercially available technology, raises questions about the types of adversaries the United States will face in the future. Trends toward a hybrid form of warfare where conflict permeates all aspects of society add complexity. The rise of China and India, along with a resurgent Russia, indicate the United States will not be the only global power in the near future. Some futurists see a transformation from an information age to a virtual age within the next 30 years with as yet indiscernible major changes to a globalized virtual society.[4] The Air Force must absorb these societal changes. The officers of the Air Force will be called to anticipate change and adapt to surprise.

This paper explores whether the Air Force officer education program is preparing officers for their leadership roles in 2035. If the Air Force is failing to prepare future leaders for their roles in 2035, then major modifications to officer education are required to adequately prepare officers for leadership in 2035. The officers currently attending the Air and Space Basic Course in 2009 will be the new general officers of the Air Force in 2035. The education programs in-place for these officers now will be a factor in how well prepared they are to lead the future force. The focus of this paper is the immediate changes required to the Air Force officer education program to prepare officers for the strategic environment in 2035. The urgency for change can best be considered within this context: the current Air and Space Basic Course students will likely complete Squadron Officer School in four years; by then they will have completed half their professional education.

The Air Force uses the term *force development* to describe how it grows officers. Air Force Doctrine Document 1-1, *Leadership and Force Development*, describes force development

---

[4] Ali A. Jalali and Hamid Mahmoodi, "Virtual Age: Next Wave of Change in Society," (address, The 2009 International Joint Conferences on e-CASE and e-Technology, Grand Copthorne Waterfront Hotel, Singapore, January 8-10, 2009), http://online.sfsu.edu/~mahmoodi/papers/paper_C50.pdf.

as a "series of experiences and challenges, combined with education and training opportunities that are directed at producing Airmen who possess the requisite skills, knowledge, experience, and motivation to lead and execute the full spectrum of Air Force missions."[5] The Air Force differentiates between the three tenets of education, training and experience. The differentiation between training and education is training teaches <u>what</u> to think while education teaches <u>how</u> to think. This paper will only address the education side of force development. Colonel Keith McBride's 2009 *Blue Horizons* paper, *Future Competencies for USAF Senior Leaders*, examines the training and experience side of force development for 2035.

There are some key terms helping frame this examination. For purposes of this discussion, *information* as defined by the *Dictionary of Scientific and Technical Terms* is; "data which has been recorded, classified, organized, related, or interpreted within a framework so that meaning emerges."[6] According to McGraw-Hill, technology is the "systematic knowledge of science and its application to industrial processes."[7] For the purposes of this paper, *technology* is simply the practical application of science. The term *exponential change* refers to a compounded rate of increase, which illustrated graphically would form an ever-steeper curve. The world has entered a period where an exponential increase in new information and technology will continue through 2035 causing significant changes in society, and thus warfare. Vision involves seeing into the future. Leadership vision involves seeing the future operating environment and envisioning the organization equipped with the general capabilities required to thrive in that environment. Adaptability is the necessary response to change. For purposes of this examination, the Army Special Warfare School's definition of adaptability is most apt; "an

---

[5] US Air Force Doctrine Document 1-1, *Leadership and Force Development*, February 18, 2006, 14.
[6] Sybil P. Parker, ed. *Dictionary of Scientific and Technical Terms*, 3rd ed., (New York: McGraw-Hill Book Company, 1984), 813.
[7] Ibid., 1614.

effective change in response to an altered situation."[8] Finally, hybrid warfare is one description of the expected future operating environment. Hybrid warfare is combat conducted across the spectrum of conflict, from criminal activity to major conventional war, either simultaneously or in various combinations. In addition, conflict is conducted across all segments of society.

This paper uses Bloom's taxonomy as a baseline for education theory.[9] Bloom's taxonomy is a classification of learning objectives in the cognitive domain that identifies intellectual skills in a hierarchy from the basic knowledge level (recalling information) through comprehension, application, analysis, synthesis and evaluation.[10] When referring to learning, this paper assumes the evaluation level, which involves making judgments about the value of concepts and ideas.

Due to space limitations, education theory is not examined in depth. The conclusions reached are based upon research rather than direct experience. This paper limits its exploration of PME to the development of Air Force officers; the enlisted PME system is not addressed.

Within this study, Chapter One examines trends going toward 2035 in the areas of technology, education, and business. It concludes with a survey of the Air Force officer education system. Chapter Two explores two possible futures in 2035 based upon futures work from the 2008 *Blue Horizons II* study. This chapter also examines the attributes desired in Air Force leaders in 2035. Chapter Three will analyze the attributes and trends within the Air Force education system. The final chapter will summarize the work and offer some recommendations for changes and future study.

---

[8] John C.F. Tillson et.al., *Learning to Adapt to Asymmetric Threats*, (Alexandria, VA: Institute for Defense Analysis, August 2005), 5.

[9] Dr. Benjamin Bloom developed a taxonomy of learning objectives in the 1950s for establishing learning outcomes in curriculum. This widely accepted education model is the basis for instructional design of all Air Force PME curricula. For this reason, Blooms's taxonomy is used as the baseline for this examination.

[10] Benjamin S. Bloom, ed., *Taxonomy of Educational Objectives: The Classification of Educational Goals*, (New York: Longmans, Green and Company), 1956.

Technological change is like an axe in the hands of a pathological criminal.

Albert Einstein

Chapter I

Trends Toward 2035

The Exponential Rate of Change

The world is experiencing an exponential growth in technology. The current rate of technical innovation is a doubling every decade.[11] Moore's Law continues to hold true as transistor density doubles every 18 months while the cost of these microchips continues to decrease.[12] Figure 1 graphically demonstrates the S-curve of exponential growth in computing power. The graph predicts that computers will process as many bits per second as the human brain around the 2035 time period. The increased power of computers enables more computation available to other fields of research.

For example, in the area of medical research, increased computing power enables greater amounts of research through sophisticated computer modeling rather than through traditional trial-and-error experimentation. Eli Lilly Pharmaceuticals processed 100 times less material while its annual productivity increased.[13] This form of research fuels exponential growth where medical knowledge is expected to double every two years by 2010.[14] This phenomenon is occurring across many fields of research. In fact, research across historically stove-piped disciplines is becoming the norm.

---

[11] Ray Kurzweil, *The Singularity is Near: When Humans Transcend Biology*, (New York: The Penguin Group,, 2006), 201.

[12] Lynn E. Foster, *Nanotechnology: Science, Innovation, and Opportunity,* (Upper Saddle River, NJ: Prentice Hall, 2006), 35.

[13] Ibid., 35.

[14] Sy Atezaz Saeed, "Science to Practice:Top 10 Research Findings of 2007-2008", http://www.ncpsychiatry.org/SAEED%20Top%2010%20findings%202008.pdf

One such combined area is in the technologies of genetics, robotics, information and nanotechnology. These four areas are mixing together and feeding off each other to produce exponential advantages in human capabilities.[15] The expectations of these advances include augmented intelligence in humans and integrated robotic-human capability by 2035. Nanotechnology is another area with incredible potential. The laws of physics at this quantum level offer great promise because: "Materials and processes at that size have unique properties not seen at larger scale, offer proportionately greater reactive surface area than their larger counterparts, and can be used in or with living organisms for medical applications. As a result, familiar materials can have completely different properties at nanoscale."[16]

Figure 1: Exponential Growth of Computing[17]
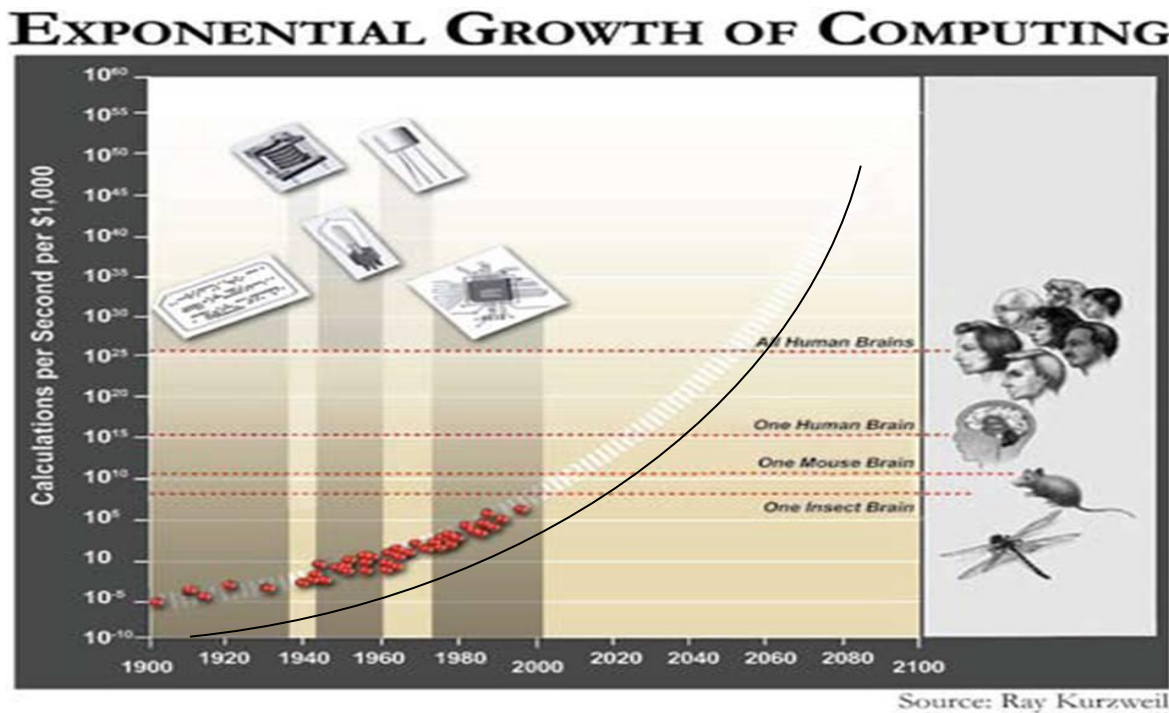
[15] Joel Garreau, *Radical Evolution: The Promise and Peril of Enhancing Our Minds, Our Bodies-and What it Means to be Human*, (New York: Broadway Books, 2005), 4.
[16] Foster, xiv.
[17] United States Joint Forces Command, "Joint Operating Environment (JOE) 2008: Challenges and Implications for the Future Joint Force", https://us.jfcom.mil/sites/J5/j59/default.aspx, 23.

The world is experiencing exponential growth in technology. The continued increase in computing power will likely continue to feed an increase in technological innovation. Cross discipline research will enable advances across all scientific disciplines creating an S-curve in new technology similar to Figure 1. The world will see the introduction of new technology on a continuing basis. We are already seeing new technologies come to fruition with the potential for significant increases in military capability.

Advances in directed energy are maturing. The United States Army recently announced it will buy five truck mounted Active Denial Systems.[18] The Active Denial System utilizes millimeter waves of energy to cause intolerable pain but no obvious physical damage to people.[19] The Air Force is testing the advanced tactical laser on a C-130 aircraft.[20] It is interesting such a significant portion of the research on these projects was not done by the military.

Foundational military research is no longer solely the responsibility of the United States government. The Defense Advanced Research Projects Agency invests 90 percent of its budget outside the federal government.[21] The Air Force Research Laboratory (AFRL) can no longer afford to conduct much of its own research. AFRL now conducts 20 percent of its research in-house and partners with academia and industry for the other 80 percent.[22] As the fields of mutually beneficial research continue to expand, the role of the private sector in military-related research is expected to increase.

---

[18] David Hambling, "Army Orders Pain Ray Trucks; New Report Shows 'Potential for Death,'" Wired Blog Network, October 10, 2008, http://blog.wired.com/defense/2008/10/army-ordering-p.html.
[19] Doug Beason, *The E-Bomb: How America's New Directed Energy Weapons Will Change The Way Future Wars Will Be Fought*, (Cambridge, MA: Da Capo Press, 2005), 114.
[20] Ibid., 174.
[21] Garreau, 22.
[22] Air Force Research Laboratory Factsheet, http://www.af.mil/factsheets/factsheet.asp?id=148.

Current Education Trends

The two biggest trends in higher education are the explosion of online education opportunities and a shift to learning-centered institutions. As of 2008, over 4 million students completed at least one online course.[23] The largest online school, the University of Phoenix, expects over 500,000 students a year by 2010.[24] The top academic institutions in the United States, such as Harvard, Boston College and MIT, are developing their online education program. Boston College has already created a virtual reality learning world. Students interact through a computer-generated representation of themselves in a three-dimensional atmosphere within cyberspace. MIT offers over 1800 course offerings online.[25]

The online education programs have gained considerable credibility. Research on the quality of online education indicates it is of equal quality to in-residence study. In some areas, such as collaborative work, online education is preferred because it is often more concisely packaged in modules and more accurately emulates the future work environment for students.[26] The result is that most universities now offer accredited degrees. Stanford, for example, offers 50 online master's programs.[27] A large factor in the growth of online education is the post-graduate professional, often referred to as a nontraditional student. The exponential growth of knowledge means college learning becomes dated very quickly. Working students must fit education between the demands of work and family.[28] These nontraditional students make up 73

---

[23] Stefan Theil, "Tune in Tomorrow," *Newsweek*, August 9, 2008, http://www.newsweek.com/id/151688.
[24] Ibid.
[25] Howard Cincotta, "Online Learning Changing the Face of American Education," US Department of State website, January 1, 2008, http://www.america.gov/st/educ-english/2008/January/20080108101202attocnich0.402767, 2.
[26] Thomas L. Russell, "The No Significant Difference Phenomenon," http://www.nosignificantdifference.org/search.asp.
[27] Theil, "Tune in Tomorrow".
[28] Howard Cincotta, "Online Learning Changing the Face of American Education".

percent of all students enrolled in college course.[29] Students often prefer online avenues because

they are more flexible and interactive, some allow students to set the pace of their schooling.

Accelerated formats are very popular because students can complete courses in half the time

through short duration but higher intensity programs. Approximately 13 percent of all

nontraditional students in college take accelerated courses.[30] Institutions have surged their

online capabilities to meet students' desires for these programs centered on student schedules

and needs.

The shift toward a learner-centered environment is the second major trend in education.

Society has moved from industrial age economies dominated by heavy industry to the

information age. The academic institutions of the industrial age were set up like factories in a

provider-centered arrangement where institutions prescribe a very orderly set schedule of

academic offerings advancing students through a prescribed sequence to degree achievement.[31]

Earning a degree was a milestone event. Knowledge increased at a moderate pace so the

industrial age worker was equipped for most of their career. Many workers would return to

school at a later stage of their career to pursue an advanced degree to build upon their

undergraduate knowledge and improve their professional standing. There was not a pressing

need to continually learn during a career.

The emergence of the information age society drove a shift to a learner-centered

academic institution involving multiple on-demand curriculum offerings where students choose

their schedule and complete their studies within a self-paced schedule. In this information age

---

[29] Raymond J. Wlodkowski and Carol E. Kasworm, "Accelerated Learning: Future Roles and Influences," in *Accelerated Learning for Adults: The Promise and Practice of Intensive Educational Formats*, San Francisco: Jossey-Bass, Number 97, Spring 2003, 96.

[30] Ibid., 96.

[31] Michael G. Dolence and Donald M. Norris, *Transforming Higher Education: A Vision for Learning in the 21st Century*, (Ann Arbor, MI: Society for College and University Planning, 1995), 11.

environment, computer simulation replaces much of the laboratory research.[32] Universities

recognize they cannot teach all the knowledge required for the information age professional.

The business community requires its future workforce to be broadly educated problem solvers

capable of working with a multinational team in a collaborative environment while acquiring and

applying knowledge across disciplines.[33] In addition, business is seeking workers with

experience in taking acquired knowledge and applying it to dynamic real-world situations.

Higher education today involves teaching information age network skills with virtual labs and

collaborative networks to prepare students for lifelong learning. Students graduate with a new

knowledge set but are also equipped with information age navigation skills that enable a lifelong

self-paced learning process.[34] The terminus is not focused on just completing a degree but

fostering skills and a desire for continuous lifelong learning.

A growing trend in higher education curriculum worldwide is future studies. What

started as a fringe academic pursuit in the 1960's has developed into an accepted discipline of

study in many institutions. Future studies are a combination of science and art creating well-

argued assessments of the future based upon the study of the past and the present.[35] The primary

purpose behind the process is to enable better decisions. According to Yale University professor

Wendell Bell, they also take the surprise out of future developments through "systematic efforts

to uncover the unintended consequences of proposed actions."[36] The growth in futures studies is

an outgrowth of business demands. As businesses try to navigate turbulent times of constant

change, they want employees with a future orientation to help identify opportunities and pitfalls

[32] Ibid., 27-29.

[33] Elizabeth A. Jones, *Transforming the Curriculum: Preparing Students for a Changing World*, ASHE-ERIC Higher Education Report: Volume 29, Number 3, Washington, DC: Jossey-Bass, 2002.

[34] Ibid., 25-27.

[35] Mike Mannermaa, "Politics + Science = Future Studies?" in *Advancing Futures: Future Studies in Higher Education*, ed James A. Dator, Westport, Conn: Praeger, 2002, 162.

[36] Wendell Bell, "Making People Responsible: The Possible, the Probable, and the Preferable," in *Advancing Futures: Future Studies in Higher Education*, ed. James A. Dator, Westport, Conn: Praeger, 2002, 40.

involved in global trends.

While some universities have futures-oriented departments and teachers, Tamkang University in Taiwan is unique in the world by having the entire university dedicated to "a globalized future-oriented information society."[37]   Future Studies is a mandatory core course for all students at Tamkang. In addition, each academic discipline has a futures course as part of its curriculum.[38]

One example in the United States is the University of Advancing Technology in Tempe, Arizona. The goal of this college is "to educate students in the fields of advancing technology to become innovators of the future."[39] Futures study practices and concepts are embedded into all aspects of the curriculum. In addition, the university has a required core course in foresight development created by the Acceleration Studies Foundation. The course examines "four fundamental foresight skills: creating the future (innovating products and services); discovering the future (models, trend identification and analysis); planning the future (developing shared goals and processes); and benefiting in the future (achieving measurable positive environmental, social, or economic results)."[40] Given the rate of change in technology, the demand from business for employees with a future orientation is expected to increase.

The Singularity University, set to open in the summer of 2009, is an example of a school created to fill this need. The name is derived from the best-selling book, *The Singularity is Near*, written by Singularity University Chancellor and best-selling futurist author, Dr. Ray Kurzweil.[41] The university "aims to assemble, educate, and inspire a cadre of leaders who strive to

---

[37] Kuo-Hua Chen, "A Generation of Futures Studies in Taiwan," in *Advancing Futures: Future Studies in Higher Education*, ed James A. Dator, (Westport, Conn: Praeger, 2002), 209.
[38] Ibid., 211.
[39] University of Advancing Technology Mission Statement, http://www.uat.edu/about_uat/default.aspx.
[40] Intro to Foresight Development, Acceleration Studies Foundation website, http://accelerating.org/foresight_development.html.
[41] Singularity University Factsheet, http://singularityu.org/about/faq.

understand and facilitate the development of exponentially advancing technologies and apply, focus and guide these tools to address humanity's challenges."[42] Based on the NASA Ames Campus, Singularity University will offer short duration executive programs as well as a nine-week Graduate Studies Program. The curriculum focuses on the interaction of the emerging technologies of biotechnology, nanotechnology, artificial intelligence, robotics, and genetics and how to conceptualize the exponential nature of their advancement. The first class will start with 30 students but the Singularity University already expects to expand to 120 students in subsequent years.[43]

Trends in Business

Google is recognized as a leading company in innovation with a culture that attracts the very best technical experts.[44] Among the keys to Google's current success is its mandate for employees to spend 20 percent of their time on personal projects.[45] This personal project is not time off or a period of reflection. In fact, part of the employees' evaluation is the innovation that results from personal research. Personal projects have produced over 50 percent of Google's new product line.[46]

Google is highly committed to the continuing education of employees. Google funds tuition assistance for all employees and regularly brings in distinguished technology researchers from around the world to conduct companywide "tech talks."[47] Education at Google is expected to benefit everyone. In fact, another area of evaluation for employees is the amount of new

---

[42] Ibid.
[43] Ibid.
[44] Bala Iyer and Thomas H. Davenport. "Reverse Engineering Google's Innovation Machine," *Harvard Business Review*, April 2008, 59.
[45] Ibid., 64.
[46] Ibid., 64.
[47] Ibid., 67.

knowledge they share with fellow employees during the tech talks they are expected to host.[48]

Google also empowers its workers to make decisions in a collaborative network. Employees are expected to collaborate across teams and fix issues as they arise. The company system has an oversight function that is very streamlined and responsive with decisions made in terms of hours instead of days or weeks.[49] Company engineers are trusted to work within broad guidelines and make good decisions on projects. This commitment to innovation by Google is now emulated across the business world as companies attempt to remain competitive and adapt to a changing world.

In his 1996 book *Leading Change*, John Kotter identifies business trends and makes recommendations for companies trying to transform for the 21st century. Kotter argues the current rate of change in technology that sparks change in business is only the beginning; he expects the rate of change in business to continually increase. Exponential technology growth will fuel social change in a globalized economy requiring businesses to continually adapt within a world of ever increasing communication speeds and competition.[50] Future companies must demonstrate a persistent sense of urgency toward change to remain competitive.

The successful company of the future will transform into a flat collaborative horizontal organization with broad-based employee empowerment. One result: individuals will not have time to absorb all the incoming information and communicate all necessary decisions. This requires multiple team leaders to cooperate across teams to make corporate decisions. Companies will seek leaders who recognize and understand these trends and who will create and communicate a vision for the company. Lifelong learning is the key to developing these future

---

[48] Ibid,

[49] Ibid., 65.

[50] John P. Kotter, *Leading Change*, (Boston: Harvard Business School Press, 1996), 18.

leaders.[51]

Officer Education

Direction for officer education is contained in Air Force Instruction (AFI) 36-2611, *Officer Professional Development*. This instruction states "the objective of Professional Military Education (PME) and academic education is to enhance performance in each developmental phase."[52] The Air Force defines the phases as tactical, operational and strategic. Academics should "refine critical analytical and communication skills."[53] Specific PME guidance is contained in AFI 36-2301. The Air Force Continuum of Education (COE) for Air Force officers is defined as pre-commissioning education, the Air and Space Basic Course (ASBC) at the initial level, Squadron Officer School (SOS) at the primary level, Air Command and Staff College (ACSC) at the intermediate level and Air War College (AWC) at the senior level.[54] This examination focuses on PME programs after officers are commissioned.

ASBC

ASBC is a 30 training day indoctrination program focused on Air Force doctrine and team building for newly commissioned lieutenants. The program uses a building block approach with foundational war theory, airpower principles, strategic issues and Air Force doctrine. Students are afforded some hands-on leadership experiences. There is also a focus on improving communication skills. Throughout the program, students act in teams to solve complex problems designed to culminate with the students' execution of an air campaign within a wargame. The curriculum is broken down into Profession of Arms (100.15), Leadership/Management (31.04), Military Studies (13.25), Communication Studies (7.20),

---

[51] Ibid., 165-166.
[52] US Air Force Instruction 36-2611, *Officer Professional Development*, 1 April 1996, 8.
[53] Ibid., 8.
[54] US Air Force Instruction 36-2301, *Professional Military Education*, 26 September 2007, 9.

14

International Studies (2.30), and War Fighting (5) with academic hours in (parentheses).[55]

SOS

The SOS program builds on ASBC's foundational work with additional focus on team building, leadership and followership for Captains between four and seven years of service. Most of the program flows from classroom instruction to teamwork practice to exercise participation. Students learn leadership and followership responsibilities in the context of Air Force core values. The program includes developing critical thinking skills for use in analyzing complex situations, developing plans and critiquing processes. Communication skills are emphasized throughout the program. The curriculum is broken into the Profession of Arms (13.75), Leadership/Management (85.33), Military Studies (9), Communication Studies (14.42) and International Studies (6.25) with academic hours in (parentheses).[56]

ACSC

ACSC is a master's degree granting program developing critical thinking skills while broadening the student's perspective from tactical operations to the operational level of war. ACSC uses a seminar format of instruction augmented with lectures and presentations by senior civilian and military leaders. The emphasis of the program is leadership development, the profession of arms, and the application of air, space and cyberspace in the joint arena. The core curriculum includes Leadership in Warfare (3), The Practice of Command (3), Inter/National Security Studies (3), Applied Warfare Studies (3), Air, Space, and Cyberspace Power Studies (3), Joint Forces (3), Joint Planning (3), Joint Air Operations (3), Regional/Cultural Studies (3),

---

[55] AU-10, *Air University Catalog Academic Year 2008-2009*, Maxwell AFB, AL: AU Press, October 2008, 115-117.
[56] Ibid., 108-110.

and Research Project (6) with semester hours in (parentheses).[57] Graduates of ACSC complete

the joint education requirements identified in Chairman of the Joint Chiefs of Staff Instruction

(CJCSI) 1800.01C and are awarded joint professional military education (JPME) I credit, the

first of two certifications required for joint staff officer qualification.[58]

AWC

AWC is a master's degree granting program developing critical thinking skills required to

be a successful senior military leader while broadening the student's perspective from the

operational level campaign planning to the strategic level of war in order to prepare students for

joint leadership. The emphasis is on analyzing air, space and cyberspace power and applying it

in the joint strategic environment. The majority of the coursework occurs in seminar discussion

and guest lectures, which feature prominent senior civil and military leaders. The core

curriculum includes Research Project (5), Foundations of Strategy (5), Joint Strategic Leadership

(2), War Fighting (8), Regional and Cultural Studies (4), International Security Studies (5) and

Solo Challenge War Game (3) with semester hours in (parentheses).[59] Graduates of AWC

complete the joint education requirements identified in CJCSI 1800.01C and are awarded JPME

II credit, the second of two certifications required for joint staff officer qualification.[60]

Advanced Degree

Air Force officers are expected to pursue advanced academic degrees to enhance their

professional qualifications. Although this does not fall under PME, it is included under the

larger umbrella of officer professional development. Officers are encouraged to pursue degrees

---

[57] Ibid., 57-61.
[58] Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 1800.01C, *Officer Professional Military Education Policy*, December 22, 2005, A-A-3.
[59] Ibid., 23-28.
[60] Ibid., A-A-4.

directly related to the officer's career specialty, or in the case of field grade officers, degrees enhancing job performance through general studies in the interest of developing operational and strategic breadth.[61]

Lifelong Learning

General Ronald Fogleman created the Chief of Staff of the Air Force (CSAF) Professional Reading Program in 1996 to create a common reference among all Air Force personnel and to improve advocacy of air and space power.[62] The reading list has expanded under each successive Chief, usually changing every year.[63] The list is intended to stimulate and cultivate self-study in the profession of arms by Air Force personnel.

Other Programs

In addition to the programs identified above, the Air Force offers a couple of other alternatives for ACSC and AWC. First, the Air Force Institute of Technology (AFIT) offers master's programs in its Graduate School of Engineering and Management. This yearlong program yields degrees in science, engineering, math and management.[64] Field grade officers completing these programs are awarded intermediate level PME (ACSC equivalent) credit.

The second nontraditional PME program is the Air Force Fellows program sending "over 100 select field grade officers to civilian universities, think tanks, industry, interagency, and air staff throughout the United States to serve as Air Force 'ambassadors' and researchers."[65] While most programs involve research at a civilian university, the Secretary of Defense Fortune 500 Fellows are placed with a private business for ten months to observe trends in technology and

---

[61] US Air Force Instruction 36-2611, 8.
[62] CSAF Reading List Program, http://www.af.mil/library/csafreading/.
[63] Ibid.
[64] AU-10 2008, 95-97.
[65] AU-10, *Air University Catalog Academic Year 2007-2008*, Maxwell AFB, AL: AU Press, October 2007, 135.

how they influence society in ways that could impact the Air Force. Officers completing this program receive senior level PME (AWC equivalent) credit.

The last program of note for the purposes of this paper is the School of Advanced Air and Space Studies (SAASS). This program takes a small group of competitively selected graduates from the intermediate level schools and provides an additional year of rigorous academic study. The mission of SAASS, the most selective of all Air Force PME schools, is "to produce strategists through advanced education in the art and science of air, space, and cyberspace power to defend the United States and protect its interests."[66]

Each PME program examined above attempts to provide officers with knowledge sets as part of Air University's mission "to prepare graduates to develop, employ, command, research, and champion air, space, and cyberspace power at all levels."[67] The common themes in the curriculum of the COE include leadership, critical thinking skills, communication skills, international affairs, military history, and the profession of arms. Each school or level of education is identified for a particular experience level as milestone education events in the career progression of an officer. The COE is a well designed linear progression in breadth of knowledge from the tactical through the strategic level of war. But, as we will examine in the next chapter, is linear thought or progression adequate preparation for the future world these officers will have to navigate?

---

[66] AU-10 2008, 78.
[67] Ibid., 1.

Chapter II

The World of 2035

The Center for Strategy and Technology at Maxwell AFB, Alabama directs the ongoing *Blue Horizons* study commissioned by CSAF. This ongoing study examines future strategic and technology trends for the Air Force. The 2008 study explored and developed four separate alternate futures: a resurgent Russia; a failed state in a vital area of U.S. interests, a successful jihadist insurgency overthrowing a friendly state in the Middle East and a peer China.[68] This paper addresses two of these alternate futures as the context for the emerging complexity of conflict in 2035 in order to assess the adequacy of current officer PME.

The peer China study concluded China's economy will dominate Asia and much of the world by 2030. In addition, China will be a near-peer to the United States in terms of military power. War with China is not inevitable. However, if interests collide and a war with China does occur, the United States will face a wide array of advanced weapons. The study expects China to develop naval power to challenge United States naval capabilities in the waters around China. China's military aircraft will be on par with United States capabilities. China will also field a wide array of technically advanced weapons such as directed-energy, space and counter-space systems, information warfare, and electronic warfare capabilities. The Chinese will also field a wide variety of anti-access capabilities to deny the United States access to areas around

---

[68] John P. Geis II et. al, *Discord or Harmonious Society? China in 2030*, (Maxwell AFB, AL:Center for Strategy and Technology, July 2008), ix.

China.[69]

The insurgency future envisions United States intervention to counter a jihadist insurgency threatening to overthrow a friendly state, to protect vital fossil fuel resources and/or to prevent instability in the region. The study predicts emerging technologies in nanotechnology, microbiology, biotechnology, cyberspace exploitation, nuclear and chemical engineering combined with radical ideology, could combine to form a robust and destabilizing insurgency. The United States could face nano-derived capabilities including new explosives and toxins. Micro-air vehicles would most likely be employed. Cyber attacks could take the form of sophisticated direct network attacks and/or electromagnetic pulse weapons. Nuclear and chemical engineering could be exploited in unique ways to create a miniaturized lethal threat.[70] All of these capabilities will most likely be employed in new and surprising ways, quite unlike the conventional military conflicts seen in the past.

Two Chinese Colonels provided some insight into how these capabilities might be utilized in their work *Unrestricted Warfare*. In this book, "Hacking into websites, targeting financial institutions, terrorism, using the media, and conducting urban warfare are among the methods proposed."[71] The thesis of their book is that in future wars, there are no rules. The authors argue current rules of war are the invention of strong Western powers. They espouse the view the Chinese would not limit themselves by the rules of war as applied by Western powers but would attack in and through all areas of human endeavor. Therefore, the United States should expect disruptive technologies employed in all facets of society without regard to any limits.

---

[69] Ibid., 103-127.
[70] James L. Cardoso et al., *Future Insurgency: Coin and the USAF in 2030*, (Maxwell AFB,AL: Center for Strategy and Technology, May 2008) 18-35.
[71] Qiao Liang and Wang Xiangsui, *Unrestricted Warfare*,(Beijing: PLA Literature and Arts Publishing House, February 1999), http://www.terrorism.com/documents/TRC-Analysis/unrestricted.pdf, 2.

These Chinese writings, combined with observations on the behavior of non-state actors, have produced a concept called *hybrid wars*. Under this concept, states and non-state actors are expected to attack any vulnerability and use multiple forms of warfare simultaneously. Adversaries would likely use conventional attacks combined with irregular warfare, terrorism and criminal activity to win.[72] The combination of regular and irregular activity is not new. The Russian use of partisans behind German lines during World War II is but one example. The concept of hybrid war does not just use irregular activity to support conventional fighting, nor is the irregular activity just a phase in an insurgency buying time until forces are ready to conduct a conventional attack. Rather, hybrid war is the fusion of multiple forms of war acting simultaneously toward a common objective.

Nathan Frier adds another perspective to future conflict with his concept of "strategic shock" in *Known Unknowns*. Frier predicts the United States will face possible unconventional catastrophic events from previously benign sources along the lines of a future 9-11. These shocks will likely fall so far outside the conventional realm of defense-related consideration they will cause sudden unanticipated change in the orientation of the Department of Defense.[73] The normal defense planning process involves linear extrapolations of the current environment due to risk adverse conservative leaders that shun speculation.[74] According to Frier, the key to limiting the scope of future shocks is to anticipate potential shocks outside the normal defense frame of reference.[75] In order to anticipate shocks, a multidisciplinary team of free thinkers must take a disciplined approach to consider plausible possibilities and counteractions.

---

[72] Frank G. Hoffman, C*onflict in the 21ˢᵗ Century: The Rise of Hybrid Wars*, (Arlington, VA: Potomac Institute for Policy Studies, December 2007), 8.
[73] Nathan Frier, *Known Unknowns: Unconventional" Strategic Shock" In Defense Strategy Development*, Carlisle, PA: Strategic Studies Institute, November 2008, http://www.strategicstudiesinstitute.army.mil, vii.
[74] Ibid., 1.
[75] Ibid., 26.

Another aspect of future warfare is the role of information. Many publications note the world has moved from the industrial age into the information age. Thomas Friedman, author of *The World is Flat*, popularized the concept of a flat world where internet connectivity has leveled the playing field around the globe. He notes a global trend of hierarchical structures transforming into horizontal collaborative structures.[76] Friedman argues successful companies of the future will be the best collaborators because future innovations will be so complex, not one single entity can innovate by itself.[77] The collaborative concept is applied to military operations in the book *Power to the Edge*.

Here the authors argue that the hierarchical military structure is not agile enough to deal with the complexity and speed of operations in the information age. The military will transform into a horizontal organization with the entire organization collaborating on a common operating system to collectively solve problems. Leaders do not control the flow of information but act to establish ground rules and intent and then let the system self-regulate.[78] Military leaders will not function as the head of a hierarchical stovepipe but as a monitor of a collaborative process working much faster than the modern military staff. The leader must learn how to establish guidelines and his intent within this network, monitor progress, guide activity, and redirect the process when required.[79]

Future military leaders will face a complex world. Technological change will be constant. War will not be a separated conventional conflict but a hybrid war interwoven in all aspects of society. The leader will likely lead a horizontal collaborative military organization.

---

[76] Thomas L. Friedman, *The World is Flat: A Brief History of the Twenty-First Century* (New York: Farar, Straus, and Giroux, 2005), 177-181.

[77] Ibid., 352-353.

[78] David S. Alberts and Richard E. Hayes, *Power to the Edge: Command Control in the Information Age* (Washington, DC: Control Research Program, 2005), 1-6.

[79] Lt Col Don Fuller provides an in-depth discussion on possible future Air Force organization in his *Blue Horizons* paper entitled "The Air Staff of Tomorrow."

What attributes should these leaders possess in this environment?

Future Leader Attributes

Critical thinking skills are necessary but not sufficient to deal with these or other alternate futures. In the rapidly emerging future, diverse complex problems will rule the day with an adversary attacking all facets of society with unique combinations of advanced technology. Closely related are innovation, adaptability and agility. Surprise will be common as technology is combined in unique ways to produce new capability, often in the hands of small groups and individuals rather than the nation-state. Hybrid war means threats will emerge in areas of society not yet foreseen or understood. Future leaders must anticipate problems and quickly adjust with creative solutions to problems outside their experience. The leader must be open to innovative ideas often forged through a rapid collaborative process.

The ability to examine trends and envision the path the Air Force must follow is imperative. Leaders will sort through large amounts of information and must detect trends in the direction of military capability and how an adversary might employ their capabilities. Simply put, leaders require vision.

The rise of peer competitors to the United States will likely mean a multi-polar world of shifting alliances to balance power. In addition, insurgencies could break out anywhere in the world. The United States will become even more dependent on coalitions to act militarily. Leaders will require the ability to establish and lead a coalition team. The Air Force leaders must be acutely aware of cultures and sensitive to the needs of peers to function within a coalition and to effectively combat a multiethnic counterinsurgency.

Science and technology are a critical factor in the senior leader's career. Where previous generations of officers dealt with new disruptive technology only a few times in the course of

their career, the leaders in 2035 must learn how to anticipate and deal with constant, often disruptive, technological advancements.

A broad knowledge set is required to develop and employ all the attributes previously mentioned. Hybrid war will permeate all of aspects of society meaning future conflict could jump from a battlefield in a foreign country and take place within the communities and homes of people throughout the United States. A basic understanding of more general areas, such as law, economics and social interactions will aid future military leaders in combating adversaries in hybrid war. Technical literacy is required. Military leaders must have a basic understanding of potential threats and keen insight to the opportunities new technologies or a combination of technology portend.

Technology is a necessary but not sufficient component of effective future Air Force capability. War will still remain a human endeavor with military leaders making decisions. How these leaders are developed will disproportionately impact the effectiveness of the future United States Air Force. Indeed, the 2008 Joint Operating Environment study on future challenges and their implications identified PME as the "critical key to the future."[80] In the next chapter, we assess the suitability of the current PME continuum in preparing Air Force officers for 2035.

---

[80] United States Joint Forces Command, JOE, 48.

There is not the slightest indication that nuclear energy will ever be obtainable.

Albert Einstein, 1932

Chapter III

Assessing Officer Education

Developing Vision

The future requires leaders with vision. Albert Einstein's quotation, from a brilliant scientist who missed the possibilities of future developments, speaks volumes about the type of leaders we need. In order to create a vision, leaders must understand historic trends to make extrapolations about the future. For military leaders, this includes visualizing the future world environment, threat capabilities and the military's role in conflict in the future strategic environment. Vision in leadership is not a new concept but a long-standing goal of Air Force PME.[81] At issue is the most effective way to foster innovative thinking about the future. The review of curriculum in each Air Force PME school reveals a strong emphasis on historical studies in the form of foundations in strategy, military studies, and the profession of arms. This is in keeping with the traditional view of PME, which asserts PME should focus on the history of warfare, strategy, operations, international affairs and the United States defense establishment. This traditional "history-strategy-operations approach" continues to dominate Air Force PME curriculum at all levels.[82] This traditional approach teaches a linear of progression from the past into the future.

Richard Neustadt and Ernest May wrote *Thinking in Time* as an aid about the appropriate

---

[81] Richard L. Davis and Frank P. Donnini, *Professional Military Education for Air Force Officers: Comments and Criticisms* (Maxwell AFB, AL: Air University Press, June 1991).

[82] Preliminary Summary Analysis of the Conference on Professional Military Education for the 21st Century Warrior, sponsored by Naval Post Graduate School and Office of Naval Research, January 15, 1998, http://www.au.af.mil/au/awc/awcgate/mil-ed/mecc-analysis.htm.

use of history for those in public office. History stimulates the imagination by looking at the past and then visualizing alternative futures.[83] According to Neustadt and May, time should be viewed as a stream where the future is a logical stream emergent from the past.[84] Another term for this stream approach is a linear progression from the past into the future. The Air Force PME curriculum arguably follows this pattern. Students study military and international affairs up through the present day. The military officer is then expected to project along this line and develop their own vision of the future, one often limited to their next assignment. The curriculum rarely looks more than a couple years into the future on any issue. The problem with this approach is twofold.

First, the future does not progress in a predictable linear fashion. As outlined in Chapter Two, exponential growth in information and technology will in turn drive exponential changes in all aspects of society. The linear rhythm and thought process will not keep pace with the change in events. Figure 2 graphically illustrates the gap between a linear extrapolation and an exponential reality.[85] As the exponential rate of change continues, the gap between linear thinking and reality also increases exponentially.

---

[83] Richard E. Neustadt and Ernest R. May, *Thinking in Time: The Uses of History for Decision Makers*, (New York: The Free Press, 1986), xv.

[84] Ibid., 246.

[85] Lt Col Mike Finn examines the implications of the intelligence gap created by linear thought in an exponential environment in his *Blue Horizons* paper entitled "Cognition 2035."
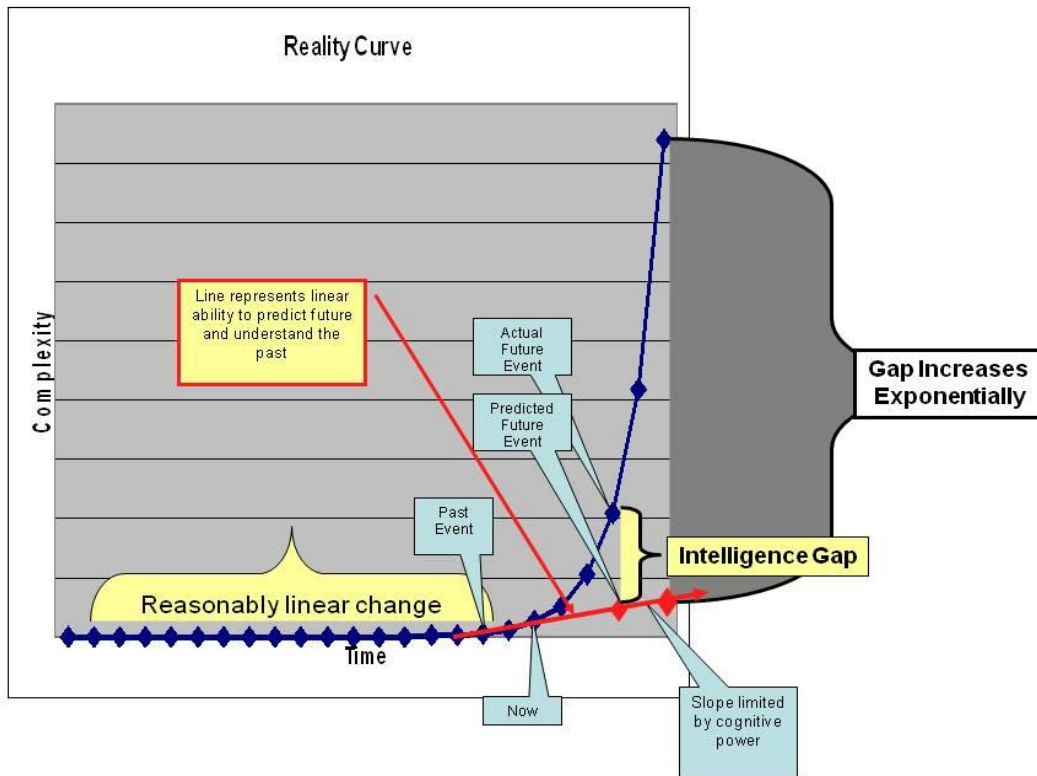
Figure 2: Reality Curve

Second, the student skill set is designed to optimize performance within the present period rather than providing them new skill sets to envision the future and the future strategic environment. The traditional approach gives the student nothing to build upon except a linear progression from the past to the present; it does not provide the tools to project into the future.

Clausewitz asserted military theory was important as a guide to learn from history.[86] The traditional Air Force PME school curricula devote significant time to military history and theory. Students explore multiple contrasting opinions of war as art versus war as science. The debate between these two schools of thought enables students to synthesize ideas and develop their own theory of war. The intent is their own theory should guide the officer during their self-directed reading of military history after formal PME. What is lacking is a similar model to examine

---

[86] Carl Clausewitz, *On War*, ed. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1984), 141.

trends and project into the future so the leader is better able to form a vision.

Chapter Two explored the trend toward hybrid war where future adversaries attack in, through, and against all aspects of modern society. The military officer needs a model designed to help them develop the skills to look forward in all aspects of society to help them anticipate and visualize the military role in future conflicts. The military officer of 2035 will not be able to cope with exponential change using the old linear approach to visualize time streams. Higher education institutions are responding to the business community by making future studies courses a fixture in their curricula. Businesses want workers fixed on the future to help companies grow and succeed through the chaos rapid technological changes will bring to society and business. Future studies is not a hollow academic pursuit – it is a permanent fixture in strategic planning by major companies and institutions.

One example in practice with business is outlined in *The Art of the Long View*. Peter Schwartz details the approach developed by Royal-Dutch Shell and used by government agencies and Fortune 500 companies. Scenario-building is a process enabling managers to create several different plausible stories for the future. After analyzing each potential future, managers make strategic choices considered sound within the context of each possible future.[87] Keys to this process include thorough research, an understanding of how to manage driving forces and then wargaming the implications of each scenario. The real value in the scenario building process is not to precisely predict the future. Rather, the value lies in challenging static mental models and opening up the mind to creatively consider new possibilities.[88]

Scenario building is not new. In fact, the Air Force pioneered a version of this process immediately after World War II. The Air Force developed alternative long-term strategies

---

[87] Peter Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World*, (New York: Doubleday, 1996), xii-xiv.
[88] Ibid., xv.

potential adversaries might pursue in order to develop counter-strategies and capabilities.[89] The

United States military has continued this process with strategic planning staffs. The

Headquarters Air Force Directorate of Strategic Planning is one example. Its current charter

requires this office to consider future changes to aid in Air Force strategic choices with long-

term implications. This office hosts a Futures Capabilities Game exploring force structures and

deploying Air Force capabilities against emerging threats.[90] In addition, the alternate futures

addressed in Chapter Two of this paper highlighted the role played by CSAT who each year lead

the research efforts of a small select group of AWC and ACSC students.

At issue is the proposition that a few personnel on the staff and at Air University are

required to conduct future studies and prepare the Air Force to confront future challenges rather

than having an entire officer corps trained to anticipate and respond to future challenges. Rapid

technological advances will drive the Air Force to transform into a more collaborative, less

hierarchical organization in the near future. Every member all the way to the "edge" of the

United States Air Force will be involved in some measurable way in the decision-making

process.

Air Force officer education must teach techniques for bringing order to vast amounts of

information, providing new skills to recognize trends likely to persist, and define the future. This

will not only aid in developing leaders with vision, but also make them value-added in this

emerging collaborative decision-making process. Air Force PME as currently constituted does

not provide any structured courses to prepare today's young officers for this or any rapidly

---

[89] Ibid., 7.
[90] US Air Force Future Capabilities Game 2007 Unclassified Report Summary, Directorate of Strategic Planning, Headquarters, Air Force Pentagon, Washington, DC, September 29, 2008, Forward.

unfolding future.[91]

The review of the core Air Force PME curricula reveals little study in the core curriculum directed toward relating historic and present trends to possible future outcomes. Only in ACSC and AWC are students exposed to any discussion about future capabilities. However, this exposure is currently limited to discussions of near-term space and cyber capabilities. The AWC International Securities Studies program does address global trends in the context of future threats to United States national interests. However, there is no attempt to look beyond a couple years into the future.

The AWC Warfighting course purports to consider emerging threats and execute a wargame set 10 years into the future. In reality, the focus of the wargame is on the joint planning process – future concepts, capabilities, and trends if used, are incidental to the game's overall purpose.[92] The capabilities played in the game are limited to current force capabilities and not future capabilities. The only structured instruction exploring capabilities 20-plus years into the future and providing instruction in the concept of exponential change are elective courses.

Both ACSC and AWC have a CSAT elective normally enrolling 30 ACSC and 16 AWC students. In addition, AWC has an intelligence elective that explores technology development and its implications.[93] Normally less than 30 students of the 250 enrolled in AWC complete this elective each year.[94] Beyond these limited programs, most students do not have any exposure to technology and other future force issues beyond the next five years. Most Air Force officer PME

---

[91] *Department of International Security Studies: National Security and Decision Making Course Syllabus AY 2009*. Maxwell AFB, AL: Air War College, 2008, 109-182.

[92] Dr. Roy F Houchin II, (Course Director, Warfighting Department, AWC), interview by author, 18 November 2008.

[93] Ibid.

[94] Ibid.

is structured to promulgate traditional linear thought; it is not structured to teach how advanced

technology will drive exponential change.

As arguably the most technologically reliant and advanced military service, the United

States Air Force would appear to have a vested interest in preparing its leaders for the

technological "tsunami" building between now and 2035. Officers in the ASBC and SOS

programs should receive a short introductory course to become familiar with the concept of

exponential progression. ACSC and AWC students to include the distance learning programs

should receive instruction on the concepts and then engage in scenario development to begin

understanding developing vision for the future. Restructuring all Air Force PME programs to

present balanced curricula including military history, operations, leadership, technology, and

future capabilities is an investment in the future force.

Understanding Technology

Closely related to creating a vision of the future is an understanding of technology. The

exponential change in technology as envisioned by Ray Kurzweil, Dennis Bushnell, Alvin

Toffler, and other futurists and technologists will drive changes in society and in turn change

how we fight and win wars. The 1998 Conference on PME for the 21st Century Warrior

discussed the effect of technology on the future of warfare and debated the merits of including

technical education in the PME curriculum. Some espoused the view PME should include

technology education to increase the technological literacy of military officers.[95] In the end, the

traditional approach won out as its supporters argued it to be a proven approach to educating

today's officers. A compromise proposal would modify the traditional approach by adding

---

[95] Conference on PME, 3.

courses on recent military operations.[96] A review of the PME programs from Chapter Two

shows the traditional approach is currently in use at Air Force PME schools.

Science, technology, engineering and mathematics (STEM) literacy is a growing concern

across the United States. Despite a shift toward an information economy dependent on high

technology skills, the number of students earning STEM-related degrees is decreasing. Only 8

percent of all degrees awarded annually in the US are in STEM programs; this trend indicates 90

percent of all scientists and engineers will soon be from Asia at the current rate.[97] Commercial

leaders and educators fear the United States will lose its competitive edge in the world economy

as more technical innovation comes from Asia where the majority of STEM expertise resides.

The Air Force shares these concerns. The Air Force requires technical degrees to match

to certain career fields, such as civil engineering, communications, science, and developmental

engineer. The Reserve Officer Training Corps (ROTC) accessions in 2008 showed 38 percent of

new officers with science or technology degrees.[98] Fifty-two percent of United States Air Force

Academy (USAFA) students are enrolled in science or technology programs.[99] A survey of the

Air Force Personnel Officer (AFPC) Database shows 48 percent of all second lieutenants on

active duty have a degree in science or technology.[100] However, in keeping with the force

development guidance addressed in Chapter Two, most officers get advanced degrees in more

general studies of the arts.

The AFPC database shows only 28 percent of the serving Air Force colonels earned a

---

[96] Ibid., 3-4.
[97] Rachel Jones, "Science, Technology, Engineering & Math," State Educational Technology Directors Association Report, September 2008, http://www.setda.org/c/document_library/get_file?folderId=270&name=DLFE-257.pdf, 3.
[98] Numbers derived from ROTC Database, author interview with Deputy Director Mr. J.C. Mann, November 18, 2008.
[99] Lt Gen John F. Regni, USAFA Superintendant Briefing, 14 November, 2008.
[100] Air Force Personnel System, Interactive Demographic Analysis System http://w11.afpc.randolph.af.mil/vbin/broker8.exe?_program=ideas.IDEAS_default.sas&_service=prod2pool3&_debug=0.

science or technology advanced degree. Recent CSAF emphasis on officers earning science and

technology degrees has cause for concern among some retired Air Force officers, such as Donald

Baucom writing in *Air University Review*, who say officers with humanities degrees are also

important to the Air Force.[101] Others, such as Thomas Hammes in *The Sling and the Stone,*

argue for less technology in PME with even more focus on history and the profession of arms.[102]

However, Hammes' criticism seems misplaced as the survey of the PME programs in Chapter

One demonstrates a noticeable void of technical education in PME programs.

Regardless of the arguments, both camps agree Air Force officers must engage in lifelong

learning throughout their careers. Today's Air Force leaders require broad knowledge. Critical

analytical skills are developed in both the arts and the sciences. As leaders rise in rank, their

technical skills, while important, become less critical than their breadth of knowledge and their

experience.

The ability of an individual to learn, transfer, and evaluate knowledge is a fundamental

concept in education. Transfer involves taking knowledge from one particular area and

transferring it to a different situation. Evaluation is the highest level of learning in Bloom's

taxonomy where value judgments are made on information to select the best solution. Multiple

theories exist on the best method to accomplish this through education. The general educational

rule supported by multiple research efforts is a broad education providing a baseline to compare

future knowledge.[103] Psychological studies show human beings are able to learn a process and

---

[101] Donald R. Baucom, "Air Force Officer Corps: Quo Vadis?" *Air University Review*, November-December, 1984, http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/nov-dec/editorial.html.
[102] Col Thomas X. Hammes, *The Sling and The Stone*, (Saint Paul, MN: Zenith Press, 2004), 242.
[103] H.S. Broudy,"Types of Knowledge and Purposes of Education," in R.C. Anderson, R.J Spiro and W.E. Montague ed. *Schooling and the Acquisition of Knowledge*, Hillsdale, NJ: Erlbaum, 1977, 1-17.

apply knowledge much better if what they are taught is presented in the form of contrast.[104]

Exposure to differing or opposing points of view and seeing the differentiation of the arguments builds skill that enable interpreting and evaluating future information.

USAFA's approach demonstrates its commitment to a curriculum and environment of broad education. The core curriculum is more in-depth than most civilian universities. It includes 14 science and technology course, 16 nontechnical, and 2 foreign language courses.[105] This commissioning source provides the Air Force 22 percent of its accessions; it is also the source of 50 percent of the current Air Force general officers.[106] This disproportionately large resource of senior Air Force leaders may be the result of the broad education afforded to its graduates.

Officers commissioned from the ROTC and Officer Training School, where the bulk of Air Force accessions originate, usually do not receive such a broad education. Officers with nontechnical degrees usually receive limited exposure to technical areas of study. As the Air Force cannot design the curriculum at public universities, it is reluctant to levy additional education requirements on ROTC because of the time required to complete degrees. Unlike USAFA graduates, many ROTC graduates require more than four years to complete their degree.[107] Arguably the Air Force would be better served if the officers commissioned through ROTC and OTS completed additional courses in science and technology to "round out" their undergraduate education and bring it more in line with USAFA's program.

A review of the PME programs in Chapter One showed that Air Force officers are

---

[104] John D. Bransford and Daniel L. Schwartz, "Rethinking Transfer: A Simple Proposal with Multiple Implications," in *Review of Research in Education*, Chapter 3, Volume 24, ed, A. Iran-Nejad and P. D. Pearson, (Washington, DC: American Educational Research Association, 2001), 61-100.
[105] US Air Force Academy, *The Curriculum Handbook*, http://www.usafa.edu/df/curriculum/handbook.cfm?catname=dfr2, 71.
[106] Lt Gen John F Regni, USAFA Superintendant Briefing, 18 November 2008.
[107] J.C. Mann, (ROTC Deputy Director), interview by the author, 18 November 2008.

exposed to an increasingly robust liberal arts education in leadership, history and international studies over the course of a career. In addition, officers are exposed to current military capabilities (and to a lesser extent, their underlying technologies). What is missing is exposure to developing technology and its potential implications for future military capabilities.

Officers with technical degrees from pre-commissioning sources become "out of date" as their knowledge base is soon overwhelmed by the rapid advance of technological development. Officers with nontechnical degrees do not receive sufficient knowledge on technology to become technically literate and by default are "out of date." Thus Air Force PME could be the most appropriate venue to broaden the knowledge base of officers in both the arts and the sciences by adding technically oriented material to their respective curriculum.

Another void in technology at the PME schools is the acquisition process. Unless in an acquisition related field, most Air Force officers receive no formal education on acquisition programs, processes, and procedures. Each PME curriculum spends little time addressing the problems with Air Force programs – none have structured courses on this extraordinarily complex process.

Early Air Force leaders, such as General Hap Arnold and General Carl Spaatz, were posted to assignments in the Material Division within the service to broaden their understanding of industry and the acquisition process. Today's Air Force officer, outside of the acquisition career field or a few staff positions, receives virtually no exposure to acquisition until they are placed in very senior positions. The Air Force Research Laboratory (AFRL) hosts tours of their facilities and provides briefings on their activities to expose future leaders to the overall process and acquaint them with future technologies.

Future threats will use readily available commercial technology in unique combinations

and applications. Thus, Air Force officers need an appreciation for the projects being worked within the United States government to help them visualize the "realms of the possible" that future adversaries equipped with new and emerging technologies may present. Equipped with this knowledge, officers then develop an appreciation of the acquisition process and thus better understand the difficulties encountered building the future force. Technical study and an appreciation for the acquisition process are potentially important additions to the ACSC and AWC curriculum that will arguably better prepare future officers for the challenges they will face in 2035.

Finally, a limited Fortune 500 Fellow program should be included in the AWC curriculum. Over 80 percent of the research conducted by AFRL is accomplished through an alliance with private business and academia. In addition, many innovations altering the way society interacts come from business innovations. The trend toward hybrid warfare implies that future conflicts will permeate all aspects of society.

As the Toffler's argued, people make war the way they make wealth.[108] A few weeks immersion into the workings of a major defense-related company could build the breadth of knowledge available to the military officer helping them prepare for future hybrid wars. The precedent for such a program is the two week regional studies trip designed to reinforce classroom instruction and to build each student's awareness of other cultures. A brief internship trip with industry for a couple of weeks could accomplish a similar goal by fostering an understanding of and appreciation for how commercial industries innovate and how they bring these innovations to the market and create a demand for them.

---

[108] Alvin Toffler and Heidi Toffler, *War and Anti-War* (New York: Warner Books, 1993), 2.

Adaptability

Adaptability is a highly desirable attribute in future Air Force officers. Research by the Institute for Defense Analysis concluded adaptability is the combination of intuition, critical thinking and creative thinking.[109] Intuition comes through pattern recognition and comparison, which is developed through experience. Critical thinking involves analyzing a problem, generating possible solutions and then selecting the best alternative. Creative thinking entails combining unique ideas to create possible solutions. The most effective way to develop these qualities is through decision-making exercises framing difficult decisions in complex environments, practicing making decisions and providing feedback on the thought process used.[110]

A review of the COE reveals mixed content between the different schools. All Air Force PME schools teach courses on problem solving and critical thinking skills. However, only the ASBC and SOS programs include practical exercises designed to reinforce the classroom instruction and develop new problem solving skills. The ACSC and AWC programs have limited classroom exercises imbedded in a couple of core classes but programs designed to provide practical problem solving experience are notably absent.[111] The focus of both programs is in classroom instruction only. AWC does have a wargame in the curriculum but as previously discussed, the focus on this program is on the joint planning process and not on actual execution or decision-making. The wargame is also a one-time short duration event; the research on adaptability advocates a wide-variety of decision-making events to help senior leaders develop the required skills.

---

[109] John C.F. Tillson et.al, *Learning to Adapt to Asymmetric Threats* (Alexandria, VA: Institute for Defense Analysis, August 2005), 64.
[110] Ibid., 61.
[111] AU-10 2008, 19-44, 53-69.

ASBC and SOS appear on the right track with programs designed to maximize adaptability in the company grade officer; ACSC and AWC are not. Rather than a one-time big event wargame, adding a multitude of games with reduced planning demands could reinforce key concepts and allow students to frequently apply their new skills in different situations. With increased frequency, the curriculum could present multiple and different scenarios, such as counterinsurgency, conventional war, future capabilities, and humanitarian relief. The varied scenarios would offer a breadth of exposure to complex situational problems and increase student intuition and creative problem solving skills. In addition, at least one of these exercises should include collaborative approaches to decision-making to expose students to future Air Force staff organization and operations.

The use of wargames within cloud computing is an area of great potential. Cloud computing offers users' web-based applications and data storage without the need for large investments in hardware.[112] Multiple different wargames could be loaded onto the cloud and made available to officers in both the distance learning and residence programs.[113]

Lifelong Learning

A review of the available literature on PME reveals many recommendations on subject matter PME curricula should include. Some call for more joint education starting earlier in an officer's career.[114] Others say the military should send more of its officers to civilian graduate

---

[112] Ludwib Siegle, "Corporate IT: Let it Rise," *The Economist*, 23 October2008, http://www.economist.com/specialreports/displayStory.cfm?story_id12411882.

[113] Lt Col Robert Spalding examines the potential use of cloud computing and its implications for the Air Force in his *Blue Horizons* paper entitled "Network Centric Warfare 2.0."

[114] Robert W. Lyonnais, "Joint Professional Military Education: Time for a New Goal," Monograph from the School of Advanced Military Studies, Fort Leavenworth, KS, AY2002-2003.

schools.[115] Current wars bring calls for more irregular warfare preparation.[116] They are all

arguably correct. As seen from the future complexity facing Air Force officers, the demands of

dealing with exponential change and constantly changing threat environments requires a very

extensive knowledge base. The challenge is the time available at PME schools is already

claimed by other arguably worthy courses. Any addition to the curriculum could require the

removal of another course or a reprioritization of the entire curriculum.

Some PME instructors express difficulty keeping pace with the information demands

given the time available to teach. They recommend PME schools stop educating generalists and

adopt a curriculum tailored to produce specialists – the counterfactual argument to such an

approach is this creates disconnected stovepipes.[117] However, the trends noted in Chapter Two

and the expected demands on future officers may do a disservice to officer PME. There is

another possible solution.

Lifelong learning is a constant theme in discussions about PME. Davis and Donnini

record in their historical review of Air Force PME that instilling lifelong learning was a goal of

Air University's founders.[118] Attempts to this point have focused on encouraging self-study and

lifelong learning. The CSAF reading program also encourages officers to pursue lifelong self-

study. The reading program is important but the Air Force could do much more. Most educators

agree lifelong learning should be inculcated early as an enduring value in a successful Air Force

career. Courses of study should be individually prescribed and officers held accountable for

completion. Annual computer-based ancillary training in areas such as computer security and

---

[115] Congressman Ike Skelton, "Skelton: Transition To The Information Age Demands Improvements To Professional Military Education System," (Address, Dwight D. Eisenhower National Security Conference, Washington, DC, 2005) http://www.au.af.mil/au/awc/awcgate/skelton/pr050928.htm.

[116] Scott D. Yancy, "Adapting Professional Military Education to the Current Threat," ACSC Research Paper, Maxwell AFB, AL, April 2006.

[117] Gary Schaub Jr., "Senior Developmental Education: A Bridge Too Far?" *The Wright Stuff*, Volume 3, Issue 19, 16 October 2008, http://www.maxwell.af.mil/au/aunews/archive/0319/indexprint.htm.

[118] Davis and Donnini, 18.

force protection are already mandated training events.

Continuing education to broaden a military officer's knowledge base should also become a fixture in officer professional development. Planners in higher education expect the current generation of professionals to spend 20 percent of their life pursuing continuing education to remain viable in a specific job role.[119] The complexity discussed in Chapter One and the demands for a broadly educated generalist means military officers, like their civilian counterparts, will likely spend more than 20 percent of their time pursuing continuing education.

As noted previously, distance learning provides a viable and even preferred alternative to classroom instruction. Accelerated courses appear to impart similar knowledge as traditional semester length coursework. The coursework is already available from civilian universities. Leading universities like Yale offer full course materials online for free.[120] MIT is trying to become a leader in online education and already has 1800 courses online, which have received over 31 million hits.[121] The capabilities exist for the Air Force to leverage this technology. What appears to be missing is the institutional will to mandate continued education.

The Air Force is in the early stages of developing a new virtual reality distance learning system. Most articles on future PME focus on the technology involved in this system rather than curriculum specifics.[122] In 2008, Air Education and Training Command published an advocacy piece entitled, *On Learning,* proposing a system of virtual reality with an Air Force 2.0 learning environment.[123] Key among the recommendations of this paper is an Air Force strategic plan for education. Indeed, a strategic plan is vital to quantifying what, when, and how the Air Force

---

[119] Dolence and Norris, 9.
[120] Cincotta, 2.
[121] Ibid., 2.
[122] SpaceCast 2020, "Professional Military Education in 2020", http://www.au.af.mil/au/awc/awcgate/awc-pme.htm#future.
[123] Air Education and Training Command White Paper, *On Learning: The Future of Air Force Education and Training*, 30 January 2008, 10.

wants its PME education programs to accomplish. Once the attributes and learning outcomes are quantified, a holistic approach to force development through education can be developed and executed. A virtual reality network will take time to develop and implement. Courseware will need to be developed. In the interim, the Air Force must identify the broad knowledge sets required of officers and begin using the current distance learning system to educate Air Force officers.

ACSC and AWC Redundancy

The basic curriculum of intermediate and senior PME can arguably be more advanced. The Air Force is not optimizing the 10 months spent in-residence at these schools. A majority of students take the curriculum through distance learning before attending in-residence largely due to command pressure and a desire by the individual to make themselves more competitive for promotion. In the AWC class of 2008, 88 percent of Air Force officers had completed AWC through distance learning prior to attending the course in-residence[124]. In-residence students retake almost exactly the same curriculum as they took through correspondence since AFI 36-2301 mandates the "nonresident program mirror the resident school curriculum."[125] The resident core courses begin with basic level information to provide a common background for students. The result is a majority of Air Force officers spend a considerable amount of time reviewing basic concepts they likely have already learned rather than exploring new material and advanced knowledge.

The goal is for all officers to attend every level of PME in-residence but space limitations, operations tempo, and other factors limit attendance to only a small percentage of the highest quality officers considered by promotion boards. In-residence students are considered

---

[124] AU Database, Mr. Ted Jackson, AU/CFRT.
[125] AFI 36-2301, 14.

the future senior leaders of the Air Force. Yet, the time available during the academic year to

educate is not optimized. The primary reason for redundancy is that distance learning is not an

absolute prerequisite for attendance in-residence. To better optimize the in-residence program,

distance learning should become a prerequisite so in-residence programs can be restructured to

challenge military officers and build their knowledge set. A majority of officers demonstrated

through their completion of non-residence PME that it is possible. In the case of AWC students,

most complete part of the program while in command. The capability exists to free up

significant time to add the new curriculum items explored in this paper for the in-residence

ACSC and AWC programs if the basic core courses are completed through distance learning.

The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so must we think anew and act anew.
Abraham Lincoln

Chapter IV

The Way Ahead

Much is written about the constant change going on around us. This paper quantifies the trend of exponential computing power growth fueling exponential growth in technology development across all scientific disciplines. Military transformation remains a buzzword within the public debate on United States defense capabilities. The armed forces maintain that people are our most vital resource. As war is a human enterprise, it will continue to involve human decision-making in its conduct. Thus, we must consider how to transform the way we educate our leaders to prepare them for the complex world of 2035.

Higher education in the civilian world has begun an evolution toward a learner-centered process of education, one responsive to the demands of a 21st century business environment with an adult workforce committed to lifelong learning. Business seeks bright people with the ability to apply creative critical thinking in a collaborative environment. The Air Force will require even more of its officer leaders to anticipate and adapt to threats to our nation's security in the fog of a rapidly changing world. The education system for these officers must transform now to enable their future success.

Recommendations

The recommendations revealed from this study are four-fold. First, the need for Air Force leaders with discerning vision is critical. Current PME stresses the study of the past as a tool to enlighten the path to the future. Future studies should be incorporated in the curriculum

in conjunction with historical study across the COE to provide Air Force leaders with tools to visualize potential futures.

Second, Air Force officers will likely face surprising or unique situations in the future due to the complexity that will permeate future society. Air Force officers will have to adapt quickly. Decision-making exercises, primarily in the form of wargames, should be added across the COE to build future leader adaptability skills.

Third, the exponential increase in technology requires technical literacy for individuals to thrive in the future. Threats in the future will include unique malicious combinations of readily available advanced commercial technology. Air Force officers need exposure to technology across the COE to open the aperture to the realm of the possible. This should include exposure to industry and the acquisition process. The focus should not be on specific technical skills but on the capabilities and limitations of technology to enable Air Force officers to make educated judgments on the possible implications of future military capabilities and threats.

Fourth, lifelong learning must become an inculcated reality. The skill sets and knowledge base officers will require to deal with future challenges necessitates a continuous learning process throughout an officer's career. A broad knowledge base will also be essential to enable future Air Force officers to rapidly adapt to new complex situations. Quality distance learning opportunities are available now from civilian institutions – the Air Force program should at a minimum, emulate them.

Finally, these recommendations should not be incorporated individually in a piecemeal fashion. The Air Force requires a comprehensive strategic implementation plan. A good first step was AETC's paper *On Learning*, which advocates transformation of Air Force training and education to include a virtual reality enterprise. The content within the virtual reality system

needs equal consideration. The chief learning officer (CLO) recommended by *On Learning* should be identified and empowered to make immediate changes.[126] The CLO should consider the future operating environment and determine the attributes and skill sets required for current and future Air Force personnel. With the desired outcomes determined, effective approaches and curriculum to develop these characteristics should be developed. This holistic approach should then be communicated in an Air Force strategic force development plan. Implementation must follow quickly thereafter.

Conclusion

Officers who will lead the United States Air Force in 2035 are already in the current PME system. Force development is a career-long process with every education event building upon the last so over time, it creates the next generation of senior leaders. The traditional Air Force PME factory has served our Air Force well in the past but given the rapid pace of change in the strategic environment driven by technological developments, the system must transform. The milestone-driven PME system must give way to education in military specific subjects as well as lifelong education across academic disciplines to equip our future leaders with a broad knowledge base.

The current in-residence programs are hampered by redundant core courses. Adding a distance learning prerequisite for the in-residence program would free up time for new course additions to the curriculum to include future studies, technical literacy, and wargaming to develop adaptability (intuitive, creative, and critical thinking). A new long-term strategic plan on force development will go a long way to quantifying Air Force needs and define a path to the future. Most of these ideas will not grow without a cultural change within the Air Force that

---

[126] On Learning, 18.

accepts exponential change as a fact of life and in turn values lifelong learning as a necessity for the future success of the organization. *Leading Change* means creating a sense of urgency about the need for organizational transformation. Today's Air Force leaders have the responsibility to grow and teach the future Air Force leaders. This heavy responsibility requires urgent action to successfully transform.

Bibliography

Acceleration Studies Foundation. "Intro to Foresight Development." http://accelerating.org/foresight_development.html.

Air Education and Training Command White Paper. *On Learning: The Future of Air Force Education and Training*. 30 January, 2008.

Air Force Leadership Development Model, from Air Force Senior Leader Management Office, Jan 2004, http://leadership.au.af.mil/af/afldm.htm.

Air Force Personnel System, Interactive Demographic Analysis System http://w11.afpc.randolph.af.mil/vbin/broker8.exe?_program=ideas.IDEAS_default.sas&_service=prod2pool3&_debug=0.

Air Force Research Laboratory Factsheet, http://www.af.mil/factsheets/factsheet.asp?id=148.

Air University Database, accessed by Mr. Ted Jackson, AU/CFRT, accessed December 8, 2008.

Alberts, David S. and Richard E. Hayes. *Power to the Edge: Command Control in the Information Age*. Washington, DC: Control Research Program, 2005.

AU-10, *Air University Catalog Academic Year 2007-2008*. Maxwell AFB, AL: AU Press, October 2007.

AU-10, *Air University Catalog Academic Year 2008-2009*. Maxwell AFB, AL: AU Press, October 2008.

Baucom, Donald R. "Air Force Officer Corps: Quo Vadis?" *Air University Review*, November-December, 1984, http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/nov-dec/editorial.html.

Beason, Doug. *The E-Bomb: How America's New Directed Energy Weapons Will Change The Way Future Wars Will Be Fought*. Cambridge, MA: Da Capo Press, 2005.

Bell, Wendell. "Making People Responsible: The Possible, the Probable, and the Preferable," in *Advancing Futures: Future Studies in Higher Education*. ed. James A. Dator, Westport, Conn: Praeger, 2002.

Bloom, Benjamin S. *Taxonomy of Educational Objectives: The Classification of Educational Goals*. New York: Longmans, Green and Company, 1956.

Bransford, John D. and Daniel L. Schwartz. "Rethinking Transfer: A Simple Proposal with Multiple Implications," in *Review of Research in Education*, Chapter 3, Volume 24, ed, A. Iran-

Nejad and P. D. Pearson, Washington, DC: American Educational Research Association, 2001, 61-100.

Broudy, H.S. "Types of Knowledge and Purposes of Education," in R.C. Anderson, R.J Spiro and W.E. Montague ed. *Schooling and the Acquisition of Knowledge*. Hillsdale, NJ: Erlbaum, 1977, 1-17.

Cardoso, James L. et. al. *Future Insurgency: Coin and the USAF in 2030*. Maxwell AFB,AL:Center for Strategy and Technology, May 2008.

Chen, Kuo-Hua, "A Generation of Futures Studies in Taiwan," in *Advancing Futures: Future Studies in Higher Education*. ed. James A. Dator, Westport, Conn: Praeger, 2002.

Cincotta, Howard. "Online Learning Changing the Face of American Education," US Department of State website, January 1, 2008, http://www.america.gov/st/educ-english/2008/January/20080108101202attocnich0.402767.

Clausewitz, Carl. *On War*. ed. Michael Howard and Peter Paret, Princeton: Princeton University Press, 1984.

Cohen, Eliot A. and John Gouch. *Military Misfortunes: The Anatomy of Failure in War*. New York, 2006.

CSAF Reading List Program, http://www.af.mil/library/csafreading/.

Davis, Richard L. and Frank P. Donnini. *Professional Military Education for Air Force Officers: Comments and Criticisms*. Maxwell AFB, AL: Air University Press, June 1991.

Department of International Security Studies: National Security and Decision Making Course Syllabus AY 2009. Maxwell AFB, AL: Air War College, 2008.

Dolence, Michael G. and Donald M. Norris. *Transforming Higher Education: A Vision for Learning in the 21st Century*. Ann Arbor, MI: Society for College and University Planning, 1995.

Foster, Lynn E. *Nanotechnology: Science, Innovation, and Opportunity*. Upper Saddle River, NJ: Prentice Hall, 2006.

Friedman, Thomas L. *The World is Flat: A Brief History of the Twenty-First Century*. New York: Farar, Straus, and Giroux, 2005.

Frier, Nathan. *Known Unknowns: Unconventional "Strategic Shock" In Defense Strategy Development*. Carlisle, PA: Strategic Studies Institute, November 2008, http://www.strategicstudiesinstitute.army.mil.

Garreau, Joel. Radical Evolution: *The Promise and Peril of Enhancing Our Minds, Our Bodies-and What it Means to be Human*. New York, Broadway Books, 2005.

Geis, John P., II, Scott E. Caine, Edwin F. Donaldson, Blaine D. Hold and Ralph A. Sandfry, *Discord or Harmonious Society? China in 2030*. Maxwell AFB, AL:Center for Strategy and Technology, July 2008.

Hambling, David. "Army Orders Pain Ray Trucks; New Report Shows 'Potential for Death,'" *Wired Blog Network*, October 10, 2008, http://blog.wired.com/defense/2008/10/army-ordering-p.html.

Hammes, Col Thomas X. *The Sling and The Stone: On War in the 21st Century*. Saint Paul, MN: Zenith Press, 2004.

Hoffman, Frank G. C*onflict in the 21st Century: The Rise of Hybrid Wars*. Arlington, VA: Potomac Institute for Policy Studies, December 2007.

Houchin, Dr. Roy F. II. (Course Director, Warfighting Department, AWC), interview by author, 18 November 2008.

Iyer, Bala and Thomas H. Davenport. "Reverse Engineering Google's Innovation Machine." *Harvard Business Review*, April 2008.

Jalali, Ali A. and Hamid Mahmoodi. "Virtual Age: Next Wave of Change in Society." Address. The 2009 International Joint Conferences on e-CASE and e-Technology, Grand Copthorne Waterfront Hotel, Singapore, January 8-10, 2009, http://online.sfsu.edu/~mahmoodi/papers/paper_C50.pdf.

Jones, Elizabeth A. *Transforming the Curriculum: Preparing Students for a Changing World*. ASHE-ERIC Higher Education Report: Volume 29, Number 3, Washington, DC: Jossey-Bass, 2002.

Jones, Rachel. "Science, Technology, Engineering & Math." State Educational Technology Directors Association Report, September 2008, http://www.setda.org/c/document_library/get_file?folderId=270&name=DLFE-257.pdf.

Kotter, John P. *Leading Change*. Boston: Harvard Business School Press, 1996.

Kurzweil, Ray. *The Singularity is Near: When Humans Transcend Biology*. New York: The Penguin Group, 2006.

Liang, Qiao and Wang Xiangsui. *Unrestricted Warfare*. Beijing: PLA Literature and Arts Publishing House, February 1999, http://www.terrorism.com/documents/TRC-Analysis/unrestricted.pdf.

Lyonnais, Robert W. "Joint Professional Military Education: Time for a New Goal." Monograph from the School of Advanced Military Studies, Fort Leavenworth, KS, AY2002-2003.

Mann, J.C. (ROTC Deputy Director), interview by the author, 18 November 2008.

Mannermaa, Mike. "Politics + Science = Future Studies?" in *Advancing Futures: Future Studies in Higher Education*. ed. James A. Dator, Westport, Conn: Praeger, 2002.

Neustadt, Richard E. and Ernest R. May. *Thinking in Time: The Uses of History for Decision Makers*. New York: The Free Press, 1986.

Parker, Sybil P. ed. *Dictionary of Scientific and Technical Terms*. 3rd ed., New York: McGraw-Hill Book Company, 1984.

Preliminary Summary Analysis of the Conference on Professional Military Education for the 21st Century Warrior, sponsored by Naval Post Graduate School and Office of Naval Research, January 15, 1998, http://www.au.af.mil/au/awc/awcgate/mil-ed/mecc-analysis.htm.

Regni, Lt Gen John F. USAFA Superintendant Briefing. USAFA, CO, November 14, 2008.

Russell, Thomas L. "The No Significant Difference Phenomenon." http://www.nosignificantdifference.org/search.asp.

Saeed, Sy Atezaz. "Science to Practice:Top 10 Research Findings of 2007-2008,." http://www.ncpsychiatry.org/SAEED%20Top%2010%20findings%202008.pdf.

Schaub, Gary, Jr. "Senior Developmental Education: A Bridge Too Far?" *The Wright Stuff*. Volume 3, Issue 19, 16 October 2008, http://www.maxwell.af.mil/au/aunews/archive/0319/indexprint.htm.

Schwartz, Peter. *The Art of the Long View: Planning for the Future in an Uncertain World*. New York: Doubleday, 1996.

Siegle, Ludwig. "Corporate IT: Let It Rise." *The Economist*, 23 October 2008, http://www.economist.com/specialreports/displayStory.cfm?story_id12411882.

Singularity University Factsheet, http://singularityu.org/about/faq.

Skelton, Ike Congressman, "Skelton: Transition To The Information Age Demands Improvements To Professional Military Education System," Address. Dwight D. Eisenhower National Security Conference in Washington, DC, 2005, http://www.au.af.mil/au/awc/awcgate/skelton/pr050928.htm.

SpaceCast 2020. "Professional Military Education in 2020. http://www.au.af.mil/au/awc/awcgate/awc-pme.htm#future.

Theil, Stefan, "Tune in Tomorrow," *Newsweek*, August 9, 2008, http://www.newsweek.com/id/151688.

Tillson, John C.F., et.al. *Learning to Adapt to Asymmetric Threats*, Alexandria, VA: Institute for Defense Analysis, August 2005.

Toffler, Alvin and Heidi Toffler, *War and Anti-War*, New York: Warner Books, 1993.

University of Advancing Technology Mission Statement, http://www.uat.edu/about_uat/default.aspx.

US Air Force Academy. *The Curriculum Handbook*. http://www.usafa.edu/df/curriculum/handbook.cfm?catname=dfr2.

US Air Force Doctrine Document 1-1. *Leadership and Force Development*. February 18, 2006.

US Air Force Future Capabilities Game 2007, Unclassified Report Summary, Directorate of Strategic Planning, Headquarters, Air Force Pentagon, Washington, DC, September 29, 2008.

US Air Force Instruction 36-2611. *Officer Professional Development*. 1 April 1996.

US Air Force Instruction 36-2301. *Professional Military Education*. 26 September 2007.

US Joint Forces Command. "Joint Operating Environment: Challenges and Implications for the Future Joint Force." https://us.jfcom.mil/sites/J5/j59/default.aspx.

Yancy, Scott D. "Adapting Professional Military Education to the Current Threat." ACSC Research Paper, Maxwell AFB, AL, April 2006.

Wlodkowski, Raymond J. and Carol E. Kasworm. "Accelerated Learning: Future Roles and Influences," in *Accelerated Learning for Adults: The Promise and Practice of Intensive Educational Formats*. San Francisco: Jossey-Bass, Number 97, Spring 2003.