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JOINT ADVANCED WARFIGHTING SCHOOL



Technological Illusions and the Entropy of American Defense

by

Michael J. Simmering

Colonel, United States Army

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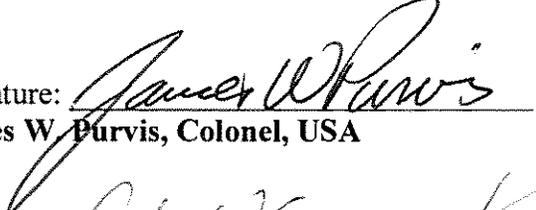
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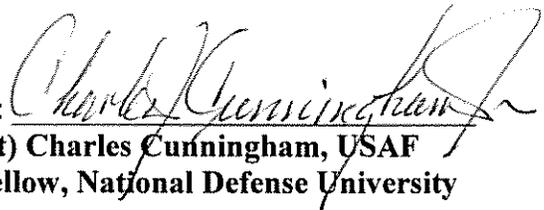
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ABSTRACT

The theory of entropy states that the disorder in the universe continually increases. Man's desire to harness energy to create order constitutes a losing endeavor over time as forces continually pull towards chaos. The concept of entropy also served as a primary consideration for numerous inventions that changed humanity's ability to transform disorder into order. At the same time, efficiency as a concept continues to permeate the business world under the premise that efficient organizations create more wealth. Yet, for all of the applications of the concept, few have significantly explored the concept of entropy as it applies to the natural behavior of large, complex human organizations.

The Department of Defense (DOD) provides an excellent large, complex human organization to examine entropy and increasing system inefficiencies over time. Adapted properly, the theory of organizational entropy provides an intellectual framework for reducing inefficiency over time, maintaining or increasing capability, and ensuring the established system can contend with evolving environmental and systemic changes.

Using organizational entropy theory, this research proves increasing inefficiencies within the DOD structure that, over time, resulted in less total capability per dollar spent. This research also helps to explain DOD's organizational behavior in light of this increasing inefficiency. Finally, this research provides one critical guideline for organizational improvement as the American defense establishment attempts to adapt for the future. Without focusing on adapting the beliefs and values within the DOD personnel system, the inefficient, entropic behavior of this complex human organization will not change until the next threat is upon us.

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While many, to whom I am indebted, have assisted with the formulation of this work, my wife, Erikka, continues to serve as the rock upon which I base my entire capacity for continued military service. I still love serving the men and women who stand up to take an oath to defend this country. The Soldiers are my inspiration. Erikka is the foundation from which I attempt to grow every day with a desire to better serve them.

To those who helped formulate this work, thank you for your patience and understanding as my own thoughts solidified. Lastly, to those who take offense to my critical characterizations of DOD that follow, just know you were my greatest teaching aide. Regardless of what challenges we may face, DOD must have within it those who are encouraged to respectfully, openly, and without the fear of reprisal, criticize, question, and seek better solutions. While history may serve as a basis of comparison, lack of imagination and a failure of contextual understanding will perpetuate past mistakes and fail to result in future victories if our enemies adapt more rapidly.

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Introduction – The Entropy of America’s Defense

In physics, entropy constitutes a measurement of a system’s energy no longer available to perform work.¹ For example, in a jet engine, entropy occurs when heat dissipates into the surrounding environment. As the engine wears, increased entropy occurs within the system creating less efficiency. Human organizations, including the Department of Defense (DOD), can behave similarly. Data since at least 1989 proves that additional money does not necessarily constitute an increase in relevant U.S. military capability once hostilities commence. Data also supports the notion that DOD generally values high-tech equipment over people as a means for creating capability rather than pursuing a balanced, adaptive approach. Therefore, DOD exhibits inefficient behaviors consistent with an entropic system, much like an older jet engine in need of an overhaul.

Today, confronted by a rigid, inefficient structure, DOD finds itself challenged to adapt and meet future demands created by an environment of accelerating change. Exacerbated by decreasing budgets, the urgency of DOD’s present solutions continue to ignore the very problem creating long-term inefficiency: un-adaptive leadership. Continuing to trade technology for people and arguing for increased funding will not allow DOD to adapt. At best, increased expenditures will result in only marginal increases in capability given America’s high-tech approach to converting national power into military capability. Therefore, the author’s enhanced theory of organizational entropy demonstrates that *absent the threat of catastrophic defeat or an alteration of the desired senior leader traits within the personnel system, entropy increases throughout DOD will result in wasted resources and yield increasingly less military capability.*

¹ Yunus A. Cengel and Michael A. Boles, *Thermodynamics: An Engineering Approach*, (New York, New York: McGraw-Hill Publishing, 1989), 213.

Past American military adaptations occurred when presented with a clear potential for national defeat. Since 1989, the existence of a dire threat has remained ambiguous at best, but our environment continues to evolve at an increasing rate. Given the pace of change in today's world, the ability of leaders at the operational and strategic level to see and understand potential threats early provides the only viable alternative to save both lives and treasure. Yet, the current system for national defense fails to allow for adaptation prior to potentially catastrophic conflict.

Presented with no immediate, devastating threat, the American system for national defense specifically perpetuates past behaviors that, since the 1980's have been to sacrifice people for more complex and increasingly expensive equipment. Meanwhile, enemies continue to acquire devastating capabilities and adopt tactics that provide clear asymmetric advantages. We now find ourselves wasting increasing amounts of both time and money on activities that ultimately fail to contribute to our defense because of our own un-adaptive behavior. The very capacity of the system to perform its desired function continues to diminish, a concept known as entropy.

Academics have attempted to develop an organizational behavior model that explains entropy within DOD. While these examinations illustrate the existence of entropy, theories, such as one offered by Philip Zelikow, only partially explain DOD's organizational behavior.² His theory of organizational entropy encounters limits because he discounts the human element within the DOD system. Moreover, these theories cannot predict likely outcomes of niche organizational efforts to increase efficiency. By

² Philip Zelikow, "Defense Entropy and Future Readiness, Fast and Slow," (Paper presented at the Aspin Institute in Washington D.C. on 26 November, 2013. The presentation on "The Future of American Defense" was part of the Washington Ideas Roundtable Series.) Video of the conference proceedings, including Zelikow's overview of his paper, can be found at <http://www.c-spanvideo.org/program/AmericanDefe> (accessed 7 Dec, 2013).

adopting an enhanced model of organizational entropy, behavioral tendencies and likely outcomes, based upon past trends, become clearer.

The author demonstrates that DOD decisions to invest continuously in a ‘high tech’ force without focusing on organizational adaptation increased entropy. America’s un-adaptive approach yielded fiscal year 2011 costs \$308 billion above fiscal year 2000 pre-9/11 levels in constant 2013 dollars.³ Yet, from 1989-2012, the force also shrank by nearly 40%.⁴ By continually defining force structure as a monetary competition between people and equipment, DOD ignored the increasing waste in the very heart of the engine that transforms American power into military might. The engine continues to wear by applying yesterday’s solutions to tomorrow’s problems.

In light of current force structure conversations, this paper demonstrates that DOD continues to perpetuate a dangerous cycle that has the potential to hollow the force from within and create a military unprepared to fight for America’s national interests in the future. What was once a gap in logic, an infatuation with technology, has grown into an entropic, un-adaptive, un-imaginative system operating in a rapidly changing and complex environment. If America wishes to remain a globally dominant nation after 2025, internal change in the next decade, beginning with the performance of the supervisory system, becomes essential.

³ U.S. Department of Defense, Office of the Undersecretary of Defense (Comptroller), *National Defense Budget Estimates for FY 2013*. (Washington, D.C.: Department of Defense, 2012). See Budget Data, Annex A.

⁴ U.S. Department of Defense, Statistical Information Analysis Division, *Quarterly Report on Active Duty Military by Service*, (Washington D.C.: Department of Defense), <https://www.dmdc.osd.mil/appj/dwp/reports.do?category=reports&subCat=milActDutReg> (accessed 19 DEC 2013). See Annex B for a listing of strengths.

Chapter 1: Entropy Theory & America's Defense

The second law of thermodynamics states, “it is impossible to construct a device that operates in a cycle and produces no effect other than the transfer of heat from a lower temperature body to a higher temperature body.”¹ Heat will not flow out of a cold body into a warmer body. Heat always seeks cold, and because of that fact, no heat engine can achieve 100% efficiency. This gap in efficiency naturally leads to a discussion of wasted energy. How much waste do we find acceptable? What is the optimal amount of work performed by the engine before waste becomes a concern? Work performed will only increase nominally as waste begins to factor increasingly into the final output. That wasted energy, energy no longer available to perform needed work, is known as entropy.

Two general factors cause entropy, a synonym for wasted energy. First, irreversible inefficiencies within the system, such as friction, expansion or compression, will work against the system's intended purpose of producing work. These are known as *systemic elements* of waste. Secondly, changes brought about by the environment serve as another impetus for waste. Air temperature, altitude, humidity, and depth, for example, all act as *environmental factors* that affect an engine's ability to perform actual work. These systemic and environmental factors combine to create the total waste of a system. Further, the amount of waste for any irreversible process is always greater than zero. Even within a perfect system, the amount of waste can only equal zero.² The total entropy of a system can be determined by adding environmental and systemic factors together. Additionally, total entropy is always greater than or equal to zero.

¹ Cengel and Boles, 213.

² Ibid., 258. Although it is theoretically possible, in nature, there is no such thing as a perfect system.

Scientifically, entropy can be expressed as:

$$E_t = E_{\text{sys}} + E_{\text{env}} \geq 0$$

When measuring work output and total waste, the concept of entropy results in two different futures depending upon the

engine. Either a system is reversible, or it is irreversible. Consequently, waste, as it relates to work output changes at varying rates, depending upon the system (Figure 1).³ Additionally, changes in the total waste

between two specified states “is the same whether the process is reversible or

irreversible.”⁴ These two concepts lead to four general conclusions regarding the waste within any given system as it relates to work output, depending upon the type of system.

First, if a process is reversible, decreased inputs yield less work and total waste. Second, if a system is reversible, increased inputs yield marginal increases in waste but greater increases in work output. Third, if a process is irreversible, decreased inputs yield decreased waste but also decreased capability. Fourth, if a process is irreversible, increased inputs yield increased waste but increasingly minimal gains in work output.

These general conclusions regarding the interaction between waste and work output provide a solid theoretical basis for analyzing other systems as well. Scientists also note, “The concept of entropy may even be applied to human beings. Efficient people are

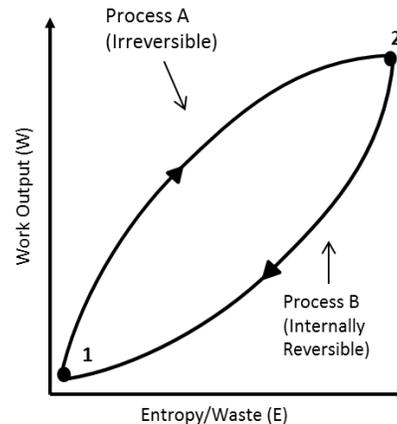


Figure 1: Entropy Growth in Differing Processes

³ Ibid., 254.

⁴ Ibid.

those who lead low-entropy lives.”⁵ If one accepts the fact that humans are not perfect, then by default, any system created by humans will have imperfections. Those imperfections constitute inefficiencies that waste energy. Therefore, the concept of entropy applies to human systems as well.

At the same time, application of scientific theory to human systems presents one critical limiting factor. Measurements of entropy are inexact when applied to human behavior. For example, irrational behavior provides a catalyst that may drive intended outputs in a number of directions other than increasing efficiency. The act of invading an entire country because of the behavior of a small group of Islamic extremists may or may not have the intended output of making America safer. Additionally, human miscalculations create limits regarding the amount of waste within a system. In this case, invading another country based upon a miscalculation of its capability to employ weapons of mass destruction may or may not have the intended output of making America safer. Finally, the inability to quantify environmental changes creates additional limitations. Recognizing the limits of applying the theory of entropy towards human behavior mitigates drawing overly dramatic or dangerous conclusions.

Regardless of these limitations, it seems reasonable that entropy theory can be used to productively illustrate the behavior of complex human systems. A social scientist can make general statements regarding the behavior of a large group of people by examining inputs, desired outputs, the system used to create outputs, the environment affecting the system and the final outputs themselves. For example, one can safely say increases in government entitlements since the 1920s indicate an increased gravitation towards a more liberal worldview within American society. The input of popular support enabled the

⁵ Ibid., 266.

creation of a government system larger than earlier versions. The resulting output, entitlements for the American population, increased domestic tranquility. However, the effects of the environment, such as immigration issues and globalization, created additional, unexpected inefficiencies. In the author's judgment, applying the theory of entropy to complex human behaviors and systems provides a framework for analysis and an objective basis for improving those systems based upon general conclusions.

Relating Entropy to U.S. National Defense – Previous Application Attempts

DOD also continues to study the behavior of complex systems in an attempt to maximize the efficiency and effectiveness of its ability to create and sustain military capability. As late as September 2013, the Army initiated a \$12.5 million dollar research project with the University of California's Complexity Sciences Center to better understand complex systems and how to control them.⁶ Reports noted, "Entropy always increases. If there is a 'secret of life,' it is in using energy to create order and structure."⁷

As recently as November 2013, highly credible academics such as Philip Zelikow have used entropy theory to question DOD behaviors stating,

*"Despite constant headlines about troubles in the world, the country is remarkably safe and secure at the moment. But American levels of defense spending are nonetheless at near-historic highs, even accounting for projected cuts. Yet these expenditures are poorly allocated, and this inefficiency is likely to get much worse. So that high spending in a period of low threat is buying less and less meaningful defense for situations, not so far in the future, that could be more threatening than they are right now."*⁸

This major disconnect posed by Zelikow has merit. Since the 1950s, the size of the force

⁶ "Army Grants \$12.5m for Complexity, Networks Research," *US Fed News Service*, Including US State News, Sep 10, 2013. <http://search.proquest.com/docview/1430972356?accountid=12686>. (accessed 7 Nov 13).

⁷ Ibid.

⁸ Zelikow, 11.

continued to shrink even in the midst of the turbulence in the late 20th Century.⁹ In that same time, when measured in constant dollars, increased levels of spending have not necessarily resulted in a larger or more capable force.¹⁰ At its apex in 2010 at \$730 billion, the greatest levels of defense spending since World War II did not result in a significantly more capable force - if defined in terms of personnel numbers and fighting structure. Additionally, following World War II, defense spending rose above \$550 billion on only three occasions. In 1952, defense spending totaled over \$622 billion in the midst of America’s nuclear buildup and the Korean War.¹¹ From 1984-1988, in the midst of Reagan era modernization initiatives, defense spending hovered around \$550 billion consistently. However, since 2003 defense spending remained above \$550 billion consistently every year for the next ten years. Regardless of more or less money provided to DOD, the force continued to become smaller (see Figure 2).

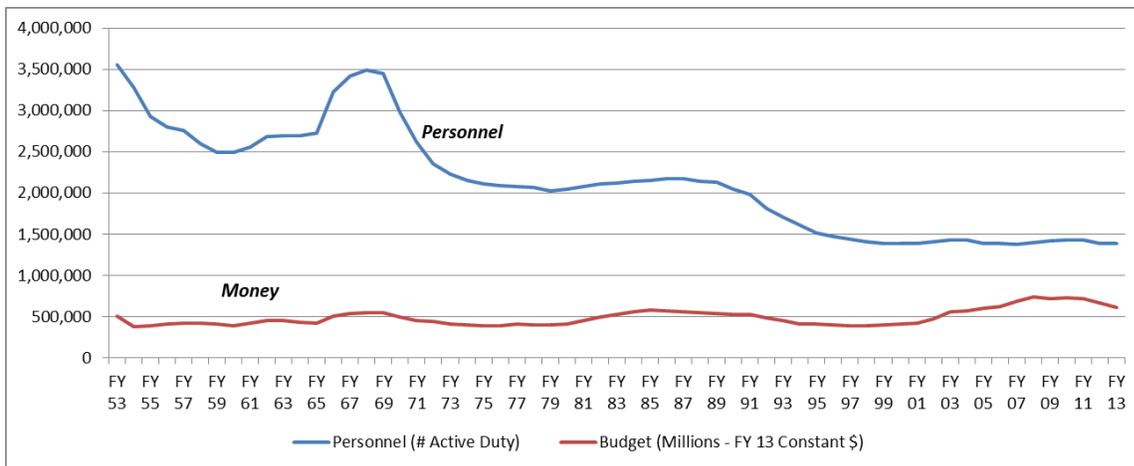


Figure 2: Active Duty Personnel & DOD Budget Trends (1953-2013)¹²

In light of recent force structure conversations, these trends will likely continue. In

⁹ See Annex B.

¹⁰ All references to dollars throughout this document, where possible, will reflect *constant FY 13* dollars in order to enable accurate comparisons and trends.

¹¹ See Annex A.

¹² See Annex A and Annex B for actual numbers by year.

August 2013, the Deputy Secretary of Defense argued that planned force reductions in the active Army to 490,000 might not be enough to keep DOD within proposed budget limitations brought about by sequestration. The active Army end strength may have to go as low as 380,000 active duty Soldiers.¹³ The Air Force, Navy and Marine Corps all face the possibility of similar cuts. DOD leaders historically rail against budget cuts and fielding less-sizable forces stating, “Quantity has a quality of its own. Future DOD budgets are not likely to sustain estimated capability needs.”¹⁴ Yet, Zelikow’s application of entropy demonstrates that budget levels do not truly matter. Regardless of increased or decreased budgets, DOD will continue to evolve to a smaller fighting force.

Zelikow goes on to correlate this increasing inefficiency within the defense establishment as entropic behavior that constitutes an increasing threat to the future of America. He specifically poses six points regarding entropy as applied to DOD.¹⁵

1. “All stakeholders in the system will tend to claim resources, both in compensation/ benefits and to support whatever they are currently doing.
2. The American system for governance of the defense establishment gives these stakeholders strong capacities to defend these claims against unwanted change.
3. The requirements for American national defense have changed significantly. Such changes should naturally tend to increase the proportion of entropy in the system, as past uses of resources become less relevant and usable in relation to new requirements.
4. To reduce growing entropy, the system would need powerful capacities for central redesign to conserve and redirect available inputs of money and effort.
5. Such powers of central redesign...fluctuate. The ups and downs partly correlate to the extent of concerted belief about threats and what must be done to address them.
6. Americans today are not...seriously threatened. They have little concerted belief about the character of the threats or about what must be done. Hence, the system’s capacity for central redesign, not strong to begin with, has ebbed.”

¹³ Tom VandenBrook, “USA Today Interview: Ashton Carter, Deputy Defense Secretary, Cuts in Troops Civilians Looming” *USA Today*, August 6, 2013, 1.

¹⁴ U.S. Department of Defense, *Defense Science Board 2005 Summer Study on Transformation: A Progress Assessment. Volume II: Supporting Reports*, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. (Washington D.C.: Department of Defense, April 2006), 258.

¹⁵ Zelikow, 16-17.

Zelikow's points provide an initial basis for theoretical application of entropy to explain DOD behavior. His application results in two behavioral conclusions regarding entropy within DOD.

Claiming Resources to Support Current Initiatives & Refuting Proposed Changes

The notion that current organizational members rally around initiatives and claim resources to perpetuate efforts appear true at first glance. For example, in 1997 Douglas Macgregor published *Breaking the Phalanx*, recommending the Army transition to a brigade sized 'combat group' as its centerpiece formation designed for 21st Century conflict.¹⁶ As reviews accumulated, even younger officers, with no frame of reference beyond the Cold War military, stated, Colonel Macgregor, "...cannot articulate any failure by the U.S. Army in the last half century which merits a wholesale change in the force structure."¹⁷ While these individuals criticized his analysis of the Army's re-design efforts at the time, when the Army finally unveiled the modular force in 2004, the brigade-centric concept appeared similar to Macgregor's initial concept except for the ranks of leaders and final number of maneuver units.

Zelikow carries this behavioral tendency further citing increasing expenditures in capital goods (procurement, research, development, testing, evaluation, and construction) that encountered dramatic, sustained increases in 2003 ultimately reached a culminating point of \$300 billion in 2008.¹⁸ These large investments provide emotional attachment and real incentive to DOD's vast network of employees to refute proposed changes and

¹⁶ Douglas A. Macgregor, *Breaking the Phalanx: A New Design for Landpower in the 21st Century*, (Westport, CT: Praeger Publisher, 1997), 74.

¹⁷ James R. Agar II, "Breaking the Phalanx (Book Review) (Undetermined)," *Military Law Review*, no 160, Jun, 1999, 266-71. <http://ezproxy6.ndu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ofs&AN=502301854&site=ehost-live&scope=site>. (accessed 27 Nov 13).

¹⁸ Zelikow, 18.

continue with programmed investments. Additionally, this systemic desire compounds when considering the vast network of acquisition firms, defense contractors, and others immediately outside of DOD who stand to lose significantly from shifts in DOD policy.

The American military system, for all of its strengths, finds itself particularly prone to resisting change. Special interest groups and political movements routinely rally around opposition to DOD reforms. The Air Force's proposal to eliminate the A-10 aircraft continues to draw external political criticism.¹⁹ Similar proposed cuts to the Global Hawk UAV program have met with defense contractor and political scrutiny, forcing additional system purchases. Air Force officials noted, "The fiscal year 2013 defense authorization bill directs the Air force to procure three more Block 30s [aircraft] despite assessments that the existing aircraft are sufficient to meet the air force's requirements."²⁰

These examples indicate the behavioral tendency of a system to protect core functions. Scholars examining the issue of organizational behavior claim organizations "...create member commitment to current practice, seeking to inculcate a sense of commitment to— emotional identification with— its practices and values."²¹ At the same time, "...when the setbacks are practices that continue to fail and should be changed— as when an army fighting guerillas persists in ineffective combat methods— this inoculation is a problem."²² Other analysts contend, "Bureaucratic organization in

¹⁹ Courtney Albon, "Louisiana Lawmakers Plead their Case for A-10s to Stay Put," *InsideDefense.Com*, Aug 21, 2012. <http://search.proquest.com/docview/1095244785?accountid=12686>. (accessed 10 Dec 13).

²⁰ "US Air Force Issues Contract for Three More Global Hawks," *Flight International*, no. 939, 12 Nov, 2013.

²¹ Steven Kelman, *Unleashing Change : A Study of Organizational Renewal in Government*. (Washington, D.C.: Brookings Institution Press, 2005), 35. <http://site.ebrary.com/lib/nationaldefense/Doc?id=10120592&ppg=35> (accessed 27 Nov 13).

²² *Ibid.*, 25.

government is particularly resistant to change.”²³ This attachment to current efforts permeates even the most effective of organizations and cultivates an environment intensely resistant to original thought.

Changing Requirements, Then?

Zelikow also argues, “Requirements for American national defense have changed significantly.” While the world may have changed significantly, Zelikow does not illustrate the nature of these changes or DOD’s failures to account for these changes. For example, the 1997 Quadrennial Defense Review (QDR) served as the first major strategic document to capture the rise of non-state actors and increasingly capable asymmetric threats.²⁴ Zelikow’s tendency to discount the nature of environmental changes and systemic inefficiencies within DOD limits his application of entropy as a method to fully explain DOD’s behavior.

From this point, Zelikow’s application of this scientific theory to a complex human organization falls short of clearly explaining organizational behavior. He does not capture DOD efforts to increase efficiency or work performed in the face of increasing entropy. He also downplays the most abundant resource within DOD – its people. Nevertheless, Zelikow’s major point remains valid as he concludes by stating the capacity for central redesign is likely not great, and, in fact, “entropy wins.”²⁵

Within this model, regardless of more or less resources, DOD continues to produce increasingly less relevant military capability per dollar if one defines capability based upon the size of the force. It does not explain the ability of the national defense

²³ Ibid., 38.

²⁴ U.S. Department of Defense, *Report of the Quadrennial Defense Review*, by Secretary of Defense William S. Cohen, (Washington D.C.: Department of Defense, 1997), iv.

²⁵ Zelikow, 17.

establishment to adapt to a changing environment such as the gravitation towards increasingly joint warfare in the late 20th Century. As David Christian observes in *Maps of Time*, all species adapt to some extent, but “humans seem to constantly develop new ecological tricks, new ways of extracting resources from their environments.”²⁶

Zelikow’s theory downplays the well-established precedent of innovation and adaptation throughout human history. Regardless, by using Zelikow’s observations as a point of departure, a more enhanced application of entropy provides a more accurate theoretical model of behavior for large, complex human organizations.

A Refined Organizational Behavior Model Explaining the Importance of Entropy

To reflect the human aspect of large organizations like DOD, an application of entropy drawing upon the evolving nature of human beings must be created. By altering Zelikow’s model, not only can we determine that DOD functions as an entropic organization, but we can also generally predict the results of past and future efforts and determine overall system performance absent fine-tuning the engine of national defense.

This application of entropy, formulated by the author, explains the seemingly inefficient behavior of DOD. It also allows analysts to predict the results of current efforts using historical analysis as a basis of comparison. Finally, an expanded application of entropy theory, more in line with the scientific model, goes beyond the causes and explains the effects of behaviors within DOD in the modern era. Most importantly, this model demonstrates a clear direction DOD must pursue to overcome entropy – it must learn to routinely adapt in peace just as it has in other situations.

Additionally, this enhanced theory makes two critical assumptions. First, the theory

²⁶ David Christian, *Maps of Time: An Introduction to Big History*, (Los Angeles, California: University of California Press, 2005), 145.

assumes DOD attempts to minimize entropy at all times. Nobody purposely builds a system to fail. While DOD may not be the most efficient organization, generally its members attempt to contribute to the common goal of defending the nation. At some point however, the maximum system efficiencies must be assumed as a constant level of residual inefficiency. Second, this theory assumes the absence of a true revolution in military affairs. For example, the internal combustion engine significantly altered how the U.S. defense establishment utilized money and constituted one of the single greatest revolutions in military affairs, changing the very structure of national defense in all domains. The machine gun and airplane are other examples. Incremental changes in technology, however, such as the integration of internet technologies or an increase in the precision of weapons, do not invalidate the theory.

The following chapters apply this model to DOD behavior, exploring each portion of the enhanced entropy theory in depth. This enhanced theory demonstrates that absent the threat of catastrophic defeat or an alteration of the desired senior leader traits within the personnel system, entropy increases throughout DOD will result in wasted resources and yield increasingly less military capability. Subsequently, the research illustrates particular ways that DOD can overcome this entropic behavior in order to create military capability relevant in the 21st Century. Given the depth of the data and the irrefutable nature of overall trends, DOD's entropic behavior becomes a force that DOD must consciously choose to deal with in peacetime in order to prevent the un-necessary loss of life and treasure in wartime.

Chapter 2 – The Department of Defense as a Complex Human Organization

One major shortcoming of previous attempts to apply entropic theory to DOD stems from an inaccurate portrayal of DOD as a system. For example, Zelikow tends to ignore the sub-systems within DOD. For the sake of theoretical analysis, an accurate classification of the nation's system for converting resources into military potential becomes critical. Any portrayal must define the type of system DOD represents and the macro-level subsystems that interact to make up the system. Next, the inputs and desired outputs of the system must be defined. Finally, the environmental factors affecting that system must be recognized. As a methodology, such actions provide a framework for applying entropy theory correctly in the search for possible predictions in behavior.

Bridging Theory & Reality – DOD's System of National Defense.

In order to make a solid argument for understanding and applying the theory of entropy to national defense, a solid basis of comparison must first be established. Any application of this theory must first define the type of system national defense represents.

1. Irreversible & Procedure Based System: America's national defense establishment (and more specifically DOD) represents an irreversible system in purely scientific terms. Money allocated to national defense cannot be recreated once obligated. While DOD may pay \$412 million on average for an F-22, it cannot reverse that process to turn an F-22 into \$412 million once the purchase is complete.¹ The inability to reverse commitments once made implies that defense constitutes an irreversible system.

¹ Ralph Vartabedian and W. J. Hennigan, "F-22's Rough Ride; delays, technical glitches and cost overruns plague military's system for acquiring weapons," *Los Angeles Times*, Jun 13. <http://search.proquest.com.ezproxy6.ndu.edu/docview/1367741047?accountid=12686> (accessed 27 Nov 13).

Defining DOD as an irreversible system also implies two specific and relevant outcomes (based upon Figure 3).² First, increasing inputs, absent any alteration of the system, will normally yield increasingly smaller gains in performance over time. Theoretically, DOD may continue to increase the amount it spends, but over time, those

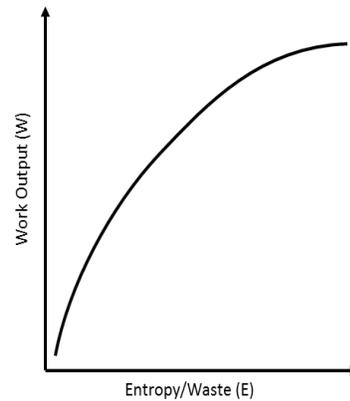


Figure 3: DOD Entropy vs. Output as an Irreversible System

expenditures typically result in less additive capability. At the same time, increasing inputs typically yields greater entropy within an irreversible system, or by spending more money, the amount of waste tends to increase. Second, decreasing inputs may create a lower amount of waste; however, decreased input will result in a decrease in total work output. DOD may portray itself as doing ‘more with less’; however, entropy theory states by decreasing inputs, DOD is only capable of doing ‘less with less’.

At the same time, defining DOD as an irreversible system does little to narrow down the type of system it represents. Given that the entropy of the universe constantly increases, reversible systems do not truly exist within nature.³ Social science allows us to narrow down DOD’s classification as a system further. When examining various types of organizations in 1989, James Wilson asserted DOD during peacetime represents a procedural organization.⁴ Every aspect of the organization is under direct supervision and “...none of these factors can be tested in the only way that counts, against a real

² Figure 3 represents the author’s interpretation of DOD as an irreversible system given the scientific theory presented in Chapter 1 (Figure 1).

³ Cengel and Boles, 258.

⁴ James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It*, (New York, NY: Basic Books, 1989), 163.

enemy, except in wartime.” For this reason, Wilson contends DOD becomes obsessed with “development of professionalism,” pervaded by SOP’s, and almost entirely means oriented.⁵ He argues that in peacetime, procedures and the organizational mission, “...exert an influence even though they are actually getting in the way of producing good outcomes.”⁶ Given complex systems such as the *Joint Strategic Planning System*, arguing that DOD does not constitute a procedural system becomes difficult.

However, Wilson also notes that in wartime, “many army and navy units change from procedural to craft organizations.”⁷ Because of the Clausewitzian friction of war, supervisors are “lucky to know the location and actions of entire battalions.”⁸ Within craft-based systems, activities are hard to observe, but outcomes are relatively easy to evaluate. Additionally, organizational learning tends to take place within craft organizations because outcomes can be easily assessed and procedures adjusted to account for change. In 2011, then Army Chief of Staff, General Dempsey lauded adaptation as a core competency of the Army stating, “The Army ought to think of itself as an organization that will adapt about every five to seven years. It’s not just about new equipment, but new organizations and structures.”⁹ A year later, as Chairman of the Joint Chiefs, General Dempsey cited adaptability as a key component for the Army’s success in Iraq and Afghanistan citing the shift to deploying brigades vice divisions marked a

⁵ Ibid.

⁶ Ibid., 164.

⁷ Ibid.

⁸ Ibid.

⁹ “Dempsey Career Reflects Adaptability, Creativity,” by Jim Garamone, *American Forces Press Service*, Washington, May 30, 2011. <http://www.defense.gov/news/newsarticle.aspx?id=64114> (accessed 3 Dec 13).

level of adaptability sought by the Army since 1991.¹⁰

Therefore, in 2013, while DOD may have wished to view itself as a craft based organization, able to easily measure outcomes of efforts, it found itself reverting to a procedure-based organization. The pending withdrawal from Afghanistan, the 2011 departure from Iraq, and downsizing of budgets force DOD to focus increasingly on procedural matters. More critically over the next few years, ‘means’ will receive increased attention as opposed to the ‘ways’ debates that permeated DOD as it combatted two growing insurgencies in Iraq and Afghanistan.

2. Inputs = Money: Given the nature of the system and its expected behavior, identification of the inputs to create defense capability present a seemingly complex problem. However, broadly characterized, inputs consist of a single component – money. Whether DOD buys equipment to accomplish a task, buys people to accomplish a task or even pays another country to accomplish a task (transition of security responsibility to Afghanistan National Security Forces constitutes a simplistic example), each purchase amounts to a single input – money. Even DOD officials agree, “We do what we fund.”¹¹

3. Output: Broadly characterizing the outputs of the defense system simply results in a capability to “protect [or pursue] U.S. national interests.”¹² A more narrow focus on various outputs would constitute a variety of subordinate points such as the ability to shape the global environment, deter conflict or win the next war. However, each of these

¹⁰ “Dempsey Discusses Importance of Embracing, Managing Military Change,” by Jim Garamone, *American Forces Press Service* Washington, Sept. 20, 2012. <http://www.defense.gov/news/newsarticle.aspx?id=117954> (accessed 10 Dec 13).

¹¹ Robert M. Gates, *Duty: Memoirs of a Secretary at War*, (New York, NY: Knopf, 2014), 146. In this passage, former Secretary of Defense Gates quotes a former Deputy SECDEF, Gordon England.

¹² U.S. Department of Defense, *2012 Defense Strategic Guidance*, (Washington D.C.: Department of Defense, Jan, 2012), 4. http://www.defense.gov/news/Defense_Strategic_Guidance.pdf (accessed 1 Aug 2013).

more narrowly focused outputs rests on an overarching objective of creating the capability to protect U.S. national interests. The various outputs (Army, Navy, Air Force, Marines, etc.) combine to create the capability to fulfill this single requirement.

3a. Defining ‘capability’: Against a clear threat such as the Soviet Union in the 1980’s, ‘capability’ requirements seemed clear. The Soviets posed a particular threat that gave rise to the American force structure and weapon systems of the late 20th Century. For example, the M1 series tank provided the increased lethality, standoff, and protection needed to hold off the onslaught of the Soviet Union on the plains of Europe to allow reinforcements from the American mainland to arrive.¹³

However, when presented with no clear threat, defining required ‘capabilities’ becomes more challenging. In the late 1980’s General Powell argued emphatically, “threat-based analysis would not meet the requirements of changing world conditions, since it was impossible to predict where the United States might become engaged.”¹⁴ His views shaped DOD’s gravitation towards the capabilities based system used today.

In today’s DOD framework, a ‘capability’ is defined generally by two elements: force structure and force posture. First, the structure of the force must provide appropriate mixes of equipment and people. Second, those ‘forces’ must be stationed and postured in a way that deters or solicits a change in enemy behavior. Combined, the notion of force structure and force posture provides the national leadership with the ‘capabilities’ needed to pursue national objectives.¹⁵ Finally, drawing upon General

¹³ Thomas G. Mahnken, *Technology and the American Way of War since 1945*, (New York, NY: Columbia University Press, 2010), 131-145.

¹⁴ U.S. Department of Defense, Office of the Chairman of the Joint Chiefs of Staff, Joint History Office, *The Development of the Base Force*, by Lorma S. Jaffee, (Washington D.C.: Department of Defense, July 1993), 22.

¹⁵ *Ibid.*, 23.

Powell's position, DOD continues to support the idea that these forces must be capable of operations anywhere in the world. The most recent strategic guidance from DOD supports this notion by citing a "world of accelerating change."¹⁶ This admittedly ambiguous definition of 'capability' and the irreversible, procedural nature of DOD serves as one of the primary causes of entropy within the system.

4. Sub-Systems (Personnel, Operations, Acquisition, Supervisory): Defining the individual sub-systems within DOD constitutes the last major step towards appropriately defining DOD as a system. Although hundreds of organizations, staffs, and agencies constitute DOD, generally, these subsystems can be grouped as systems of acquisition, operations, personnel, and supervision. Acquisition portions of the system gather and transform the equipment DOD requires into appropriate hardware capability. Personnel systems gather, train, and educate the people needed to operate equipment and perform various functions. Operations systems ensure the proper employment and sustainment of capabilities. Finally, supervisory functions ensure the entire system functions as designed to accomplish various missions required by the nation. These supervisory systems function within, among, and throughout the personnel, acquisition, and operations sub-systems. Each of these four subsystems adequately defines the DOD system and subsystems, possible inputs, and required outputs.

5. The Environment: Lastly, the environment affecting DOD must be defined. When boiled down to its most basic elements, five general characteristics exist: climate, social, economic, political, and technology. Climate implies the physical, natural, and geographic demands humans must cope with in order to perpetuate the order they

¹⁶ U.S. Department of Defense, *2012 Defense Strategic Guidance*, 7.

desire.¹⁷ The social factor encompasses the various cultures, ideologies, and collective traits of humans within the physical environment.¹⁸ The economic factor constitutes the resources demanded to further group needs. The political factor represents man’s effort to harmonize those needs by taking away from someone else or by creating an environment of cooperation.¹⁹ Finally, technology represents man’s ability to harness resources to create particular capabilities for perceived requirements. These characteristics evolve constantly in an increasingly interwoven environment DOD must contend with to produce military capability. Given the evolving environment, limited inputs, the irreversible, procedural nature of the DOD system, and the challenge of measuring specific outcomes absent war, the potential for entropy continually exists.

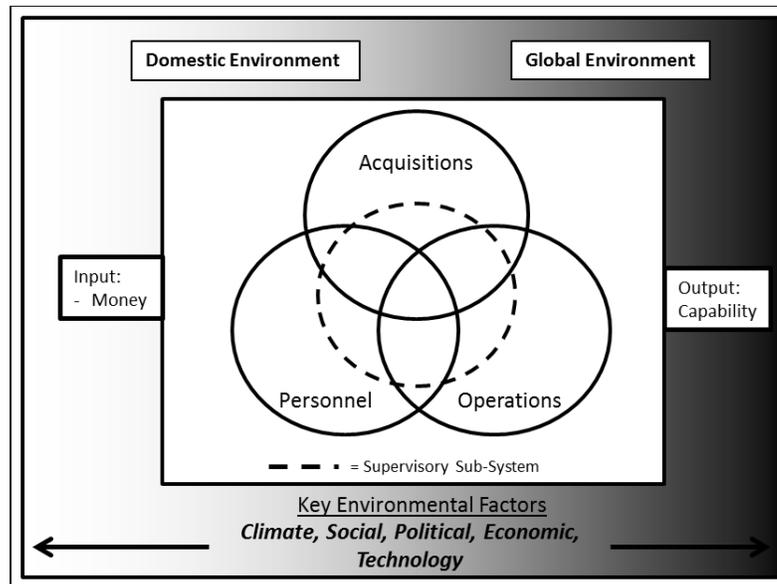


Figure 4: DOD as an Irreversible, Procedural system (Author’s Model)

¹⁷ Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed*, (New York, NY: Penguin Books, 2005), 12. Diamond argues that ‘climate’ encompasses a confluence of natural forces man seeks to contend with: hot, dry, wet, cold, etc all constitute factors of the climate.

¹⁸ Samuel P. Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations*, (Cambridge, MA: Harvard University Press, 1957), 2.

¹⁹ Plato, *The Republic*, Translated by Benjamin Jowett, (Norwalk, CT: Easton Press, 1980), 411. Specifically, the document reads, “The ideal State is under the rule of reason, not extinguishing but harmonizing the passions” of its citizens.

Together, these attributes constitute the American national defense establishment embodied by DOD (see Figure 4). By examining the nature of systemic entropy and the nature of entropy within the environment, one can estimate the total waste of DOD efforts to produce relevant military capability. Also, by examining the relationship between this system and its environment over the last few decades, one can more accurately predict future behaviors. Finally, the theory of entropy points clearly at the changes required within DOD to overcome inefficiencies to produce relevant capability. By examining DOD's force structure and posture initiatives over the last 25 years, evidence of increasing waste and less relevant capability begins to accumulate. By examining the money spent as well as the resulting capabilities through a historical lens, evidence of increasing inefficiency becomes clear.

Chapter 3 – Factors Outside of DOD: Accelerating Environmental Change

In order to apply the theory of entropy to DOD, an initial ‘system’ state must be defined. Many defense analysts would agree the Reagan era modernization initiatives and ensuing reforms of the 1980’s marked the beginning of the singular U.S. super-power era.¹ Innovations during the 1980s resulted in a new starting point for the American defense establishment after the perceived failure of the military in Vietnam. As Murray contends, America’s ability to account for multiple factors simultaneously (context, procedures, equipment, technological, operational, strategy, operations, and tactics) resulted in a re-vamped military establishment.²

In 1989, the budget for defense totaled over \$540 billion in FY13 dollars.³ In 1989, the United States found itself with a high-tech multi-million man force consisting of over 2.13 million active duty military members.⁴ Changes, such as the Goldwater-Nichols Act of 1986, corrected previous mistakes by streamlining command structures and enforcing the concept of joint efforts.⁵ At this point, what many perceived as a new plateau for DOD constitutes a starting point, circa 1989, for examining the behavioral inefficiencies of DOD.⁶ By beginning in 1989 and by examining key factors, outputs, and major trends since that time, entropic behavior of the DOD system becomes apparent.

¹ Terence Roth, Jane Mayer, and Timothy Aepfel, “Fallen symbol: Berlin Wall No Longer Will Hold Germans Behind Iron Curtain --- Trying to Halt Defections, Communist East Claims Citizens are Free to go --- A 28-Year Fight for Freedom,” *Wall Street Journal*, Nov 10. 1989. <http://search.proquest.com.ezproxy6.ndu.edu/docview/398122306?accountid=12686>. (accessed 15 Aug 13).

² Williamson Murray and Allan R. Millet, *Military Innovation in the Interwar Period*, (Cambridge, MA: Columbia University Press, 1996), 305.

³ See Budget Data, Annex A

⁴ See Service Active Duty Strength, Annex B.

⁵ 99th Congress of the United States, 2nd Session, Department of Defense Reorganization Act of 1986, Committee on Armed Services United States Senate. <https://digitalndulibrary.ndu.edu/cdm4/document.php?CISOROOT=/goldwater&CISOPTR=830&CISOSHOW=653> (accessed 16 Aug 2013).

⁶ Daniel Wirls, *Irrational Security: The Politics of Defense from Reagan to Obama*, (Baltimore, MD: John Hopkins University Press, 2010), 19.

Environmental Factor #1 – Accelerated Political Change

From a geopolitical point of view, the 1990s marked a tectonic shift in politics throughout the world. The collapse of the Soviet Union and the relegation of the Cold War international system to history gave rise to a “multipolar and multicivilizational” world order.⁷ While some argued that the 1990s marked the beginning of a uni-polar world, Henry Kissinger refuted this notion arguing, “The United States is actually in no better position to dictate the global agenda unilaterally than it was at the beginning of the Cold War.”⁸ As arguments over uni-polarity and multi-polarity persisted, this geopolitical shift created an accelerated drift within America politics that would not allow U.S. civilian leaders to form a coherent, long-term strategy.

While the 1989 Bush administration subscribed to a concept of selective engagement, the subsequent Clinton administration shifted to a strategy of enlargement. Viewing enlargement as the only logical sequence to a strategy of containment of communism, the Clinton administration argued America’s challenge “was to recognize that the world was embracing democracy, and America’s national interest rested on supporting that global transformation.”⁹ After 9/11, America openly shifted towards a strategy of preemption codified in the 2002 National Security Strategy (NSS). While President Obama continues to reserve preemption as an American right, he took a more constructivist worldview by emphasizing ‘values’ in the 2010 NSS.

In 1993, Secretary of Defense Les Aspin claimed, “changes in the international

⁷ Samuel P. Huntington, *The Clash of Civilizations and The Remaking of World Order*, (New York, NY: Touchstone, 1996), 21.

⁸ Henry Kissinger, *Diplomacy*, (New York, NY: Simon and Shuster, 1994), 809.

⁹ Derrick Chollet and James Goldgeier, *America Between the Wars from 11/9 to 9/11: The Misunderstood Years Between the Fall of the Berlin Wall and the Start of the War on Terror*, (New York, NY: Public Affairs, 2009), 37.

security environment have fundamentally altered America's security needs."¹⁰ In 2012, the Defense Strategic Guidance stated, "The global security environment presents an increasingly complex set of challenges" while also noting the increasing influence of nations such as China.¹¹ Due to a rapidly changing geopolitical environment, how America approached foreign policy and, by default, military policy, drifted from one administration to the next.

While this drift within America's approach to geopolitics constitutes nothing new, the accelerating rate of change in the 1990s marked a fundamental point of friction within DOD. Although the DOD system may have been a by-product of learning during World War II, the system was also guided largely by a consistent strategy of containment for nearly 40 years. Now, as geopolitical change continued to accelerate, a procedural system encounters increases in entropy due to geopolitical environmental factors.

Domestically, since 1989 debates over DOD actions also exacerbated arguments over America's role in the world. While not new to American politics, the friction between the American political environment and DOD evolved rapidly during the 1990s for several reasons. Some immediately argued for a decrease in military spending, or the realization of a peace dividend, citing, "the nation's long-standing policy of betting heavily on high technology for its defensive edge" served as the true reason to maintain military spending.¹² The need for less entropy (i.e. greater efficiency) began to weigh politically upon the perception of required capability. At the same time, even when DOD attempted to reduce some inefficiency, such as through the 1995 Base Re-alignment and

¹⁰ U.S. Department of Defense, *Report on the Bottom Up Review*, by Secretary of Defense Les Aspin, (Washington D.C.: Department of Defense), iii.

¹¹ U.S. Department of Defense, *2012 Defense Strategic Guidance*, 1.

¹² Dan Cordtz, "No More for the Military," *Financial World*, Oct 18, 1988, 3. <http://search.proquest.com.ezproxy.6.ndu.edu/docview/225612241?accountid=12686>. (accessed 14 Dec 13)

Closure initiative (BRAC), politicians fought to keep bases within their districts open.

As the iterative process between politicians and DOD persisted, additional legislative oversight initiatives induced additional requirements on the defense system. For example, the legislation mandating the quadrennial review of defense policy cemented a political attempt at ‘outside the box’ thinking on defense issues with many politicians claiming, “that there had already been attempts by the Pentagon to reassess strategy and force posture for the future...but that reviews had led to little change and were unsatisfactory.”¹³ At the same time, politicians questioned the logic for other expenditures complaining DOD refused to invest in the type of warfare it would likely encounter in the future. Critics noted, “...relics of the cold war like the SSN 21 Seawolf submarine, Trident II missiles, the F-22 fighter, and MILSTAR satellite(s) survived ...even though the Soviet threat that brought about their development had gone away.”¹⁴

The political entropy introduced into the DOD system in the 1990s found itself quickly overshadowed by the political challenges presented at the dawn of the 21st Century. Globally, the rise of non-state actors captured in the 1997 QDR presented DOD with a fundamentally new challenge, an identification that preceded the attacks of 9/11.¹⁵ Fighting two wars simultaneously implied the need for the military to rapidly expand the depth of alliances with friendly nations. Meanwhile, typical domestic frictions within the American political system continued to evolve. Secretary Hagel summed up the impact of the political environment on DOD when he stated, “In the past, many modest reforms

¹³ Richard A. Lacquenment Jr., *Shaping American Military Capabilities After the Cold War*, (Westport, CT: Praeger Publishers, 2004). <http://psi.praeger.com/doc.aspx?d=/books/dps/2000a8cf/2000a8cf-p2000a8cf9970111001.xml> (accessed on 9 Sep 2013).

¹⁴ Winslow T. Wheeler and Lawrence J. Korb, *Military Reform: An Uneven History and an Uncertain Future*, (Stanford, CA: Stanford University Press, 2009), 67.

¹⁵ U.S. Department of Defense, *Report of the Quadrennial Defense Review (1997)*, 4.

to personnel and benefits, along with efforts to reduced infrastructure and restructure acquisition programs were met with fierce political resistance.”¹⁶ Although political influence presents a consistent challenge, the rapidly evolving political environment since 1989 further complicated matters.

Environmental Factor #2 – Accelerated Social Change

While changes in the social environment occur consistently, the accelerated rate of change in the 20th Century, and particularly those since 1989, created new pressures on DOD. David Christian characterizes these societal changes best when he states, “The acceleration in the pace and scale of change is perhaps the most striking and (for contemporaries) the most frightening aspect of twentieth-century history.”¹⁷ Much like political considerations, social changes domestically and globally combine to pressure a DOD system founded in a different social environment prior to the Cold War.

Globally, accelerated social change manifested after 1989 in ways America found itself poorly equipped to deal with.¹⁸ For example, in the 1970s, Africa was actually self-sufficient in food production. Due to population growth in the 1990s, the “gross domestic product of sub-Saharan Africa’s population of 450 million was less than that of Belgium, with a population of only 11 million.”¹⁹ Population change throughout the Middle East manifests itself as tenuous, sometimes violent political movements such as the Arab Spring. The rise of the expansive Chinese middle class manifests itself as an increased demand for resources and source of government instability. These types of

¹⁶ U.S. Department of Defense, Office of the Secretary of Defense. SAC-D Budget Request, (Washington DC: Department of Defense, 2013). <http://www.defense.gov/speeches/speech.aspx?speechid=1788> (accessed 5 Oct 13). A DOD speech transcript regarding the Pentagon’s 2013 budget.

¹⁷ Christian, 463.

¹⁸ Ibid., 449.

¹⁹ Ibid., 451.

conditions serve as the impetus for increasing tensions within and among populations.

While the implications of these types of changes remain debatable, few argue the increasing rate of social change throughout the 1990s and 2000s. Some contend, “The extent of warfare among and within states lessened by nearly half in the first decade after the Cold War.”²⁰ Christian, for example, argues that in the 1990s global military expenditures declined by nearly 40%.²¹ Global changes in the social environment therefore continue to manifest themselves in complex, often-unpredictable ways for an organization initially designed to produce military capability to defeat a clear, peer-threat.

Domestically, DOD continues to wrestle with social changes based on the concepts of equality and individual freedoms born out of the Civil Rights movement in the 1960’s. After 200 years of comparatively minor scrutiny, since 1992, homosexual service within the military came under constant bombardment. Beginning with the 1993 implementation of Clinton’s “Don’t Ask, Don’t Tell Policy” to the 2010 DOD review, views toward homosexual service within the military fundamentally changed.²² This shift culminated in the September 2011 Presidential repeal of the Clinton era policy and continues to manifest in different ways throughout DOD after the June 2013 Supreme Court ruling striking down the Defense of Marriage Act.²³ At the same time, DOD faces accelerating pressures to increase the opportunities for women in the military.²⁴

This increased pace of change goes against the very grain of an organization

²⁰ Fareed Zakaria, *The Post-American World*, (New York, NY: WW Norton & Company, 2008), 8-9.

²¹ Christian, 458.

²² U.S. Department of Defense, *Report of the Comprehensive Review of the Issues Associated with a Repeal of Don’t Ask, Don’t Tell*, (Washington D.C.: Department of Defense, 2010), 3.

²³ “Hagel: Defense Department Welcomes Supreme Court Decision,” *American Forces Press Service*, 16 Jun 2013. <http://www.defense.gov/news/newsarticle.aspx?id=120364> (accessed 23 Dec 2013).

²⁴ Jon Cohen and Scott Clement, "Most Americans Back Women in Combat, See no Harm to Military Effectiveness," *The Washington Post*, Jan 29, 2013. <http://search.proquest.com.ezproxy6.ndu.edu/docview/1282268188?accountid=12686> (accessed 23 December 2013).

specifically designed for another time and unable or unwilling to evolve (or both). For example, even after DOD integrated formations, allowed women into the military, and formed the All-Volunteer force in the mid-20th Century, researchers in 1983 noted “the military’s desire to maintain social solidarity in an increasingly individualistic social environment” as an impediment to relevancy.²⁵ The accelerating change within the social environment ultimately works against the consistent DOD systemic desire to maintain order through current procedures and policies.

Environmental Factor #3 – Accelerated Economic Change

While some within DOD may view economic change as a factor related predominately to defense spending, the global economy since 1989 has had a far more dramatic impact on the DOD environment. For example, global economic growth, “from 1995 to 1998 is estimated to have been greater than the total growth in the 10,000 years before 1900.”²⁶ Again, like political and social trends, the implications of change serve as a point of debate while an increasing rate of change remains consistent throughout all arguments. Christian argues that while capitalism proved its “ability to generate abundant wealth” after the fall of the Soviet Union, “so far it has proved incapable of distributing global wealth in equitable, humane, and sustainable ways.”²⁷ Similarly, Sachs argues, “the gap between the richest and poorest is widening to proportions simply unimaginable for most people.”²⁸ Both cite accelerating changes in the last two decades that “overturn many of our basic assumptions about economic life.”²⁹

²⁵ David R. Segal and Mady Wechsler Segal, "Change in Military Organization," *Annual Review of Sociology* 9 (1983), 151-70. <http://www.jstor.org/stable/2946061>. (accessed 23 Dec 2013)

²⁶ Christian, 446.

²⁷ Christian, 449.

²⁸ Jeffrey D. Sachs, *Common Wealth: Economics for a Crowded Planet*, (New York, NY: Penguin Press, 2008), 205.

²⁹ *Ibid.*, 3.

Globally, the migration of the “economic center of gravity” towards East Asia presents a new, yet familiar, set of challenges President Obama attempted to capture in the 2010 National Security Strategy.³⁰ Increased social change, forming the basis for adoption of political movements finds itself driven by economic realities. Challenges within sub-Saharan African, much of Asia and the Middle East present the most contentious areas as these governments attempt to wrestle with increased demands of local populations.

Domestically, these economic changes since 1989 manifested themselves in sporadic ways that make it difficult for DOD to contend with in the context of an irreversible, procedure-based system. Economic challenges of the early 1990s fueled the political push for a peace dividend. Regardless of the desire to harness newly realized internet driven technologies and the Clinton administration’s desire to enlarge the prospects for democracy through enhanced military engagement, economic factors in the 1990s drove defense budgets to historical low points.³¹ While Zelikow and others rail against historically high defense spending since 2003, they subsequently ignore the fact that the lowest level of defense spending since 1953 occurred in 1998 when DOD spending bottomed out at \$389 billion.³² Therefore, while overall spending may have risen, the rate of change in defense spending accelerated dramatically. Faced with the sudden enforcement of the Budget Control Act of 2011, officials stated, “The magnitude and pace of change is breathtaking. That we are forced to this quick action, certain to have

³⁰ Ibid., 18.

³¹ See Annex A.

³² See Annex A.

adverse consequences, is proof certain of the dire straits this country finds itself in.”³³

Both domestically and globally, the accelerating rate of change appears to present more of a challenge than change itself.

Besides defense budgets, changes in the global and domestic environment resulted in other dramatic changes for DOD since 1989. Following cuts in defense spending in the early 1990s the American defense industry shrank from 15 to 4 major American defense contractors as many began to ‘cash out’ after the Reagan era build up.³⁴ In turn, officials during the 1990s worried America had “a defense industry that is even more isolated, technologically sluggish, and exceedingly expensive to maintain.”³⁵ By 1997, defense officials complained, “it has become increasingly clear that we are failing to acquire the modern technology and systems that will be essential for our forces to successfully protect our national security interests in the future.”³⁶ Even in the midst of America’s economic challenges in 2012, economists noted a continuation of the economic effect on DOD complaining, “New weapon systems tend to be more costly to operate ... aging weapon systems tend to be more costly to operate and maintain, particularly as they approach the end of their service life or as they are upgraded.”³⁷ Regardless of DOD’s answer, - purchasing new equipment or maintaining old equipment – the impact of the economic environment becomes a critical factor.

³³ Lawrence P. Farrell Jr., “Budget control act of 2011 forces real cuts to defense, and difficult choices,” *National Defense* 96, no. 694, 2011, 4. <http://search.proquest.com.ezproxy6.ndu.edu/docview/890171992?accountid=12686> (accessed 19 DEC 13)

³⁴ Ann R. Markusen and Sean S. Costigan (Editors & Authors), “Policy Choices in Arming the Future,” Found in the Book, *Arming for the Future: A Defense Industry for the 21st Century*, (New York, NY: Council on Foreign Relations, 1999), 409.

³⁵ *Ibid.*, 85.

³⁶ U.S. Department of Defense, *Report of the Quadrennial Defense Review (1997)*, iv.

³⁷ U.S. Congress, Congressional Budget Office, *Long Term Implications of the 2013 Future Years Defense Program*, (Washington DC: Congressional Budget Office, 2012), 24.

Environmental Factor #4 – Perceptions of Accelerating Climate Change

As discussed, the climate represents the physical, natural and geographic phenomena DOD must contend with to fulfill mission requirements. While some assert, “The overall impact of human activity on the physical environment is producing multiple environmental crises as never before in human history,” this point ultimately remains debatable.³⁸ However, the perception of this change throughout the world and its subsequent effect on DOD is unquestionable. For example, the 1997 QDR simply listed humanitarian assistance as one possible mission for DOD when examining smaller scale contingency operations.³⁹ Comparatively, the 2012 Defense Strategic Guidance listed “humanitarian assistance and disaster relief” as one of the primary missions of the U.S. military.⁴⁰ Within a period of fourteen years, the perception of climate change, and its associated impacts on humanity, fundamentally changed the primary mission requirements for DOD.

The challenge of using the military for humanitarian assistance lies with the frequency of occurrences as opposed to singular events themselves. Whether examining the conquests of Alexander the Great or the Berlin airlift of 1947, humanitarian assistance missions have always been required of the military.⁴¹ Yet, from 1998 to 2013 the “DOD share of U.S. official development assistance has increased from 3.5 percent to 22 percent,” leading the DOD to place it as a primary mission requirement.⁴² Former Army Chief of Staff, Gordon Sullivan codified this trend in 2013 when he stated, “The world

³⁸ Sachs, 18.

³⁹ Cohen, 11.

⁴⁰ U.S. Department of Defense, *2012 Defense Strategic Guidance*, 6.

⁴¹ Fredrick C. Cuny, “Use of the Military in Humanitarian Relief,” *Frontline*, November 1989. <http://www.pbs.org/wgbh/pages/frontline/shows/cuny/laptop/humanrelief.html> (accessed 23 Dec 2013)

⁴² Joel R. Charny, “The U.S. Military’s Expanding Role in Foreign Assistance,” *Interaction*, Jan 2013. http://www.interaction.org/files/FABB%202013_Sec16_NGOAndMilitaryRelations.pdf (accessed 23 Dec 2013)

has changed significantly since the end of the Cold War, with the fragmentation of the world, the globalization of the world, global climate change...we have an increasing demand for humanitarian aid and assistance.”⁴³ Again, the rate of change, globally and domestically, presents the primary challenge for DOD in the modern era.

Environmental Factor #5 – Accelerated Technological Change

Each of the preceding environmental factors pales in comparison to the rate of technological change faced by DOD since 1989. Historians, economists, social scientists, military analysts and many others cite technology as significant contributing factor accelerating change in the global environment. When analyzing large trends throughout history, Christian believes technologies since 1989, fueled by electronic developments of the early 20th Century, have drawn “all parts of the world more tightly together than ever before.”⁴⁴ This change has “blurred the lines between states as well as between enterprises.”⁴⁵ Economists note, “The economy continues to import technologies from abroad, but now foreign exchange is also earned by exporting knowledge and technological advances.”⁴⁶ The networking of people, economies, and governments through technology directly influences DOD’s ability to perform functions specifically designed for a pre-globalized era.

The scale of technological change since 1989 fundamentally altered the challenges faced by DOD. The 1993 Bottom Up Review cited weapons of mass destruction as a threat to the United States, but it couched that danger in an environment of smaller, more

⁴³ C. Todd Lopez, ‘Peacekeeping Institute paying increasing dividends after 20 years,’ *Army News Service*, 25 November 2013. http://www.army.mil/article/115840/Peacekeeping_Institute_paying_increasing_dividends_after_20_years/ (accessed 23 Dec 2013).

⁴⁴ Christian, 444.

⁴⁵ Ibid.

⁴⁶ Sachs, 211.

unstable former Soviet states.⁴⁷ Only four years later, the 1997 QDR voiced those same concerns but framed the argument in terms of non-state actors as well.⁴⁸ The 2001 QDR carried the concerns a step further citing non-state actors as a primary threat to the United States due to their increasing ability to acquire advanced technologies.⁴⁹ Finally, in 2012, DOD found itself wrestling with a myriad of technology-based challenges such as cyberspace, space, non-proliferation of weapons of mass destruction, area access/area denial and other advanced technologies capable of inflicting harm on America's vital national interests.⁵⁰ With increasing access to technology, asymmetric threats, non-state actors, and rogue nations consumed a significant portion of DOD's time when only two decades earlier, the primary threat faced was the Soviet Union.

Environmental Conclusions – Accelerating Change Since 1989.

Since 1989, the environment affecting DOD evolved at an increasingly rapid pace. Significant geopolitical changes in the 1990s fundamentally altered the global landscape. Domestically, the United States addressed the situation in a haphazard and non-unified manner characterized by shifting national strategies. Social and economic demands within and among other nations increasingly drove change on a global scale. Within America, the social environment continued to evolve with considerable pressure placed on DOD to conform to the norms increasingly accepted by American society. These changes took place in the midst of a rapidly shifting economic environment that provided DOD very little predictability. In the midst of this unpredictable economic environment, DOD was forced to also increasingly address non-traditional missions such as

⁴⁷ U.S. Department of Defense, *Report on the Bottom Up Review*, 2.

⁴⁸ U.S. Department of Defense, *Report of the Quadrennial Defense Review (1997)*, 4.

⁴⁹ U.S. Department of Defense, *Quadrennial Defense Review Report*, by Secretary of Defense Donald H. Rumsfeld, (Washington D.C.: Department of Defense, 2001), 5.

⁵⁰ U.S. Department of Defense, *2012 Defense Strategic Guidance*, 4-6.

humanitarian assistance. Finally, technological changes increasingly linked people and potentially placed dangerous technologies into the hands of state and non-state actors.

Within each of these environmental factors, the existence of change does not present the primary obstacle. Rather, the relationship between DOD's management system and the accelerated rate of change within the environment presented the largest obstacle for DOD to overcome. Environmental factors can induce entropy, much like altitude can affect the performance of a jet engine. Since 1989, relevant environmental factors affected DOD at an increasingly accelerated rate. The next chapter will show the effects of increasingly evolving environment on an irreversible, largely procedure-based system – increasingly inefficient results that add little overall capability to protect American national interests.

Chapter 4 – Performance of DOD’s ‘System’ Since 1989

The implication of an accelerating rate of environmental change combined with the classification of DOD as an irreversible, largely procedural-based organization presents a paradox. How can a system that focuses largely on carefully thinking through problems over an extended period of time deal with an environment of accelerating change? On one hand, the system could attempt to account for every change by increasing inputs. On the other hand, the system could ignore some changes and assume changes in risk. DOD’s peacetime choices appear to assume risk, a risk realized in Iraq and Afghanistan as the force went to war with inadequate equipment. After these wars, DOD again appears to be assuming additional risk, gravitating back towards 1990s methods to achieve 2025 results. In either case, an input-driven focus on problem solving while consistently prioritizing technology and equipment above people pervades DOD’s approach. This approach, relying less on tuning the engine and more on sustaining increased inputs, created an increasingly inefficient organization from 1989-2013.

Acquisition Subsystem: Increasingly Slow & Expensive

The incorporation of technology into the modernization efforts of American forces has served as a central pillar for accomplishing national security objectives since at least the 1980s, and many would argue since World War II. Most experts agree, “No nation in recent history has placed greater emphasis upon the role of technology in planning and waging war than the United States.”¹ President Reagan adopted the incorporation of new technologies and defense modernization as a specific policy to deter the Soviet threat.²

¹ Mahnken, 5.

² Ronald Reagan, Office of the President of The United States, “National Security Decision Directive 75: U.S. Relations with the USSR”, 17 January 1983, Ronald Reagan Presidential Library, <http://www.reagan.utexas.edu/archives/reference/Scanned%20NSDDS/NSDD75.pdf> (accessed 1 Aug 13).

As a starting point for analyzing acquisition performance, 1989 marked a high point for DOD as it commanded the largest, most highly advanced peacetime military fielded in American history. With some analysts arguing that Reagan's military strategy forced a Soviet choice, America's bet on advanced technologies appeared to pay off.³

After 1989, the accelerating change occurring throughout the environment resulted in a decade where DOD attempted to substitute technology for consistent strategic direction. While strategic goals may have fluctuated throughout the 1990s, technology's place in the military held fast in every strategic document published by DOD. The 1991 Base Force Review re-affirmed technological superiority as a centerpiece bringing with it a "peculiarly American faith in science's ability to engineer simple solutions to complex human problems."⁴ The 1993 Bottom Up Review argued the United States must "maintain the technological superiority of our weapons and equipment."⁵ Finally, the 1997 QDR went even further arguing

"The information revolution is creating a Revolution in Military Affairs that will fundamentally change the way U.S. forces fight... This technology will transform the way our forces fight, ensuring they can dominate the battlefield... The key to success is an integrated "system of systems" that will give them superior battlespace awareness, permitting them to dramatically reduce the fog of war."⁶

Throughout the 1990s, DOD consistently argued the acquisition methods used during the

Specifically, NSDD 75 reads, the "U.S. must modernize its military forces – both nuclear and conventional – so that Soviet leaders perceive that the U.S. is determined to never accept a second place... military technology advances must be exploited."

³ Edwin Meese III. "The Man Who Won the Cold War," *Policy Review*, no. 61 (Summer, 1992), 36. <http://ezproxy6.ndu.edu/login?url=http://search.ebscohost.com.ezproxy6.ndu.edu/login.aspx?direct=true&db=mth&AN=9211161238&site=ehost-live&scope=site> (accessed 17 Aug 13). Specifically, Meese states, "Reagan's strategic goal was to force the Soviets to choose: either stand down from their continuing confrontation with the West, or face increasingly devastating pressures on the home front."

⁴ U.S. Department of Defense, Department of the Army, Assistant Secretary of the Army (Acquisition, Logistics and Technology), *Army Science Board 1998 Summer Study Final Report: Concepts and Technologies for the Army Beyond 2010*, (Arlington, VA: Army Science Board, March 1999), D-3.

⁵ U.S. Department of Defense, *Report on the Bottom Up Review (1993)*, 12

⁶ U.S. Department of Defense, *Report of the Quadrennial Defense Review (1997)*, iv.

Reagan era could continue to ensure American dominance in the new century.

These views gave rise to two increased inefficiencies within DOD. First, the hubristic belief that future triumphs were best ensured by past methods regardless of evolving threats limited the selection of capabilities acquired by DOD in a time of shrinking budgets. Critics argued DOD's approach of "big defense programs with correspondingly large budgets" requiring "massive investment in information technology and high-tech weapon systems" ensured unpreparedness for the next generation of warfare.⁷ While smaller conflicts appeared in the 1990s as environmental change accelerated, DOD continued to place the majority of its emphasis on conventional capabilities such as ships, tanks, planes, and artillery. Regardless of substantial social, economic, and political change in the 1990s, DOD argued past military methods could ensure future success.

Second, the adoption of a capability-based approach in the early 1990s, rooted in conventional dominance and infrequent, large-scale warfare, ensured increases in inefficiency. A capability based approach relies on the need to project forces quickly to any part of the world. It relies on adequate force structure to project forces quickly and overwhelm an enemy to achieve a quick victory before conflicts spiraled out of control. Rather than fight the Soviet Union, in an evolving threat environment DOD required the ability to force a fundamental change to *any* adversary's behavior.⁸ Finally, to provide required capabilities to forward postured forces, the American military would further

⁷ Thomas X. Hammes, *The Sling and The Stone: On War in the 21st Century*, (Saint Paul, MI: Zenith Press: 2006), 225.

⁸ U.S. Department of Defense, Office of the Chairman of the Joint Chiefs of Staff, Joint History Office, *The Development of the Base Force*, 48. Specifically, in refining the arguments for the base force concept, "there was also an expansion of the treatment of the link between strategy and planning. In addition, J-5 introduced the concept of strategic agility to denote the rapid movement of forces not only from the United States but also from one theater to another."

increase the lethality, mobility, protection, precision, and command infrastructures of those forces abroad. This notion implied that small amounts of forward postured forces needed to not only survive, but to also be able to achieve considerable shaping effects on enemy forces, until quick deploying forces could be pushed from other locations. Assumptions of quick victory and an over reliance on conventional military power combined to ensure, “this approach to modernization put the Pentagon into an arms race with itself and was bound to cause problems.”⁹ Due to an inability to accurately replicate human warfare and test theories, DOD has a difficulty measuring outcomes in peacetime. DOD’s conventional investments in the 1990s would need to wait for the next war to be truly tested.

Acquisition Subsystem: Expensive Short Term Adjustments to Satisfy Large Gaps

As America went to war with the military it had in 2001 and again in 2003, capability gaps became evident. The acquisition system encountered two fundamental challenges. First, the system needed to address the immediate nature of the fight. In 2007, DOD’s Inspector General noted:

“Based on responses from approximately 1,100 Service members, they experienced shortages of force-protection equipment...and communications equipment. As a result, Service members were not always equipped to effectively complete their missions.”¹⁰

To correct the shortcomings brought about by the 1990s gamble on conventional capabilities, DOD began use the same acquisition system to create solutions. From 2003 to 2009, the DOD portfolio of major defense acquisition programs grew from 77 to 96 programs with overall Future Year Defense Program (FYDP) investments growing by

⁹ Wheeler and Korb, 65.

¹⁰ U.S. Department of Defense, Office of Inspector General. *Report No. D-2007-049 (Project No. D2006-DOOLA-0092.000) Equipment Status of Deployed Forces Within the U.S. Central Command.* (Washington DC: Department of Defense, 2007), 1.

\$400 billion for research, development and procurement initiatives alone.¹¹ A few significant asymmetric acquisition initiatives during this period included: Mine Resistant Ambush Protected Vehicles (\$44 billion), JLENS (\$6.7 billion), MQ-9 Reaper (\$2.9 billion), Sky Warrior UAS (\$2.3 billion), and Navy Broad Area Maritime Surveillance UAV (\$44.9 billion). While just examples, the DOD portfolio designed to combat specific asymmetric threats in Iraq and Afghanistan totaled \$221.6 billion in the period from 2004 to 2010 of the \$1.2 trillion spent on those wars as of 2011.¹²

As acquisition programs attempted to fill the capability gaps, they could not address the immediate nature of the fight. Even though the first vehicles did not arrive in theater until 2008, the \$44 billion MRAP program constituted only a partial solution. DOD acquired some materials direct from commercial venues and injected them into the frontlines. By March 2011, “nonstandard equipment in Iraq constituted approximately 47% of all Army equipment in Iraq totaling 523,000 pieces of equipment worth over \$4 billion.”¹³ Ranging from computers to optics, DOD procured this equipment to fight the Iraq insurgency. If 47% of all Army equipment was nonstandard, then only 53% of the equipment could be considered standard. Non-standard equipment included construction equipment, radios, material handling equipment, and a myriad of surveillance systems. In hindsight, DOD’s acquisition system in the 1990s only produced approximately half of the Army equipment required for the first U.S wars of the 21st Century.

¹¹ Government Accountability Office, Acting Comptroller General of the United States, *Defense Acquisitions: Assessment of Selected Programs*, by Gene L. Dodaro, (Washington D.C.: Government Accountability Office, 2009), 7. The \$400 billion listed is an increase over the course of the FYDP from \$1.2 trillion to \$1.6 trillion.

¹² Amy Belasco, Congressional Research Service, *The Cost of Iraq, Afghanistan, and Other Global War on Terror Operations Since 9/11*, (Washington D.C.: Congressional Research Service, 2011), 32.

¹³ Government Accountability Office, *Warfighter Support: Improved Cost Analysis and Better Oversight Needed over Army Nonstandard Equipment*. (Washington DC: Government Accountability Office, 2011), 1.

Acquisition Subsystem: After War - Ignoring Trends

In a military that based its entire acquisition process on technological superiority, post conflict drawdowns present an opportunity to change course or continue previous trends. After two decades of learning, DOD appears to be ignoring the trends of the 1990s and early 2000s, gravitating once again back to a system that will ensure the continued evolution towards a smaller force that is increasingly expensive to employ.

In 2002, DOD planned on procuring 1,591 F-35 Joint Strike Fighter airplanes. Due to increasing budget pressures, technological issues, and a host of other concerns, in 2012, DOD stated that it would only acquire 365 by 2017 with future purchases pending reconsideration, a 77% reduction in planned future capability.¹⁴ The F-22 presents another example with DOD stating acquisition limits for the F-22 will be roughly 180 of the 750 originally desired.¹⁵ Recently, officials have begun to question the long term value of such acquisitions stating,

“Air Force fighter planes today average 28 years old. Although they have been upgraded to keep pace with the latest aircraft of their potential adversaries, they have no greater relative advantage than they had when they were new. There are merely far fewer of them in relation to the potential threat. In deterrence, quantity has a quality all its own.”¹⁶

Naval acquisition plans provide further evidence of the gravitation towards conventional capability. After christening the \$13 billion *USS Gerald Ford* in 2013, the Navy “ordered the second ship of that class...and plans to order another ship every five

¹⁴ Christopher Drew, “Costliest Jet, Years in the Making, Sees the Enemy: Budget Cuts,” *New York Times*, 28 Nov 2012. <http://www.nytimes.com/2012/11/29/us/in-federal-budget-cutting-f-35-fighter-jet-is-at-risk.html>? (accessed 1 Oct 13)

¹⁵ Christopher J. Niemi, “The F-22 Acquisition Program: Consequences for the US Air Force's Fighter Fleet,” *Air & Space Power Journal* 26, no. 6, (Nov/Dec 2012, 2012), 53-82. <http://search.proquest.com/docview/1210662101?accountid=12686>. (accessed 17 Feb 14).

¹⁶ John Lehman, “More than half of our active-duty servicemen and women serve in offices on staffs,” *Wall Street Journal*, 9 Dec, 2013.

years thereafter.”¹⁷ The total carrier acquisition efforts seek to maintain a fleet of approximately 11 aircraft carriers for the next decade. Regardless of a rapidly evolving environment, DOD continues to acquire and sustain capabilities that provide marginal increases in capability at a far greater cost. While numerically determining these marginal increases proves difficult due an inability to measure human behavior, the subjective trend clearly presents itself when one considers the utilization rate of such capabilities compared with the increases in cost.

This inefficient system also results in increased waste. The Army lags furthest behind in acquisition efficiency with DOD reports noting, “every year from 1996 to 2010, the Army spent more than \$1 billion annually on programs that were ultimately cancelled.”¹⁸ While these are only a few examples, shrinking budgets, growing scrutiny and internal inefficiencies generated by a high-tech approach increase acquisition challenges. By ignoring past inefficiencies of the acquisition system, DOD appears to be creating a smaller version of the 1990s military that has failed to adjust to the reality of a rapidly evolving environment where technology, social change, and economic change almost guarantee increasing entropy. The result becomes an entropic acquisition system that produces increasingly marginal capabilities for greatly increased costs. Figure 5 captures this increasing trend.

¹⁷ U.S. Congress, Congressional Budget Office, *Long Term Implications of the 2014 Future Years Defense Program*, (Washington D.C., Congressional Budget Office, November 2013), 35.

¹⁸ U.S. Department of Defense, Office of the Under Secretary for Acquisition, Technology, and Logistics. *Performance of the Defense Acquisition System, 2013 Annual Report*, (Washington DC: Department of Defense, 2013), 13. <http://www.acq.osd.mil/docs/Performance%20of%20the%20Def%20Acq%20System%202013%20-%20FINAL%2028June2013.pdf> (accessed 1 Oct 13).

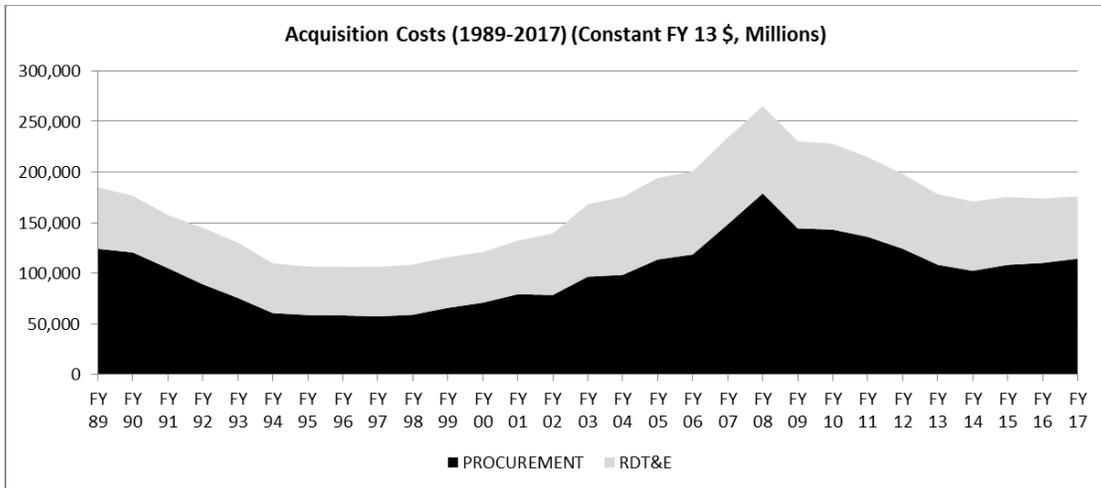


Figure 5: Acquisition Costs (1989-2017) (Constant FY 13 \$, Millions)

Personnel Subsystem: An Increasingly Contentious Bargaining Chip

To fuel the appetite for a capabilities-based approach designed to beat any threat anywhere in the world, DOD’s personnel system consistently finds itself under pressure. At the same time, the quality people needed to operate high-tech equipment have grown more expensive. In 1989, DOD had a force consisting of over 2.13 million active duty Soldiers, Sailors, Airmen and Marines.¹⁹ Even as America decided to fight two wars simultaneously, personnel numbers fell to a pre-World War II low-point in 2007 with 1.379 million active duty members marking a 35.2% decrease in personnel since 1989.²⁰ With planned reductions announced through 2016, the force will continue to shrink to 1.29 million active duty personnel marking a 39% decrease since 1989.²¹ As a percentage of the force, future projections estimate as much as a 20% reduction in force from 2012 levels by 2020. From 1989 levels, this figure would constitute an overall 48% reduction in active military strength. As DOD consistently seeks to increase funding to generate required capability, constantly trading people for more costly equipment

¹⁹ See Service Active Duty Strength, Annex B.

²⁰ Ibid.

²¹ Ibid.

captures DOD’s longest-term challenge. With fewer people to adapt to tomorrow’s challenges, the likelihood of miscalculation and perpetuating past approaches become greater as high-tech equipment continues to replace personnel required for innovation.

DOD also continues to downsize personnel to pay for cost increases. In 2012, DOD reported within the base defense budget alone (i.e. funding not including wartime funds or contingency funds), personnel costs since 2000 had “increased by nearly 90%, or about 30% above inflation, while the number of military personnel increased only by about 3%.”²² The cited reasons for increasing personnel costs encompassed a myriad of issues. Health care, military housing, base pay, and retirement funding constituted a large portion of DOD’s concerns regarding increases in the last decade.²³

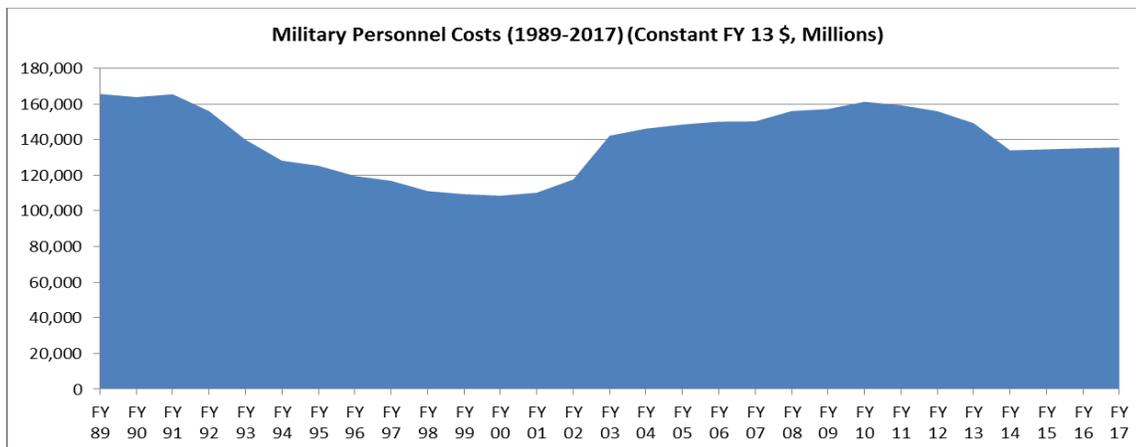


Figure 6: Personnel Costs (Budget) 1989-2017 (in constant FY 13 dollars)²⁴

However, the analysis offered by DOD presents a somewhat disingenuous discussion of the true changes in personnel costs (Figure 6 above). When analyzed in the context of constant FY 13 spending in DOD’s own reporting, personnel costs since 2001 increased by 35% total and peaked in 2011; however, as of 2012, personnel costs began to decline

²² U.S. Department of Defense, *Defense Budget Priorities and Choices*, (Washington, D.C.: Department of Defense, 2012), 13.

²³ Mauren Leed and Brittany Gregerson. “Keeping Faith: Charting a Sustainable Path for Military Compensation.” (Washington D.C.: Center for Strategic and International Studies, 2011), multiple pages.

²⁴ See Annex B

with the return toward pre-9/11 force structure levels with FY 15-17 projected real growth between 0.4 and 0.5%.

Recently, some critics began to refute DOD's conclusions stating, "While civilian personnel costs have grown by 78% [a questionable number] between 2001 and 2012, the overall defense budget has been growing even faster, calling into question the emphatic calls from Pentagon brass to reduce personnel related costs."²⁵ Congress also questioned DOD's analysis stating,

"...changes in the number of military personnel participating in the two wars has not been the primary factor in growth in war costs... little of the overall \$107 billion or 150% increase in DOD costs between FY 2004 and FY2008, the peak funding year during the Iraq surge, is attributable to changes in the average strength of military personnel either deployed or mobilized for the Afghan and Iraq wars."²⁶

DOD's intent could be to shape the debate over personnel with Congress; however, some believe DOD is once again trending towards hedging technology-based solutions by claiming the argument is "about the top brass aiming to protect other parts of the budget, such as tanks, ships, planes, vehicles, and other weapons."²⁷ DOD's trading of personnel to offset increasingly expensive investments in technology can only be carried so far before dramatic decreases in fielded capability are realized.

Regardless, the last decade has demonstrated areas where personnel costs did, in fact, increase to some extent due to acquisition decisions. First, a technologically advanced force implies personnel with a greater range of specialty skills. Second, a technologically advanced force, because of the need for more educated people and desire to retain trained

²⁵ "Report: Pentagon emphasizing personnel, but budget costs are up across the board," *Stars and Stripes* (online), Nov 25, 2013. <http://www.stripes.com/report-pentagon-emphasizing-personnel-but-budget-costs-up-across-the-board-1.254546> (accessed 27 Nov 13).

²⁶ Belasco, 32.

²⁷ "Report: Pentagon emphasizing personnel, but budget costs are up across the board," *Stars and Stripes* (online), Nov 25, 2013, <http://www.stripes.com/report-pentagon-emphasizing-personnel-but-budget-costs-up-across-the-board-1.254546> (accessed 27 Nov 13).

personnel, results in an increasingly senior workforce. These factors and the associated costs are directly attributable to acquisition decisions.

A military that maintains a broad portfolio of highly specialized, technically demanding capabilities must recruit and subsequently retain high quality personnel. From 2001 to 2012, special pay for service members increased by 27 percent overall. Most notably, bonuses for high skill, low demand positions increased significantly. For example, even with the National Guard, to meet demands for a high-tech force, bonuses in the first years of the Iraq war grew from an average \$8000 to \$20,000.²⁸ Annual bonuses for other high-tech specialties, such as network administrators in the Army, grew disproportionately reaching \$50,000 routinely for junior enlisted soldiers. These cost increases, driven by the need to recruit, train, and retain a high tech force, constituted a portion of DODs personnel cost growth.

Finally, as DOD officials seek to retain personnel for a high tech force by offering increasingly greater incentives, the force increasingly matures overall in both age and rank. From 2000 to 2011, the ratio of officers to enlisted rose from one to 5.3 in 2000 to one to 5.1 in 2011.²⁹ Personnel that are more senior typically have more family members leading to increased military benefits. In 2000, 53.1% of the active duty force was married compared to 55.8% in 2009.³⁰ Similarly, active duty personnel with children rose from 39.9% in 2000 to 43.3% in 2009.³¹ Overall, the decisions within the acquisition system led to a requirement to recruit and retain people that are more educated. These quality individuals bring with them more skill, increasing levels of

²⁸ Christine Wormuth, *The Future of the National Guard and Reserves*, (Washington DC: Center for Strategic and International Studies, 2006), 102.

²⁹ Leed and Gregerson, 8.

³⁰ *Ibid.*, 5.

³¹ *Ibid.*

personal responsibilities and the very real option of departing the military if DOD fails to address the needs of these volunteers.

Operations Subsystem – Surprising Cost Growth

Operating costs from 1989 to 2013 reflected the dangers of choosing to accept risk by not accounting for emerging threats identified in the 1990s. Performance of the operations system also demonstrates the dangers posed by the assuming a technologically driven quick victory against a human based threat. Operations and Maintenance (O&M) costs in peacetime grew steadily from \$55,000 per active duty service member in the 1980s, by about “\$2,200 a year and deviated little from that trend during the period despite some significant changes.”³² From 2001 to 2012, those same costs, when analyzed only within DOD’s base budget (excluding wartime costs), grew to \$147,000 per active duty service member, 19% above what historical trends from the previous two decades would indicate, or by \$4,000 per active duty member on a yearly basis.³³

Expecting O&M costs not to increase in wartime seems unrealistic, but researchers have noted “if O&M costs had grown proportionately with changes in the number of deployed troops, the amount in FY2008 would have been \$52.5 billion,” suggesting that about \$26.6 billion of the increase reflected other factors.³⁴ These include unanticipated requirements for “force protection gear and equipment ranging from night vision goggles to up-armored HMMWVs” not addressed by the acquisition system.³⁵ Additionally, they were reflective of extensive increases in demand for command, control, communications,

³² U.S. Congress, Congressional Budget Office, *Long Term Implications of the 2013 Future Years Defense Program*, (Washington DC: Congressional Budget Office, 2012), 18.

³³ *Ibid.*

³⁴ Amy Belasco, 32.

³⁵ *Ibid.*, 35.

computers, and intelligence support.”³⁶ However, the growth in quantity and types of contracted services to support wartime activities also constituted a major departure from previous wartime estimates as well. To adjust to the notion of sustained conflict vice quick victory, contractor support swelled due primarily to the downsized sustainment capability resident within the smaller, lighter American military.

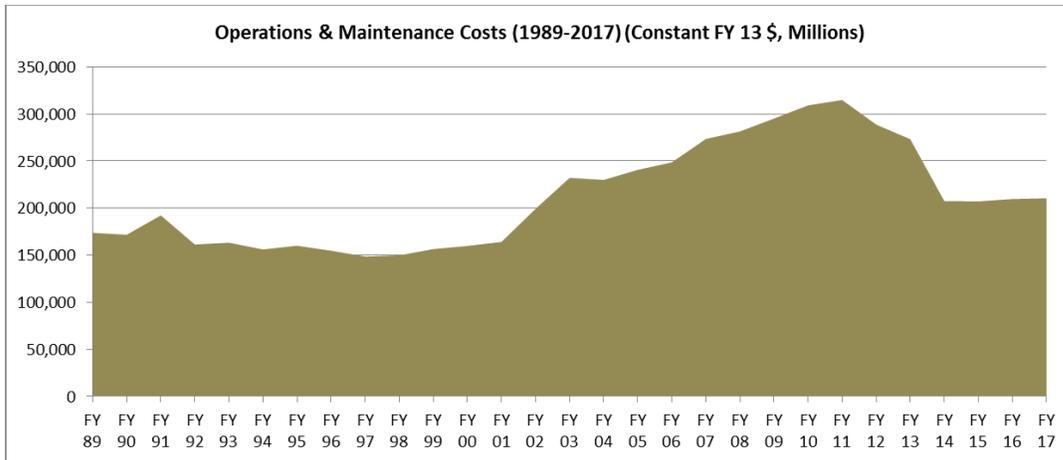


Figure 7 – Operations & Maintenance Costs (1989-2017) (Constant FY 13\$)

At the same time, the cost of maintaining, employing and repairing high-tech systems when used for training or wartime purposes challenged DOD. A 76% growth in O&M costs throughout DOD from 2001 to 2012 when measured in constant FY 13 dollars, implies an escalating, unanticipated cost.³⁷ These notions of exponentially escalating repair costs can be seen within the service budgets. For example, the Army, arguably the most low-tech of all services, estimated in 2005 that “equipment reset would cost \$12 billion to \$13 billion per year.” By 2007, those same reset costs grew to more than \$17 billion in single fiscal year.³⁸ Coupled with the fact that the ground forces did not

³⁶ Ibid.

³⁷ See Annex A.

³⁸ Government Accountability Office, Director, Defense Capabilities and Management. *Force Structure: Restructuring and Rebuilding the Army Will Cost Billions of Dollars for Equipment but the Total Cost Is Uncertain.* by Janet St. Laurent. (Washington D.C.: Government Accountability Office, 10 April 2008), 11.

employ many of their most costly ground systems in large numbers (M1 tanks, Bradley Infantry Fighting Vehicles, etc), these dramatically rising costs imply the funding only covered a portion of the high tech force (helicopters, C2 equipment, ISR equipment, etc).

The increase came about because the cost of a technologically advanced force increasingly grows over time as the cost of equipment increases. Once engaged in conflict, from 2001 to 2012, operations and maintenance costs grew at about 12% above the rate of inflation annually, a result of the increased expense of using high-tech equipment on a sustained basis.³⁹ Experience demonstrates that without a quick victory, O&M grows at surprising rates with maintenance becoming more expensive even if only utilizing a portion of the equipment.

In reality, the cost of sustained operations are often the greatest reason for bloating budgets, although DOD often cites personnel as the primary problem. Acquiring more increasingly expensive equipment and operating it on a sustained basis creates the secondary need to either decrease personnel costs or receive additional funding. For the last ten years, the American debt has swollen to pay for this increased funding. Given increasing budgets will no longer be the case, DOD has tried to safeguard the crown jewels (equipment) while citing personnel costs as a growing concern.

Supervision Subsystem – Increasing Oversight.

As inefficiencies and shortcomings of DOD's approach presented themselves, supervisory agencies also found themselves challenged to answer demands brought about by various environmental changes and increasing inefficiencies within DODs system. Congress and DOD answered this challenge through increased oversight and the creation of additional organizations, rather than the dissolution of irrelevant organizations, to meet

³⁹ See Annex A.

changing demands.

From the mid-1990s, the oversight within DOD more than doubled while the fighting forces “shrunk by more than half.”⁴⁰ In 2013, the Secretary of the Navy reported,

“According to the latest figures, there are currently more than 1,500,000 full-time civilian employees in the Defense Department—800,000 civil servants and 700,000 contract employees. Today, more than half of our active-duty servicemen and women serve in offices on staffs.”⁴¹

Increased oversight manifested not only in the form of bloated staffs but also in the form of completely new and expensive organizations designed to wrestle with the challenges of accelerating environmental change. For example, to address the growing threat of Improvised Explosive Devices (IEDs) on the battlefield, the DOD stood up the Joint Improvised Explosive Device Defeat Organization (JIEDDO). Established with a separate JIEDDO funding line in the DOD budget, JIEDDO expenditures through fiscal year 2011 totaled \$20.2 billion dollars.⁴²

In another example, the Army initiated the modular transformation initiative in 2004, dramatically increasing brigade level oversight capabilities while the overall combat capability of the formation was reduced.⁴³ The Army billed the transformation to a modular force as necessary to support ongoing operations due to the high demand in Operation ENDURING FREEDOM and Operation IRAQI FREEDOM. In 2006, the Government Accounting Office estimated the total cost of Army transformation at \$52.5 billion through fiscal year 2011. Within the Army, the increased manning of Division and Corps staffs also provide evidence of the trend towards increased oversight.

⁴⁰ John Lehman, “More than half of our active-duty servicemen and women serve in offices on staffs,” *Wall Street Journal*, 9 Dec, 2013.

⁴¹ Ibid.

⁴² Belasco, 1.

⁴³ Government Accountability Office, Director, Defense Capabilities and Management. *Capabilities and Cost of Army Modular Force Remain Uncertain*, by Janet St. Laurent. (Washington D.C.: Government Accountability Office, 2006), 1.

As recently as 2013, the Secretary of Defense sought to reverse this oversight trend by implementing a 20% reduction his staff. The Army has followed suit, pushing for a 25% reduction in all Division Headquarters. Both of these efforts aim towards maintaining the capability of fighting formations. However, no recent information shows a desire to dissolve irrelevant formations or combine oversight initiatives to achieve efficiencies. While reductions may take place, the headquarters themselves appear established enough to overcome any effort to dissolve them and combine responsibilities to achieve efficiencies.

Subsystem Conclusion: The Same Approach to New Problems

In the midst of accelerating environmental change, DOD maintained a 1980's approach to building capability. Complicated by the lack of a clear threat and decreasing budgets, DOD assumed risk in the 1990s by weighting conventional high-tech capabilities above capabilities needed to counter growing low-tech threats realized as early as 1997. It appears that when the enemy presented itself in 2001, DOD spent the next ten years attempting to make up for the shortcomings of outdated acquisition and supervision systems using an inefficient capabilities-based planning approach.

As the wars in Afghanistan and Iraq wind down, DOD seems to be gravitating toward its 1990's way of doing business by sacrificing people to gain newer conventional capabilities. The acquisition of these new, conventionally focused capabilities, by default, necessitates a smaller force to pay for costs of other DOD systems. Meanwhile, as DOD's system continues to perform as designed in the 1980s, the relevancy of the capabilities produced becomes increasingly questionable. For example, while the *USS Gerald Ford* may generate 25% more sorties than any other aircraft carrier, the value of

that increased capability appears marginal compared to the changing operational environment and the greatly increased cost of the ship. While America’s 183 F-22 aircraft may be able to defeat any potential enemy defenses, the added value this capability provides for the cost becomes increasingly marginal in an ever-changing operational environment – the definition of an entropic system.

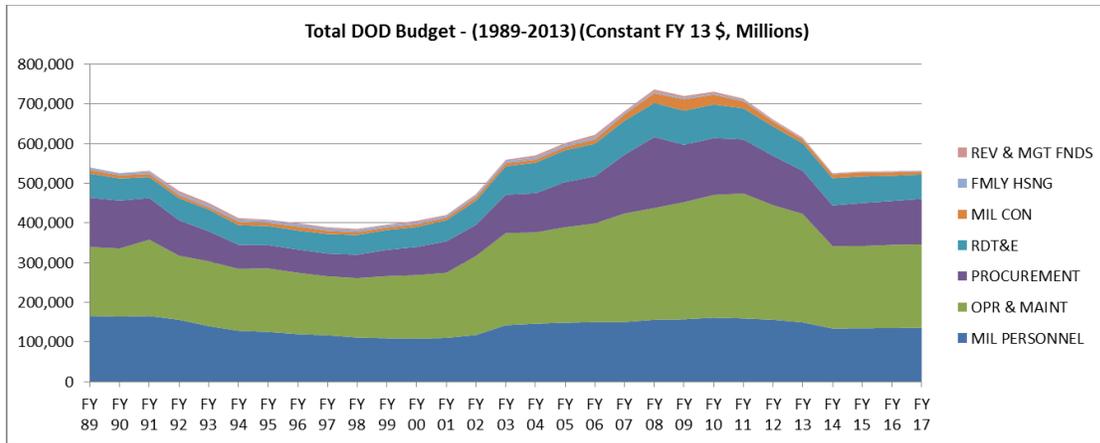


Figure 8: Total DOD Budget (1989-2017 in Constant FY 13 Dollars)

DOD’s own officials recognize this entropic behavior. In 2013, the Secretary of the Navy stated, “Although current U.S. spending on defense adjusted for inflation has been higher than at the height of the Reagan administration, it has been producing less than half of the forces and capabilities of those years.”⁴⁴ Regardless of the fact that America spends more on national defense than any time since World War II, the value of those capabilities appears increasingly marginal in today’s rapidly changing environment. Looking forward to 2016 and beyond, projected defense budgets will likely remain above the Reagan era spending levels (see Figure 8 above). The defense budget passed for 2014 by Congress allocates \$633 billion for defense, defers future cuts and remains above the

⁴⁴ John Lehman, “More than half of our active-duty servicemen and women serve in offices on staffs,” *Wall Street Journal*, 9 Dec, 2013.

\$568 billion allocated in 1986 for a force 40% larger.⁴⁵

In the construct of the theory presented in Chapter 2, the last two chapters demonstrate the first half of the enhanced organizational behavior model regarding entropy.

- From 1989-2013, DOD force structure initiatives focused on maintaining Cold War capabilities that excessively hedged technology in favor of personnel. This unilateral focus to achieve required capability, over time, resulted in increased entropy within DOD.
- From 1989-2000, regardless of a dramatically changing environment, DOD continued to spend using an obsolescent force structure engine resulting in vastly increased inefficiencies where capabilities developed were simply not the capabilities required for the first conflicts of the 21st Century.
- Once conflict commenced in 2001, DOD found itself forced to wrestle with what seemed like minor inefficiencies in the 1990s as the inefficient nature of defense spending compounded from 2001-2013.
- Today, regardless of a rapidly evolving threat environment, increasingly capable of integrating a wide variety of newer technologies, DODs largest defense acquisitions continue to focus on increasing conventional capabilities needed to wage wars with peer competitors.
- Because of internal and external factors, total inefficiencies within the system continue to grow.

The final chapters examine the second half of the theory by explaining failed efforts to increase efficiency, why DOD continues to fail to adapt to an environment of accelerating change, and the changes DOD must make to break this cycle to prevent the continuous evolution to a force which yields increasingly less relevant military capability.

⁴⁵ “Senate Passes Sweeping Defense Bill, Sends It To Obama,” CBS News (online), 20 Dec, 2013. <http://www.cbsnews.com/news/senate-passes-sweeping-defense-bill-sends-it-to-obama/> (accessed 23 Dec, 2013).

Chapter 5 – Results of DOD Efforts Absent Adaptation

While DOD's approach to producing required capabilities continues to revolve predominately around altering people or equipment investments, there have been efforts from 1989-2013 to increase efficiency, increase work performed, or both. As Wilson argues, in peacetime, these initiatives take place in the context of a large procedure-based organization. Even if one assumes some subordinate elements act as craft organizations in wartime, the entire system remains irreversible and largely procedural based, even in a time of conflict. Therefore, absent an impetus to change the system itself, efforts to increase efficiency or work output have finite limitations that result in very little change overall. The system remains locked in past procedures. In DOD's situation, it remains locked in past procedure in the context of a rapidly changing environment.

Efforts to Increase Efficiency - Yielding Less Capability

DOD has attempted to reduce the amount of wasted work and increase efficiency. The 1993 Bottom Up Review used variants of the word 'efficient' sixteen times, and the 1997 QDR used the variants ten times. Even in the 2001 QDR, published after 9/11, utilized the word thirteen times. From 2006 to 2012, the word 'efficient' became restricted in DOD lexicon with the 2006 QDR not addressing it, and the 2010 QDR mentioning it eight times. DOD's desire to improve efficiency depends upon the political winds and the size of the defense budget. The primary point is that efficiency concerns ebb and flow as the fiscal situation ebbs and flows.

Yet, the same periods during which DOD pushed for efficiency were the same periods when the size of the active force simply decreased. As already discussed, the 1990s marked a 36% decrease in the size of the force. Chapter 4 noted that in the fall of 2013, with force reductions through 2016 announced, further decreases would result in a

48% smaller active duty force compared to 1989. By comparing the timing of DOD's efficiency concerns, the timing of shrinking budgets, and the ensuing decreases in output, a correlation can be drawn that as DOD focuses increasingly on efficiency, no real decrease in entropy is realized. The capability produced simply becomes less without a true revolution in military affairs that forces the restructuring of the entire DOD system, such as the internal combustion engine, the machine gun, or the airplane.

In the 1990s, DOD became particularly susceptible to over-valuing minor changes in equipment believing these changes would revolutionize the very nature of warfare. For example, the 1997 QDR highlighted a 'revolution in military affairs' brought about by emerging information age technologies (see page 37). For the first time since the early years of the airplane, an unrealized, yet promising set of technologies took center stage claiming to change the very nature of how the United States military conducted operations. DOD could minimize the Clausewitzian fog of war through approaches such as information dominance and superior intelligence.¹ In the end, these investments resulted in marginal increases in the capability of subordinate formations and little increase in overall DOD capability.

In 2013, DOD largely maintained the same range of capabilities possessed two decades earlier. The Army still maintains a brigade centric construct, having shed itself of many echelon above brigade capabilities, while it now plans to decrease the number of brigades.² The Navy still maintains the aircraft carrier as a centerpiece of its surface warfare philosophy, but as it attempts to rebalance to the Pacific, the types of ships

¹ H.R. McMaster, "Crack in the Foundation: Defense Transformation and the Underlying Assumption of Dominant Knowledge in Future Warfare," Strategy Analysis Thesis, (Carlisle, PA: US Army War College, 2003), 1. <http://handle.dtic.mil/100.2/ADA416172> (accessed 15 Sep 13).

² International Institute for Strategic Studies, *The Military Balance 2013: The Annual Assessment of Global Military Capabilities and Defence Economics*, (London, UK: Routledge Press, 2013), 52.

provided, “leads to a higher hull count, but not necessarily an increase in warfighting capability.”³ The Air Force maintains its focus on fighter and bomber aircraft even “when an expanded set of capabilities, such as improved ISR, was required.”⁴ Although the changing environment continues to point to evolving low-tech threats with the increasing capability to acquire newer technologies and irregular warfare, services continue to place the predominance of their efforts in preparing for conventional means. The relevance, or true value, of produced capabilities increasingly comes into question.

Efforts to Increase Work Performed – Yielding Marginal Gains

In 2002, Secretary of Defense Rumsfeld charged the graduating Air Force Academy class to question bureaucratic systems that limited their ability to do “more with less.”⁵ Eleven years later, Secretary of Defense Hagel challenged military leaders again to “do more with less” in light of shrinking budgets.⁶ At the same time, the Chairman of the Joint Chiefs of Staff, General Dempsey stated, “we’re going to do less with less, but not less well.”⁷ General Campbell, Army Vice Chief of Staff, warned Congress in April 2013, “we can’t continue to do more with less, or else we’re going to put [service members’] lives at risk.”⁸ Each of these describe DOD’s philosophical viewpoints

³ Ibid, page 54.

⁴ Ibid, 57-59.

⁵ U.S. Department of Defense, Office of the Secretary of Defense, at United States Air Force Academy Commencement Ceremony (transcript), As Delivered by Secretary of Defense Donald H. Rumsfeld, Colorado Springs, Colorado, Wednesday, May 29, 2002. <http://www.defense.gov/speeches/speech.aspx?speechid=244> (accessed 3 Dec 13).

⁶ “Hagel Stresses Value of Special Operations Forces to Security,” by Marine Corps Lance Cpl. Steven Fox U.S. Marine Corps Forces Special Operations Command, Marine Corps Base Camp Lejeune, N.C., July 18, 2013. <http://www.defense.gov/news/newsarticle.aspx?id=120471> (accessed 3 Dec 13).

⁷ “Dempsey: U.S. Will Remain World Power Despite Budget ‘Mess’” by Karen Parrish *American Forces Press Service*, Yokota Air Base, Japan, April 25, 2013. <http://www.defense.gov/news/newsarticle.aspx?id=119869> (accessed 3 Dec 13).

⁸ “Services: Sequestration Will Affect Force Readiness” by Nick Simeone *American Forces Press Service*, Washington, April 19, 2013. <http://www.defense.gov/news/newsarticle.aspx?id=119829> (accessed 3 Dec 13).

toward increasing or maintaining capability by altering work output of the system. They each portray competing emotional views of how to increase capability: work smarter or work harder.

However, absent altering the method by which the system converts money into people or equipment, such as re-implementing stop loss policies or returning to a partially drafted force, overall personnel costs will continue to increase, thereby degrading efficiency. Absent continual increases in funding or the next truly revolutionary technological development, the defense dollar will consistently devalue itself as technology-based answers become increasingly expensive. At some point, ‘working harder’ or ‘working smarter’ only maintains so much capability. If DOD does its best to maintain efficiency and inputs do not increase, inputs yield increasingly marginal gains and increased entropy due to environmental and systemic factors.

Chapter 4 explored investment trends in the 1990s in light of an emerging non-conventional threat and highlighted the \$221.6 billion in acquisitions expenditures from 2004 to 2010 due to failing to prepare for that threat. The 1990s investments, although seemingly efficient at the time, resulted, in the 2000’s, in \$221.6 billion for lacking capabilities - a failure of the system to meet its required output. In another example, while the F-22 does represent an additional capability for the United States military, its acquisition cost also caused the Air Force to petition to rid itself of other systems such as the A-10 and increasingly utilized UAV platforms. Therefore, the idea that the F-22 has vastly improved the overall capability of the American military shifts from an intellectual debate to an emotional debate over future required capabilities. Overall, the F-22 represents a marginal increase in overall capability by adding an incredibly valuable tool

to America's arsenal but, at the same time, stripping the military of other important capabilities.

These examples highlight the second aspect of DOD's behavior in which inputs yield increasingly less capability over time while entropy increases. The trends show that

investments and adaptations in the 1980s, in a period of reform and renovation, did vastly increase the lethality of American forces. The Army believed their resulting formations were six times as lethal as those employed in Vietnam.⁹

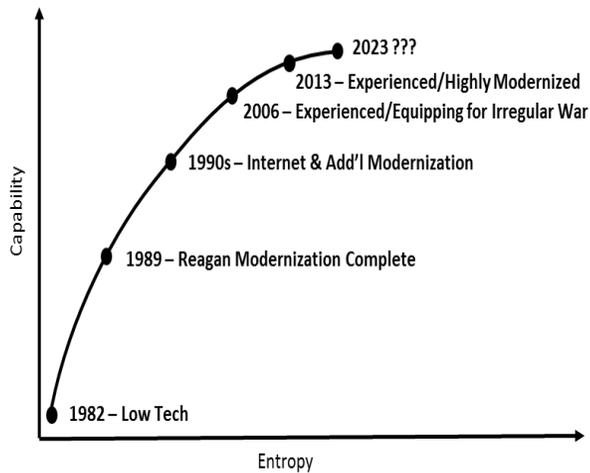


Figure 9: Entropy Results: Increasingly Marginal Increases in Capability

However, since that time, while

lethality increases have taken place, officials have not offered up the same optimistic claims. Regardless of massive investments in internet technologies in the 1990s, the same increases in capability did not occur (See author's representation in Figure 9). As entropy increases and the nature of inputs remain relatively unchanged, efforts to increase capability produces increasingly marginal results.

The Remaining Option - Adaptation

Despite efforts to increase efficiency, modernization efforts to increase capability, and ever-increasing budgets in the 2000's, DOD's rigid engine yielded increasingly minor additions to overall capability over time since the 1980s. If the engine of force structure cannot provide the capability required, in the right amounts, at the right time and place, then shortfalls logically exist. If spending more money does not answer this

⁹ Mahnken, 134.

challenge, then system inefficiency must exist. Therefore, the remaining option available becomes to adapt the system to changed circumstances. Rather than trying to make the environment adapt to DOD, DOD must adapt to the environment. Rather than attempting to overcome increasing inefficiencies in an increasingly unproductive system, the system itself must change to produce the required outputs. This was the essence of Secretary Rumsfeld's intense effort to force the embracement of transformation as part of the military ethos.

Adaptation became a primary source of military pride during the Iraq and Afghanistan conflicts. As mentioned earlier, General Dempsey has praised previous organizational efforts to adapt, citing Army efforts to meet to the evolving situation in both Iraq and Afghanistan.¹⁰ While true, these efforts took place when confronted by the very real prospect of operational and strategic defeat. Additionally, his remarks discount the fact that an unwillingness to adapt in the 1990s (as the 1997 QDR described the rise of enemies using asymmetric tactics), preceded adaptation efforts to prevent defeat only five years later. Military doctrine stresses the need for adaptation stating, “..great militaries adapt to fight the enemy, not the plan.”¹¹ Adaptability appears to be a key attribute of military leaders and organizations expected to persecute the nation's wars.

While senior leaders in DOD appear to demand adaptable organizations and leaders, they do so within the confines of a larger restrictive system unable or unwilling to adapt. Chapter 3 explained how the political environment can counter adaptation efforts given a

¹⁰ “Dempsey Career Reflects Adaptability, Creativity” By Jim Garamone *American Forces Press Service*, Washington, May 30, 2011. <http://www.defense.gov/news/newsarticle.aspx?id=64114> (accessed 3 Dec 13).

¹¹ U.S. Department of Defense, Department of the Army, Combined Arms Training Center, *Army Leadership, FM 6-22*, (Fort Leavenworth, KS: Combined Arms Training Center, 2006), 6-1. http://www.defense.gov/Blog_files/Blog_assets/20080422_ColReider_fieldmanual.pdf (accessed 10 Dec 13).

democratic system. While Secretary Hagel cites ‘political resistance’ as the primary reason for a lack reform regarding many issues, he goes on to state,

“New realities are forcing us to more fully confront these tough and painful choices. And to make the reforms necessary to put this Department on a path to sustain our military strength for the 21st century and meet these new and complicated threats, we will have to do things differently.”¹²

The Secretary’s statement seeks to alter an unforgiving political environment and implies environmental change is required rather than a change within DOD.

While politicians, interest groups, and others may constrain adaptability through external pressures, internal pressures affect adaptability in the form of emotional, parochial tendencies. For example, during the debates over the 1986 Defense Re-organization Act (i.e. Goldwater-Nichols), the Navy established a crisis management center with the “purported mission to defeat the legislation.”¹³ Secretary Gates addressed these parochial tendencies in Congress as he limited the Air Force’s F-22 acquisition program stating, “We need to rise above narrow, parochial interests and make decisions that are in the best interest of our overall national security. We need to change the way we have been conducting business in this department.”¹⁴ With top DOD officials decrying the force structure system and the inability to adapt due to both internal and external factors, the final element of the enhanced entropy theory becomes apparent.

¹² U.S. Department of Defense, Office of the Secretary of Defense, SAC-D Budget Request, (Washington DC: Department of Defense, 2013). <http://www.defense.gov/speeches/speech.aspx?speechid=1788> (accessed 5 Oct 13). This is a continuation of Secretary Hagel’s quote mentioned on page 25. In the quote, he blames political resistance as the reason DOD failed to behave more efficiently.

¹³ James. L. Locher, “Goldwater-Nichols: Fighting the Decisive Battle,” *Joint Forces Quarterly*, Summer 2002, 42.

¹⁴ “F-22 Debate Reflects Broader Acquisition Challenges,” by Donna Miles *American Forces Press Service* Washington, July 15, 2009. <http://www.defense.gov/news/newsarticle.aspx?id=55138> (accessed 24 Nov 2013).

The Critical Forcing Function

National defense has reformed in the past. The military of the 1920's did not look like the military of 1944. The military that fought the Vietnam conflict did not look like the military that fought the 1991 Iraq war. However, the transformation of the defense establishment always occurred because of a forcing function, a catalyst for change.

Successful forcing functions, those able to drive adaptation, take many forms. The 1941 bombing of Pearl Harbor served as an external geopolitical forcing function (an act of war) that enabled President Roosevelt to mobilize the military establishment, when only days prior, "...soldiers were booing newsreel shots of Roosevelt and General George C. Marshall...while cheering outspoken isolationists."¹⁵ In large part, adaptive actions during the Reagan era stemmed from a fear of the Soviet threat. Genuine fear, brought about by the threat of defeat in wartime, appears to have been a powerful forcing function to adapt the DOD system to the operational environment.

While some may view forcing functions through a lens of technology such as the invention of the internal combustion engine, most often they occur at the "intersection of organizational, cultural, doctrinal, personnel culture, and technological change."¹⁶ For example, even one of the staunchest critics of DOD bureaucracy, Secretary Rumsfeld, largely failed in his personal attempt to propel adaptation, in the form of transformation, within the military.¹⁷ For a forcing function to foster adaptation, it must pervade multiple domains simultaneously.

¹⁵ Rick Atkinson, *An Army at Dawn: The War in North Africa 1942-1943*, (New York: Henry Holt and Company, 2002), 9.

¹⁶ Douglas Macgregor, *Transformation Under Fire: Revolutionizing How America Fights*, (Westport, CT: Praeger Press), 12.

¹⁷ Dale R. Herspring, *Rumsfeld's Wars: The Arrogance of Power*. (Kansas: University Press of Kansas, 2008), xxi-xxii.

Given the need for a forcing function and the difficulty of identifying one absent an immediate threat, Williamson Murray asked the simple question, “What are the possible implications for those who will innovate during periods of low budgets, major technological changes, and an uncertain strategic environment?”¹⁸ He quickly determined that, the bureaucratization of innovation – particularly in the framework of the U.S. military – guarantees its death.¹⁹ The best prospect for adaptation lies in one that begins with changes in service culture.²⁰ The best prospect for change lies within a military culture that promotes experimentation, re-invents its military education programs, and ensures that the gathering of ‘lessons learned’ seeks to do more than validate current doctrine. As a result, in *peacetime*, the most realistic forcing function must come from *within* the American military – not among the many actors in a rapidly evolving environment. This conclusion warrants serious, unfettered debate among all stakeholders.

¹⁸ Murray and Millet, 326.

¹⁹ Ibid.

²⁰ Ibid.

Chapter 6: Overcoming Entropy & Reducing Risk

Given the parochial nature of sub-elements of DOD and the environmental impediments to adaptation, prospects for reducing entropy and avoiding reduced capability over time appear bleak. Efforts to institutionalize an adaptive approach within the rigid force structure system in the 1990s resulted in an ever-increasing focus on technology highlighted during the Reagan era. As a result, the current force relied too heavily on technology-based solutions entering Iraq and Afghanistan. Today, the military itself continues to perpetuate this infatuation with technology stating, Joint Force 2020 will “have cutting edge capabilities” and exploit “our technological, joint, and networked advantage.”¹ Rather than fostering the adaptation of the system to achieve required capabilities, the military continues to pursue the same method for success due to parochialism and non-innovative approaches. However, working with Congress, DOD can spur an era of adaptation by altering the core of the framework that produces capabilities, changing the formula for success rather than manipulating inputs.

If the human factor is the only element common in the DOD system, then adaptation and flexibility in the system must result from a change in human behavior. Human behavior is influenced by values and beliefs. Therefore, changing values can change human behavior. Changing beliefs can change human behavior. While DOD leaders cite the need for adaptive leaders, the current personnel system does not promote those values. For example, in 2011 a study of the Army promotion system pointed out that 60% of the Lieutenant Colonels selected for Battalion Command had “tactical and

¹ U.S. Department of Defense, *2012 Defense Strategic Guidance*, 5 (in forward by Secretary of Defense).

technical” competence listed on their proficiency reports as their primary strengths.² In comparison, only 40% of those selected listed critical or creative thinking as their strongest attribute.³ Similarly, 75% received high marks for their decision making and execution abilities. 25% received high marks for adaptive traits such as learning and listening. Only 8% received marks for learning and assessing abilities.⁴ The need for adaptive leaders may be there, but the desire to promote adaptive behavior is not.

Conversely, while some may consider the Air Force the most innovative of the services, their promotion of adaptation as a desired senior leader trait also appears lacking. In 2003, pilots comprised 19% of the total Air Force officer population. That same year, pilots made up 63% of the Air Force general officer corps.⁵ The emphasis on a person’s ability to perform technical functions and make tactical decisions under pressure resulted in a system where only the most technically and tactically demanding positions received due consideration for promotion to senior levels. Innovation and adaptation took a backseat to technical and tactical competence.

However, even with an increased emphasis on robotics, drones, and other unmanned platforms, the emphasis on technical competence, perpetuating the solutions of the past, continues to stifle the Air Force. Between 2002 and 2010, the inventory of unmanned vehicles in the services grew by approximately 4000%. In roughly the same period, the

² John Richardson IV, *Real Leadership and the U.S. Army: Overcoming a Failure of Imagination to Conduct Adaptive Work*, Strategic Studies Institute, (Carlisle, PA: U.S. Army War College, December 2011), 73-74.

³ Ibid.

⁴ Ibid.

⁵ Brian J. Collins. "The United States Air Force and Profession: Why Sixty Percent of Air Force General Officers are Still Pilots when Pilots Comprise just Twenty Percent of the Officer Corps," (Georgetown Maryland, Georgetown University, 2006), page iii. <http://search.proquest.com/docview/305337486?accountid=12686>. (accessed 16 Feb 2012).

budget for UAVs increased from \$284 million in FY 2000 to \$3.3 billion in FY10.⁶ Yet, the Air Force leadership continued to place 92% of its procurement budget toward manned systems. As Kane observes, there appears to be an irony “in the unpreparedness of the personnel culture of the US Air Force for this new kind of unmanned flying.”⁷ Given these, the likelihood of the Air Force placing innovation and adaptation at the top of the list for desired senior leader traits seems remote. The need for adaptive thinking may be present, but the desire to promote adaptive behavior is not.

Like the Army and Air Force, the Navy understands the importance of leadership in the military. As the Chief of Naval Operations, Admiral Mullen stated, “Everything starts and ends with leadership.”⁸ Cultivating leaders prepared to meet the challenges of the 21st Century security environment became a centerpiece for his tenure as the CNO. At the same time, the Navy continues to place a higher premium toward ‘on the job training’ vice developing innovative and adaptive leaders prepared for a new era.⁹

As a result of the Navy’s enduring focus on technical and tactical competence achieved through on the job training even at the field grade levels, in 2007, only 20% of the Navy flag officers were graduates of resident senior service colleges.¹⁰ This statistic speaks volumes to the emphasis the Navy places on technical and tactical competence versus fostering creative thinking, innovation, and adaptation among future senior

⁶ Jeremiah Gertler, “U.S. Unmanned Aerial Systems,” Congressional Research Service, Report 42136, (Washington, D.C.: Congressional Research Service, 3 Jan 2012), I & 14.

⁷ Tim Kane, *Bleeding Talent: How The US Military Mismanages Great Leaders and Why It's Time for a Revolution*, (New York, New York: Palgrave Press, 2012), 194.

⁸ U.S. Department of Defense, Department of the Navy, Chief of Naval Operations, *CNO Guidance for 2006: Meeting the Challenge of a New Era*, by Admiral Michael Mullen, (Washington, D.C.: Department of Defense, 2006), 2. <http://www.navy.mil/features/2006CNOG.pdf> (accessed 14 Feb 2014)

⁹ Christopher D. Hayes, "Developing The Navy's Operational Leaders: A Critical Look," *Naval War College Review* 61, no. 3 (Summer 2008), 96. <http://search.proquest.com/docview/205933515?accountid=12686>. (accessed 10 Feb, 2014).

¹⁰ *Ibid.*, 89.

leaders. Recognizing this challenge, in 2008, the Chief of Naval Personnel sponsored a RAND study specifically to examine the areas of expertise required of future flag officers. Although the study utilized a dizzying mathematical approach to an inherently human problem, it ultimately found that judgment, adaption, and perception as critical requirements for future flag officers.¹¹ The Navy, much like the other services, recognizes, but has not addressed this overarching challenge.

Within the joint world, recent efforts to spur innovation and adaptation also appear lacking. If the joint education system stands as the primary method by which to jointly shape adaptive and innovative efforts, those efforts appear to fall short. For example, while General Dempsey calls for critical thinking as an essential ingredient for future professional military education, “the amount of time devoted to critical thinking has hardly changed despite the emphasis on a command system that is absolutely dependent upon it.”¹² At the same time, other internal critics characterized military war colleges as an, “...educational experience more of a preparation for retirement than a platform for leadership at the higher levels.”¹³ Given these criticisms, questioning the military’s commitment to spur innovation and adaptation appears appropriate.

Those who choose to question the joint force’s commitment also highlight the need to both “encourage and promote innovation and adaptation.”¹⁴ Observers such as Burns and Miller believe, “Civilian leaders need to ensure that those chosen to sit on selection

¹¹ Lawrence M. Hanser, Louis W. Miller, and Herbert J. Shukiar, *Developing Senior Navy Leaders: Requirements for Flag Officer Expertise Today and in the Future*. (Santa Monica, California: RAND Corporation, 2008), 101.

¹² Nicholas Murray, “The Role of Professional Military Education in Mission Command,” *Joint Forces Quarterly*, Issue 72, 1st Quarter 2014, 10-13.

¹³ George E. Reed, “The Pen and the Sword: Faculty Management Challenges in the Mixed Cultural Environment of a War College,” *Joint Forces Quarterly*, Issue 72, 1st Quarter 2014, 14-20.

¹⁴ William R. Burns and Drew Miller, “Improving DOD Adaptability and Capability to Survive Black Swan Events,” *Joint Forces Quarterly*, Issue 72, 1st Quarter 2014, 31-38.

boards and the precepts given to these boards contribute to promoting military leaders who are most capable of adapting to a rapidly change environment.”¹⁵ Similar to individual service challenges, those observing the joint force point toward promoting that which we value as a means to achieve true change in the system. Most agree tomorrow’s complex challenges require those can think critically and see beyond the number of aircraft carriers, brigades, and planes required for an operation. Tomorrow’s challenges require leaders who not only can offer the best military advice to civilian leaders but can also look within and understand the long term ramifications of current trends. Continuing to pursue technological capability while undervaluing personnel poses limitations. The future joint force requires adaptive leaders focused on future challenges.

While Goldwater-Nichols served as a catalyst to entice joint qualification, the services retained their independent ability to promote. In the current environment, “citizens feel unqualified to challenge a system they know nothing about.”¹⁶ Kane characterized it best stating,

“Despite its very real cultural emphasis on putting people first, and despite the risk-taking entrepreneurial style of men and women in uniform, the regulations that manage them – literally human capital management – are a nightmare for central planning. Unorthodox commanders or officers with unconventional careers are routinely skipped for plum assignments and higher rank.”¹⁷

While he puts forward seemingly radical ideas such as eliminating year groups after ten years using market mechanisms to allocate jobs instead of central placement, and firing more officers, Kane gears each of his ideas towards “transforming the military’s

¹⁵ Ibid.

¹⁶ Kane, 5.

¹⁷ Ibid., 17.

industrial personnel hierarchy into an innovative, entrepreneurial powerhouse.”¹⁸ Efforts to re-invigorate the educational system to promote innovation become important as well. Based upon the trends since the Reagan years, without a personnel system that promotes adaptation from within, entropy continues to increase as the human element produces increasing frictions on the system. This approach requires a bold step initiated at the very top of the DOD hierarchy. Without revising valued personnel traits, efforts to create an adaptive force will achieve marginal results.

Therefore, future DOD efforts to foster adaptation must cultivate creativity, learning, critical thinking, and the ability to critically assess current actions for future relevancy. By promoting people based upon demonstrated adaptive characteristics, the tendency for DOD to perpetuate non-productive activities decreases. Ensuring the core values of all services reflect adaptation as a critical trait at the operational and strategic levels will further alter system behaviors.

At the same time, none of these arguments should imply that today’s senior leaders have failed. Rather, looking forward, today’s senior leaders must understand that adaptation and innovation as a senior leader trait in an environment of accelerating change will become increasingly critical in the coming years. Since growing a senior leader takes decades, all services must foster these adaptive and innovative leader traits today to ensure that tomorrow’s force remains relevant. Tomorrow’s problems will not be solved by the same level of thinking that created them. Tomorrow’s problems will require those who can look beyond past solutions and, if necessary, take an entirely different path to achieve mission success.

Valuing adaptation, creativity, and innovation over more direct personality traits does

¹⁸ Ibid., 136.

move risk into other areas for DOD. Organizations that value procedures, checklists, and rote memory perform in a predictable manner. The outcomes they produce are expected, and, therefore, the perception of control is greater for the organization as a whole. While DOD must have tactical leaders who do their duty and charge when ordered to charge, it is also imperative to promote at senior levels those with the ability to do much more. More adaptive levels of performance at the operational and strategic levels of war are expected but not groomed by the services. Therefore, the challenge becomes identifying adaptive leaders earlier and fostering those traits in an environment where simply following orders remains a valid requirement at times.

Regarding the management of risk, leaders should realize the existing system already induces risk given an environment of accelerating change. Few within DOD believed the 2003 invasion of Iraq would not conclude until 2011. Even fewer within DOD believed the 2001 invasion of Afghanistan would still rage in 2014. DOD's record at predicting outcomes based upon organizations that value rote memory and learned behavior seems suspect. While tactical and technical competence may produce seemingly positive results at the tactical level, it produces questionable results at the operational and strategic levels of war. By not adapting, DOD continues to assume a greater amount of risk in a rapidly changing environment.

Additionally, the idea of promoting adaptation and creativity must not be seen as undermining the importance of tactical and technical competence. At the tactical level of war, those skills will continue to determine immediate success. However, as leaders transition to the operational level of war, a shift must occur in the skills the military seeks to promote. Technical and tactical competence at the operational level, in an

environment of accelerating change, cannot take a distant backseat to innovation and adaptation as desired senior leader attributes.

While an infatuation with technology continues to erode capability over time due to increasing entropy, the solution to DOD's challenge lies with the one resource it has had all along – its people. Individuals who can 'think' through problems critically and avoid illogical, delusional conclusions constitute DOD's greatest long-term resource. Rather than demanding adaptability within the confines of a rigid system, DOD must formulate a system that rewards innovation and adaptation. By rewarding innovation, but never stepping away from the idea that leaders must demonstrate and pursue professional excellence, DOD can alter the equation for generating capability. General Dempsey recognized the challenge stating, "We've got to be quicker on our feet, and we've got to be more willing to make changes that provide what the nation needs in its military dimension of power."¹⁹ The key to reducing entropy is adaptation. The key to adaptation is people. The key to unlocking their innovative nature is a personnel system that nurtures adaptability rather than constricting it.

¹⁹ "Dempsey Discusses Importance of Embracing, Managing Military Change," by Jim Garamone, *American Forces Press Service*. 20 Sep 2012.

Conclusion – Towards an Adaptable Department of Defense

“One constant will be that our military power must always provide a variety of capabilities suitable for dealing with a broad range of contingencies. Our military power must not only serve to deter but also, if deterrence fails, to defend.”¹

Written in 1964, those words ring true in 2014 as well. In some respects, the military has done poorly. The notion that the military has succeeded by protecting American interests in the past does not constitute a true measure of success. The ability to sustain that success, indefinitely, constitutes the true measure of success for a professional military. By failing to think innovatively, past military leaders grew an unsustainable high-tech force focused on conventional operations regardless of an emerging low-tech threat. Consistently hedging technology over personnel since the 1980’s, the military lost the ability to approach problems critically. From 1989-2000, DOD experienced major inefficiencies in national defense that were the direct result of an inability to understand the effect of an environment of accelerating change. DOD recognized but did not address changes in required capabilities due to environmental factors.

From 2000-2013, DOD again experienced major inefficiencies as a result of internal sub-systems that placed an increasing percentage of inputs toward equipment rather than innovation. To compensate for the inefficiencies of the 1990s, DOD drastically altered the path taken by increasing money used and hedging that money towards technology and equipment in the midst of two simultaneous conflicts. Today, DOD again has taken the approach of decreasing people for equipment while seeking more money rather than restructuring internal systems.

Entropy theory demonstrates DOD’s current trajectory will result in less relevant

¹ Roswell L. Gilpatric, “Our Defense Needs,” *The Long View*, April 1964, Volume 42, Issue 3, 366-378.

military capability over time. Past behaviors indicate DOD's current focus will likely result in less relevant military capability over time as an increasing percentage of resources battle inefficiencies. By primarily attacking efficiency, the force of 2023 will provide less relevant capability to protect U.S. national interests than the force of 2013. Singular initiatives to increase output will result in increased entropy with gains in capability becoming increasingly marginal. Working harder only achieves a finite amount of additional output and automatically induces additional entropy into the system.

Therefore, adaptability becomes paramount to designing an organization capable of accounting for environmental change and organizational inefficiencies. Because of the human desire to continue along a single vector, the military is most likely to gravitate towards a previous high-tech approach that stands to diminish American military capability in the long-term and has already resulted in increasingly less relevant military capability and capacity. Without a forcing function designed to foster the adaptation of the supervision system, prospects of overcoming entropy become increasingly poor.

To foster adaptation, DOD must alter the values it cultivates among future senior leaders. Unless DOD is able to identify, develop, and nurture adaptive leaders, entropy within the system is bound to increase. Efforts to increase efficiency or outputs will only achieve marginal results. As a result, DOD will face a continuation of past approaches that wastes increasing amounts of resources in an environment of accelerating change. The increase in waste yields increasingly less military capability relevant to tomorrow's challenges. Therefore, absent the threat of catastrophic defeat or an alteration of the desired senior leader traits within the personnel system, entropy increases throughout DOD will result in wasted resources and yield increasingly less military capability.

Annex A:

Department of Defense Total Obligation Authority by Fiscal Year (1948-2017)

Data from this section is pulled specifically from the Department of Defense Green Book published in March 2012.¹ The author has used this as a source of budget data because it provides one of the few sources which represents the Department of Defense Budget in real fiscal year terms as well as constant fiscal year 2013 dollars. Drawing conclusions based upon real time expenditures only paints part of the picture. However, real cost growth and analysis can be achieved by examining expenditures in constant dollar amounts. In essence, this approach minimizes, to the extent possible, the drama of economic fluctuations and accounts for true growth by providing data rooted in a common point of reference.

DEPARTMENT OF DEFENSE TOA BY TITLE

(Dollars in Millions)

CURRENT DOLLARS	FY48	FY49	FY50	FY51	FY52	FY53	FY54	FY55
MIL PERSONNEL	4,232	4,601	4,942	8,522	11,141	12,181	11,190	11,040
RETIRED PA Y,DEF	175	193	197	324	331	356	386	422
OPR & MAINT	3,881	4,436	4,205	11,676	13,661	10,884	8,678	8,407
PROCUREMENT	2,995	3,251	4,176	21,837	28,173	16,481	6,469	8,917
RDT&E	405	484	553	1,183	1,796	2,112	2,243	2,621
MIL CON	215	239	265	1,631	2,087	2,269	1,464	2,338
FMLY HSNB								44
REV & MGT FNDS								
TRUST, RECEIPTS, & OTHER								
TOTAL, CURRENT \$	11,903	13,204	14,337	45,173	57,188	44,283	30,429	33,790

FY13 CONSTANT DOLLARS	FY48	FY49	FY50	FY51	FY52	FY53	FY54	FY55
MIL PERSONNEL	82,274	89,626	88,027	139,465	187,989	191,785	180,088	172,404
RETIRED PA Y,DEF	2,816	3,088	3,289	3,355	3,494	3,707	4,305	4,433
OPR & MAINT	63,026	66,317	60,753	133,117	157,709	131,281	110,224	104,184
PROCUREMENT	29,160	30,377	37,601	177,952	241,184	142,052	57,101	72,240
RDT&E	4,296	4,333	5,234	10,961	15,957	18,617	19,074	21,043
MIL CON	1,757	1,915	2,065	12,686	16,345	17,423	10,840	16,348
FMLY HSNB								312
REV & MGT FNDS								
TRUST, RECEIPTS, & OTHER								
TOTAL, CONSTANT \$	183,329	195,656	196,969	477,536	622,678	504,865	381,633	390,964

¹ U.S. Department of Defense, Office of the Undersecretary of Defense (Comptroller), *National Defense Budget Estimates for FY 2013*. (Washington, DC: Department of Defense, 2012). The numbers included encompass all money provided to DOD except those listed in the President's Budget under the line of "Atomic Energy Defense".

CURRENT DOLLARS	FY56	FY57	FY58	FY59	FY60	FY61	FY62	FY63
MIL PERSONNEL	10,888	10,945	10,987	11,294	11,241	11,356	12,158	12,042
RETIRED PA Y,DEF	479	511	561	635	693	788	896	1,015
OPR & MAINT	9,195	9,614	10,112	10,214	10,329	10,671	11,562	11,467
PROCUREMENT	11,844	12,221	13,628	13,118	11,137	14,238	16,194	16,026
RDT&E	3,539	4,381	4,159	5,144	5,476	6,366	6,269	7,028
MIL CON	2,095	2,048	1,634	1,748	1,350	1,115	915	1,286
FMLY HSNB	25	3	42	42	32	108	440	556
REV & MGT FNDS								
TRUST, RECEIPTS, & OTHER								
TOTAL, CURRENT \$	38,065	39,724	41,124	42,193	40,257	44,643	48,434	49,420

FY 13 CONSTANT DOLLARS	FY56	FY57	FY58	FY59	FY60	FY61	FY62	FY63
MIL PERSONNEL	162,611	164,667	156,798	151,470	148,908	148,420	160,583	157,220
RETIRED PA Y,DEF	4,708	4,832	5,261	5,562	6,124	6,984	7,933	9,061
OPR & MAINT	107,695	108,669	108,436	106,032	103,289	101,777	108,194	105,453
PROCUREMENT	93,645	93,363	104,789	100,582	84,503	108,453	120,184	117,763
RDT&E	26,155	30,597	28,880	34,807	36,480	41,666	41,087	45,533
MIL CON	14,251	13,702	10,979	11,686	9,028	7,461	6,074	8,240
FMLY HSNB	174	30	269	262	200	657	2,962	3,658
REV & MGT FNDS								
TRUST, RECEIPTS, & OTHER								
TOTAL, CONSTANT \$	409,238	415,861	415,414	410,400	388,531	415,419	447,017	446,928

CURRENT DOLLARS	FY64	FY65	FY66	FY67	FY68	FY69	FY70	FY71
MIL PERSONNEL	12,983	13,430	15,455	18,236	19,961	21,385	22,978	22,625
RETIRED PA Y,DEF	1,211	1,386	1,592	1,831	2,093	2,443	2,853	3,389
OPR & MAINT	11,693	12,563	15,378	19,365	20,950	22,290	21,517	20,422
PROCUREMENT	15,028	14,111	22,012	23,277	22,528	22,245	19,156	17,364
RDT&E	7,053	6,433	6,885	7,225	7,263	7,730	7,399	7,123
MIL CON	977	1,063	2,595	1,217	1,557	1,142	1,015	1,209
FMLY HSNB	602	575	613	439	612	518	593	714
REV & MGT FNDS								
TRUST, RECEIPTS, & OTHER								
TOTAL, CURRENT \$	49,547	49,560	64,531	71,590	74,965	77,752	75,512	72,846

FY 13 CONSTANT DOLLARS	FY64	FY65	FY66	FY67	FY68	FY69	FY70	FY71
MIL PERSONNEL	157,784	157,742	165,323	184,754	192,173	193,499	185,966	171,117
RETIRED PA Y,DEF	10,393	11,691	12,854	14,259	15,772	17,469	18,980	20,379
OPR & MAINT	104,975	106,920	122,839	145,896	153,991	156,492	143,203	127,381
PROCUREMENT	106,714	97,338	140,304	143,348	131,422	124,470	103,894	88,884
RDT&E	45,284	40,519	41,919	42,566	41,518	42,596	38,842	35,572
MIL CON	6,177	6,464	14,807	6,855	8,400	5,982	5,109	5,658
FMLY HSNB	3,909	3,694	3,812	2,700	3,577	2,982	3,218	3,620
REV & MGT FNDS								
TRUST, RECEIPTS, & OTHER								
TOTAL, CONSTANT \$	435,236	424,367	501,858	540,377	546,853	543,490	499,212	452,610

CURRENT DOLLARS	FY72	FY73	FY74	FY75	FY76	FY77	FY78	FY79
MIL PERSONNEL	23,147	23,639	24,104	24,885	25,430	25,947	27,184	28,650
RETIRED PAY,DEF	3,889	4,392	5,137	6,239	7,326	8,219	9,173	10,282
OPR & MAINT	21,254	22,151	23,865	26,156	28,851	32,015	34,904	37,876
PROCUREMENT	18,491	18,199	17,437	17,289	20,996	27,075	29,948	31,311
RDT&E	7,584	8,020	8,200	8,632	9,520	10,585	11,503	12,362
MIL CON	1,262	1,550	1,847	1,828	2,147	2,210	1,860	2,535
FMLY HSNB	839	974	1,104	1,103	1,254	1,297	1,385	1,605
REV & MGT FNDS					135	220	171	101
TRUST, RECEIPTS, & OTHER								
TOTAL, CURRENT \$	76,467	78,925	81,693	86,132	95,658	107,567	116,128	124,721

FY13 CONSTANT DOLLARS	FY72	FY73	FY74	FY75	FY76	FY77	FY78	FY79
MIL PERSONNEL	153,901	141,528	135,334	130,160	125,710	121,808	119,493	118,635
RETIRED PAY,DEF	21,927	23,343	24,896	26,498	28,023	29,682	30,814	31,903
OPR & MAINT	127,407	123,651	119,660	123,254	122,296	125,772	125,662	129,392
PROCUREMENT	88,253	80,008	69,728	61,865	67,721	84,410	85,099	80,129
RDT&E	35,958	35,639	33,065	31,671	31,514	33,257	33,236	32,024
MIL CON	5,476	6,047	6,403	5,770	6,245	6,277	4,881	6,070
FMLY HSNB	4,061	4,511	4,792	4,243	4,477	4,265	4,257	4,358
REV & MGT FNDS					461	694	503	272
TRUST, RECEIPTS, & OTHER								
TOTAL, CONSTANT \$	436,982	414,727	393,878	383,461	386,446	406,166	403,944	402,781

CURRENT DOLLARS	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87
MIL PERSONNEL	31,065	36,746	42,829	45,638	48,177	68,079	71,695	74,491
RETIRED PAY,DEF	11,920	13,724	14,940	15,954	16,503			
OPR & MAINT	46,612	55,248	62,014	66,760	70,429	77,647	76,338	80,316
PROCUREMENT	35,087	47,204	63,281	76,614	83,399	90,025	87,301	83,230
RDT&E	13,492	16,630	20,090	22,789	26,865	30,574	33,470	35,720
MIL CON	2,255	3,403	4,849	4,204	4,744	5,468	5,107	5,169
FMLY HSNB	1,552	2,069	2,317	2,624	2,630	2,826	2,732	3,132
REV & MGT FNDS		525	347	909	2,525	1,554	1,497	661
TRUST, RECEIPTS, & OTHER								
TOTAL, CURRENT \$	141,983	175,549	210,667	235,493	255,271	276,173	278,140	282,718

FY13 CONSTANT DOLLARS	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87
MIL PERSONNEL	119,197	123,090	125,236	127,472	128,582	164,354	166,803	168,801
RETIRED PAY,DEF	32,996	34,164	34,898	35,226	35,240			
OPR & MAINT	134,979	143,566	152,706	159,087	164,668	175,921	171,823	174,345
PROCUREMENT	81,637	101,013	127,151	146,804	154,504	161,798	152,139	140,268
RDT&E	32,029	36,343	41,661	45,427	51,700	57,044	60,810	62,862
MIL CON	5,089	7,201	9,839	8,340	9,099	10,129	9,205	8,962
FMLY HSNB	3,661	4,460	4,654	5,241	5,116	5,324	5,023	5,563
REV & MGT FNDS		1,159	712	1,795	4,800	2,857	2,677	1,151
TRUST, RECEIPTS, & OTHER								
TOTAL, CONSTANT \$	409,588	450,997	496,858	529,392	553,710	577,427	568,479	561,953

CURRENT DOLLARS	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95
MIL PERSONNEL	76,563	78,448	78,864	83,974	81,055	75,983	71,293	71,473
RETIRED PA Y.DEF								
OPR & MAINT	82,720	86,623	88,531	109,764	92,145	90,767	89,091	93,989
PROCUREMENT	82,101	79,412	79,709	71,416	61,919	53,621	43,761	43,084
RDT&E	36,878	37,306	35,793	34,714	37,879	37,677	34,508	34,422
MIL CON	5,461	5,680	5,158	5,496	4,988	3,905	6,477	5,874
FMLY HSNB	3,253	3,350	3,165	3,385	3,705	3,822	3,566	3,728
REV & MGT FNDS	830	722	137	1,871	3,504	3,881	2,643	1,645
TRUST, RECEIPTS, & OTHER								
TOTAL, CURRENT \$	287,806	291,540	291,356	310,620	285,195	269,655	251,339	254,215

FY 13 CONSTANT DOLLARS	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95
MIL PERSONNEL	166,891	165,586	163,814	165,411	155,943	139,914	128,130	125,332
RETIRED PA Y.DEF								
OPR & MAINT	173,254	173,822	171,765	192,298	161,408	163,313	156,171	160,105
PROCUREMENT	133,202	124,268	120,657	105,170	89,174	75,731	60,714	58,799
RDT&E	62,378	60,580	55,968	52,501	55,740	54,677	49,100	47,955
MIL CON	9,051	9,064	7,991	8,268	7,330	5,650	9,117	8,140
FMLY HSNB	5,562	5,513	5,018	5,137	5,481	5,529	5,049	5,198
REV & MGT FNDS	1,404	1,172	213	2,796	5,275	5,690	3,934	2,493
TRUST, RECEIPTS, & OTHER								
TOTAL, CONSTANT \$	551,743	540,004	525,426	531,581	480,350	450,504	412,214	408,020

CURRENT DOLLARS	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
MIL PERSONNEL	69,699	70,187	69,686	70,731	73,538	77,251	87,146	109,061
RETIRED PA Y.DEF								
OPR & MAINT	93,233	91,834	95,856	102,661	106,791	114,545	142,974	172,680
PROCUREMENT	43,432	43,149	44,884	50,770	55,502	62,930	63,342	79,571
RDT&E	35,115	36,481	37,184	38,104	38,753	41,748	48,623	58,307
MIL CON	7,358	6,003	5,469	5,148	5,404	5,280	6,745	6,592
FMLY HSNB	4,312	4,122	3,931	3,553	3,601	3,727	3,894	4,323
REV & MGT FNDS	1,903	2,411	2,114	1,764	3,369	1,579	2,570	2,488
TRUST, RECEIPTS, & OTHER							83	
TOTAL, CURRENT \$	255,052	254,186	259,123	272,729	286,958	307,060	355,378	433,024

FY 13 CONSTANT DOLLARS	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
MIL PERSONNEL	119,589	116,843	111,111	109,368	108,513	110,207	117,582	142,148
RETIRED PA Y.DEF								
OPR & MAINT	154,798	148,643	149,845	156,578	159,883	164,150	199,181	232,240
PROCUREMENT	58,438	57,418	59,095	65,946	71,016	79,344	78,578	96,668
RDT&E	47,962	49,115	49,446	50,084	49,988	52,975	60,811	71,573
MIL CON	10,017	8,092	7,297	6,764	6,990	6,722	8,404	8,011
FMLY HSNB	5,879	5,536	5,234	4,670	4,670	4,742	4,904	5,367
REV & MGT FNDS	2,785	3,393	2,950	2,285	4,298	1,981	3,193	3,050
TRUST, RECEIPTS, & OTHER							104	
TOTAL, CONSTANT \$	399,468	389,040	384,979	395,696	405,356	420,121	472,755	559,056

CURRENT DOLLARS	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
MIL PERSONNEL	115,549	121,311	126,665	130,287	139,776	145,183	152,997	153,628
RETIRED PAY,DEF								
OPR & MAINT	177,494	197,848	211,636	239,894	256,878	270,550	291,763	304,248
PROCUREMENT	83,161	98,549	105,315	134,384	164,684	134,837	135,889	131,472
RDT&E	64,367	69,296	72,691	77,589	79,448	80,651	80,655	76,135
MIL CON	6,505	7,305	9,826	14,373	22,423	26,743	23,379	17,036
FMLY HSNB	4,260	4,495	4,653	4,420	3,461	3,544	2,425	3,415
REV & MGT FNDS	4,716	3,671	5,485	2,850	5,386	4,354	4,683	3,157
TRUST, RECEIPTS, & OTHER				75				2
TOTAL, CURRENT \$	456,052	502,476	536,272	603,872	672,055	665,861	691,791	689,092

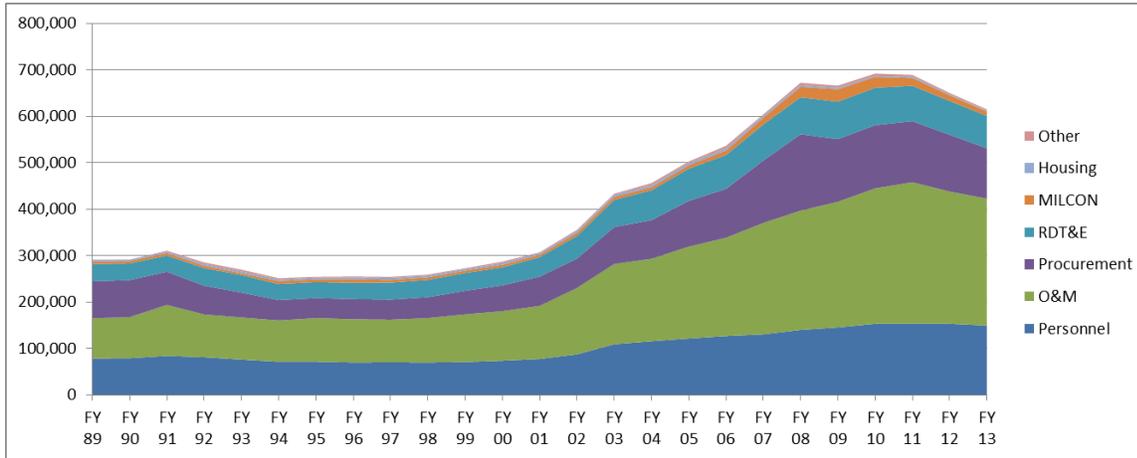
FY13 CONSTANT DOLLARS	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
MIL PERSONNEL	146,110	148,413	150,019	150,199	155,981	157,121	161,197	159,251
RETIRED PAY,DEF								
OPR & MAINT	230,006	240,709	248,651	273,492	281,481	295,196	309,238	314,921
PROCUREMENT	98,505	113,696	118,645	148,396	178,993	144,455	143,195	136,054
RDT&E	76,976	80,469	82,124	85,646	85,955	86,063	84,777	78,556
MIL CON	7,684	8,401	11,055	15,880	24,363	28,590	24,624	17,604
FMLY HSNB	5,153	5,229	5,271	4,911	3,757	3,786	2,568	3,537
REV & MGT FNDS	5,662	4,284	6,223	3,152	5,829	4,649	5,115	3,270
TRUST, RECEIPTS, & OTHER				83				2
TOTAL, CONSTANT \$	570,096	601,201	621,989	681,758	736,359	719,861	730,715	713,194

CURRENT DOLLARS	FY12	FY13	FY14	FY15	FY16	FY17
MIL PERSONNEL	153,112	149,172	136,350	138,376	140,978	143,983
RETIRED PAY,DEF						
OPR & MAINT	284,822	273,297	209,888	212,785	219,185	224,365
PROCUREMENT	122,208	108,511	104,265	112,273	116,339	122,857
RDT&E	72,837	69,653	69,782	69,172	66,827	65,807
MIL CON	12,184	9,572	10,245	11,021	9,350	7,991
FMLY HSNB	1,865	1,856	1,573	1,506	1,597	1,634
REV & MGT FNDS	3,075	2,628	1,428	772	1,615	686
TRUST, RECEIPTS, & OTHER						
TOTAL, CURRENT \$	650,102	614,688	533,531	545,905	555,891	567,323

FY13 CONSTANT DOLLARS	FY12	FY13	FY14	FY15	FY16	FY17
MIL PERSONNEL	155,916	149,172	133,964	134,509	135,133	135,658
RETIRED PAY,DEF						
OPR & MAINT	288,793	273,297	207,579	207,217	209,701	210,527
PROCUREMENT	124,300	108,511	102,464	108,382	110,320	114,439
RDT&E	73,943	69,653	68,630	66,930	63,587	61,539
MIL CON	12,388	9,572	10,065	10,644	8,876	7,456
FMLY HSNB	1,893	1,856	1,553	1,462	1,524	1,532
REV & MGT FNDS	3,127	2,628	1,404	745	1,532	640
TRUST, RECEIPTS, & OTHER						
TOTAL, CONSTANT \$	660,360	614,688	525,661	529,889	530,674	531,790

**Annex A1: Budget Trends (1989-2017) Based Upon FY 13 and Real Time
(Current Year) Appropriations**

**Figure 1: DoD Budget (by Total Obligation Authority) (1989-2017) –
Current Year \$ (Includes OCO)**



**Figure 2: DoD Budget (by Total Obligation Authority) (1989-2017) –
Constant FY 13 \$ (Includes OCO)**

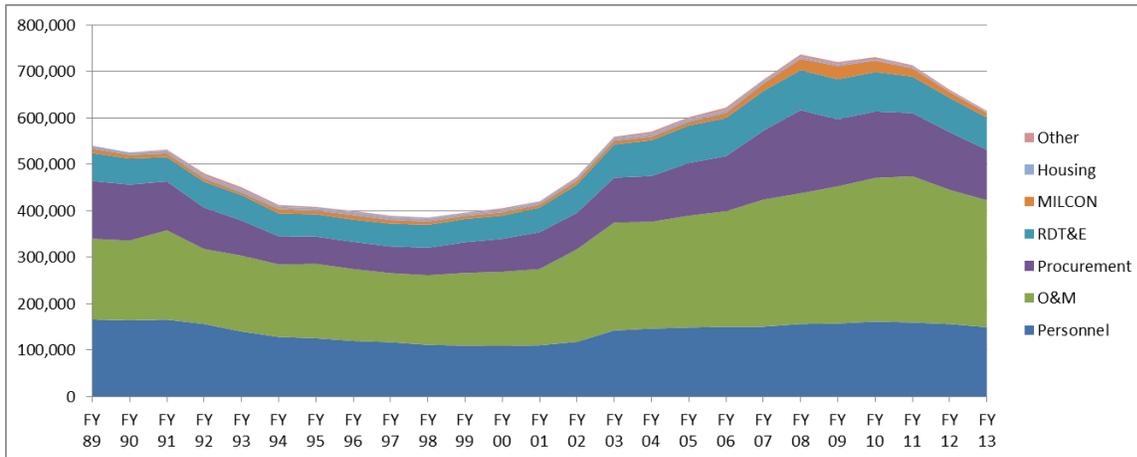


Figure 3: DoD Total Personnel Costs (1989-2017) in Current Year \$

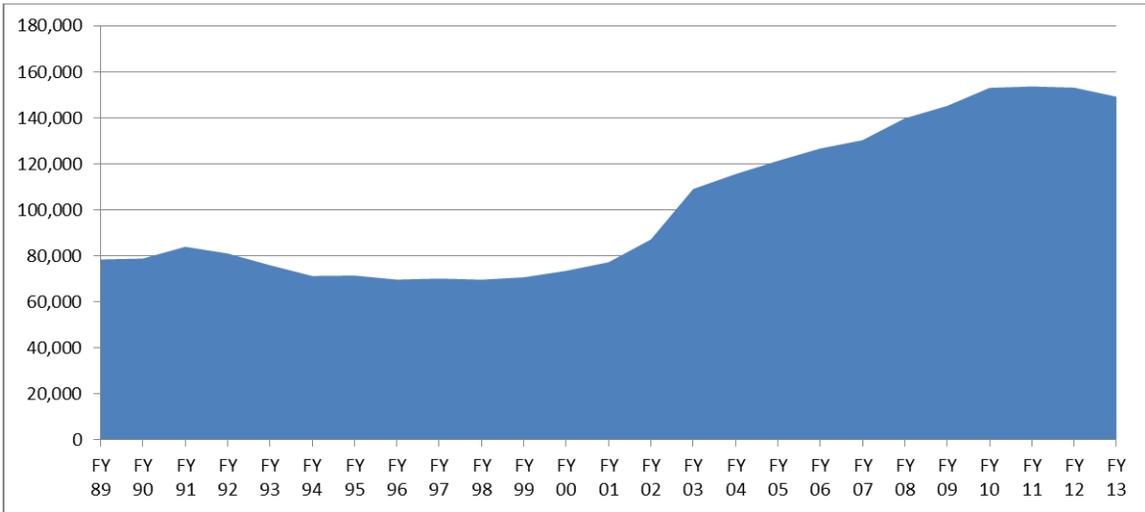
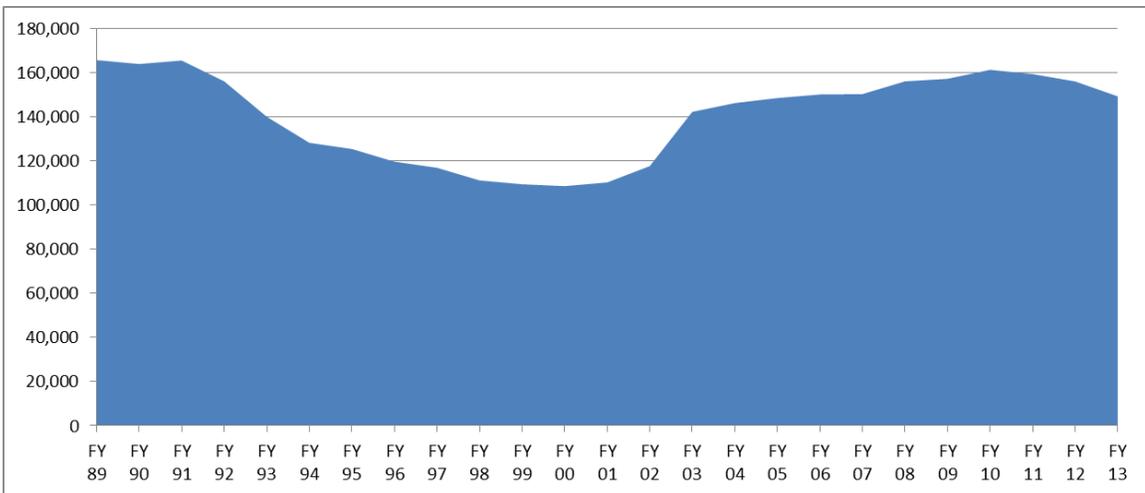


Figure 4: DoD Personnel Costs (1989-2017) in Constant FY 13 \$



Annex B: Active Duty Military Strength (1953-2016)¹

Fiscal Year	Army	Navy	Marine Corps	Air Force	Total Active Strength
<i>FY 53</i>	1,533,815	794,440	249,219	977,593	3,555,067
<i>FY 54</i>	1,384,983	711,107	221,818	961,671	3,279,579
<i>FY 55</i>	1,109,543	660,614	201,579	959,487	2,930,863
<i>FY 56</i>	1,005,558	676,928	201,459	911,515	2,795,460
<i>FY 57</i>	980,250	663,067	198,023	916,729	2,758,069
<i>FY 58</i>	900,440	643,452	188,885	865,238	2,598,015
<i>FY 59</i>	867,437	618,191	173,654	833,167	2,492,449
<i>FY 60</i>	877,749	624,895	175,919	813,474	2,492,037
<i>FY 61</i>	893,323	641,995	185,165	832,429	2,552,912
<i>FY 62</i>	962,712	662,837	192,049	870,092	2,687,690
<i>FY 63</i>	961,211	668,626	189,937	875,466	2,695,240
<i>FY 64</i>	972,546	670,160	189,634	857,801	2,690,141
<i>FY 65</i>	1,002,427	690,162	198,328	832,883	2,723,800
<i>FY 66</i>	1,310,144	740,646	280,641	897,778	3,229,209
<i>FY 67</i>	1,468,754	749,299	299,501	894,377	3,411,931
<i>FY 68</i>	1,516,973	759,163	308,138	905,314	3,489,588
<i>FY 69</i>	1,514,223	764,867	311,627	858,554	3,449,271
<i>FY 70</i>	1,293,276	677,152	246,153	767,287	2,983,868
<i>FY 71</i>	1,050,425	615,767	204,738	755,855	2,622,785
<i>FY 72</i>	849,924	593,135	199,624	713,718	2,356,301
<i>FY 73</i>	791,460	566,653	192,064	681,731	2,231,908
<i>FY 74</i>	784,128	546,464	192,174	634,254	2,157,023
<i>FY 75</i>	775,301	532,270	195,683	601,541	2,104,795
<i>FY 76</i>	782,668	527,781	189,851	583,281	2,083,581
<i>FY 77</i>	782,246	529,895	191,707	570,695	2,074,543
<i>FY 78</i>	771,624	530,253	190,815	569,712	2,062,404
<i>FY 79</i>	758,852	523,937	185,250	559,455	2,027,494
<i>FY 80</i>	777,036	527,352	188,469	557,969	2,050,826
<i>FY 81</i>	781,473	540,502	190,620	570,302	2,082,897
<i>FY 82</i>	780,391	552,996	192,380	582,845	2,108,612
<i>FY 83</i>	779,643	557,573	194,089	592,044	2,123,349
<i>FY 84</i>	780,180	564,638	196,214	597,125	2,138,157
<i>FY 85</i>	780,787	570,705	198,025	601,515	2,151,032

¹ U.S. Department of Defense, Statistical Information Analysis Division, *Quarterly Report on Active Duty Military by Service*, Washington DC. <http://siadapp.dmdc.osd.mil/personnel/MILITARY/miltop.htm> (accessed 30 Jul 2013).

Fiscal Year	Army	Navy	Marine Corps	Air Force	Total Active Strength
<i>FY 86</i>	780,980	581,119	198,814	608,199	2,169,112
<i>FY 87</i>	780,815	586,842	199,525	607,035	2,174,217
<i>FY 88</i>	771,847	592,570	197,350	576,446	2,138,213
<i>FY 89</i>	769,741	592,652	196,956	570,880	2,130,229
<i>FY 90</i>	732,403	581,856	196,652	535,233	2,046,144
<i>FY 91</i>	710,821	570,966	194,040	510,432	1,986,259
<i>FY 92</i>	610,450	541,883	184,529	470,315	1,807,177
<i>FY 93</i>	572,423	509,950	178,379	444,351	1,705,103
<i>FY 94</i>	541,343	468,662	174,158	426,327	1,610,490
<i>FY 95</i>	508,559	434,617	174,639	400,409	1,518,224
<i>FY 96</i>	491,103	416,735	174,883	389,001	1,471,722
<i>FY 97</i>	491,707	395,564	173,906	377,385	1,438,562
<i>FY 98</i>	483,880	382,338	173,142	367,470	1,406,830
<i>FY 99</i>	479,426	373,046	172,641	360,590	1,385,703
<i>FY 00</i>	482,170	373,193	173,321	355,654	1,384,338
<i>FY 01</i>	480,801	377,810	172,934	353,751	1,385,296
<i>FY 02</i>	486,542	383,108	173,733	368,251	1,411,634
<i>FY 03</i>	499,301	382,235	177,779	375,062	1,434,377
<i>FY 04</i>	499,543	373,197	177,480	376,616	1,426,836
<i>FY 05</i>	492,728	362,941	180,029	353,696	1,389,394
<i>FY 06</i>	505,402	350,197	180,416	348,953	1,384,968
<i>FY 07</i>	522,017	337,547	186,492	333,495	1,379,551
<i>FY 08</i>	543,645	332,228	198,505	327,379	1,401,757
<i>FY 09</i>	553,044	329,304	202,786	333,408	1,418,542
<i>FY 10</i>	566,045	328,303	202,441	334,196	1,430,985
<i>FY 11</i>	565,463	325,123	201,157	333,370	1,425,113
<i>FY 12</i>	546,057	314,339	198,820	328,812	1,388,028
<i>FY 13</i>	541,291	317,237	195,338	333,772	1,387,638
<i>FY 14</i>	520,000	315,000	190,000	330,000	1,355,000
<i>FY 15</i>	500,000	312,000	185,000	328,000	1,325,000
<i>FY 16</i>	480,000	310,000	182,100	327,672	1,299,772

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Vita

Colonel Michael J. Simmering most recently served as the G3 Operations Officer for the 4th Infantry Division at Fort Carson, Colorado. A 1989 graduate from South Webster High School, South Webster, Ohio and commissioned as an Armor officer in 1993 from the United States Military Academy at West Point, New York, Colonel Simmering holds a bachelor's degree in Engineering Management. He has served as a Platoon leader, Company executive officer, Company commander, Battalion staff trainer, Battalion Operations Officer, Regimental Operations Officer, and Regimental Executive Officer, and Battalion Commander in Cavalry, Armor, and Combined Arms formations throughout the Army. His experiences overseas include two tours in Iraq and one tour in Afghanistan as well as experiences in Germany, Bosnia, Kosovo, and South Korea. In addition to the military academy, Colonel Simmering's military education includes Armor Officer Basic Course, Scout Platoon Leader Course, Armor Officer Advanced Course, and Command and General Staff College. He also holds a Master's degree in Adult and Continuing Education from Kansas State University.