Re-Architecting the DoD Acquisition Process:
A Transition to the Information Age

by

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ABSTRACT

The military is the midst of significant change, due to the DoD transformation guidance and movement to Network-Centric Warfare/Operations. Unfortunately, both the guidance given, roadmaps produced and the level of espoused support for the transformation have caused fundamental change to occur slowly and at increasing expense. The military material development process was designed around a platform-centric system and worked well, but now the information age is causing a move to network-centric systems. This fundamental shift is not aligned with the DoD development process and reform will require broad changes in both organization and policy. This paper reviews the NCW Transformation goal, the DoD transformation guidance and compares them to the Transformation Roadmaps of the Army, Navy and Air Force. These guidance documents are then compared with actual transformation changes and the associated factors effecting the change, using J. Forrester type system dynamics models. The systems dynamics analysis studies numerous transformation factors for their effects and yields recommended alternative development architecture.

The goal of the paper is to align the DoD development process with the transformation guidance goals to result in a process which speeds prototype testing, development and fielding of new military systems, while integrating state-of-the-art business practice and theory. This resulted in the creation of several models which describe the various acquisition systems and a new model which addresses the issues found in the other models. The new model represents a reconfigured architecture for the DoD acquisitions system and a new organization to implement the transformation.

BIOGRAPHICAL NOTE

Kevin Brown was a Captain as a combat engineer in the Army for eight years. He completed his last tour in Baghdad, spending 16 months (May 2003 – August 2004) rebuilding the infrastructure of the city.

Kevin Brown most recently served as Headquarters and Headquarters Detachment, Engineer Brigade Detachment Commander, Alpha Company Commander 40th Engineer Battalion and the Deputy Assistant Division Engineer for the 1st Armored Division Engineer Brigade. Previously he has served as a Platoon Leader with the 44th Engineer Battalion, Korea. As the Assault and Obstacle Platoon Leader and S-1(Personnel Officer/Adjutant) with the 65th Engineer Battalion (Light), Schofield Barracks, Hawaii. He also served as the Aide-de-Camp for the Pacific Ocean Division Commander, Corps of Engineers, Fort Shafter, Hawaii.

Kevin Brown is a graduate of the Engineer Captain Career Course, the Combined Arms and Services Staff School, Nuclear Biological and Chemical Weapons Training and the Engineer Officer Basic Course. His awards and decorations include the Bronze Star for actions in Iraq, Meritorious Service Medal, Army Commendation Medal with one Oak Leaf Cluster, the Army Achievement Medal with two Oak Leaf Clusters, the Airborne Badge, the Air Assault Badge, the Ranger Tab, and the Pearl Harbor Naval Scuba School Badge.

Kevin Brown graduated in 1996 from Embry-Riddle Aeronautical University with a minor in Math and a Bachelors of Science degree in Aerospace Engineering. He also holds a Masters degree in Engineering Management from the University of Missouri-Rolla and this work completes the requirements for his Masters of Science in Engineering and Management from the Systems Design and Management Program at Massachusetts Institute of Technology.

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work. I am very grateful for all the support they provided and the numerous side conversations held with my other classmates during the course of the year.

I wish to thank Cindy Ash who provided endless input and served as a sounding board on many of the ideas and mechanics used in the research. Her assistance and advice proved indispensable. Finally, I am grateful for my loving wife, Maja, who not only endured a grueling year of work but supported me through the entire program.

Boston, Massachusetts   Kevin M. Brown

January 10, 2006

LIST OF FIGURES

PART I - Problem Statement / Background / Literacy Review

Chapter 1: Introduction

My career with the military has given me ample opportunity to look at the acquisition products of the military and to critically evaluate them in actual use. After my recent tour in Iraq, working with combat engineers, infantry, tankers, aviators and many other specialties in the Army, I found my concerns with the acquisition system were not unique. My personal military experience has offered me the chance to work with all the other branches and to understand, better than most, the intricate underlying cultures of those organizations. That experience, coupled with my desire to understand systems and work within them, has led me to the study of system dynamics. Though the subject will be explained in greater detail in the thesis, the ability to notice patterns in both military and in nature has revealed many important insights to scientists and leaders alike. I expect the same to occur during the course of this thesis.

Upon the completion of my tour in Iraq, I embarked on a private quest to understand how the transformation[1] of the Department of Defense (DoD) works and how it will look in the future. This led me to study Network-Centric Warfare (NCW) Theory, Effects Based Operations (Davis)(Smith), as well as other emerging theories on war, and compare them to past theories and the basic acquisition system. The result was a startling revelation that our military acquisition system may not be able to produce the desired transformation the leaders of the military are ordering to occur. This thesis is one look at the process, from the perspective of a former soldier, leader and engineer.

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[1] In the April 2003 *Transformation Planning Guidance (TPG),* Secretary of Defense Rumsfeld identifies transformation as: A process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people, and organizations that exploit our nation's advantages and protect against our asymmetric vulnerabilities to sustain our strategic position, which helps underpin peace and stability in the world.

Section 1.1.1 - Define Concern/Question

The thesis is concerned with the nation's ability to rise and meet future world threats, and its ability to adjust quickly enough to handle them. The thesis is also concerned that the military will not be able to transform enough to achieve the goals and capabilities NCW Theory proposes as possible. The Office of Force Transformation provides high level visions of where the force should go, but it fails to provide a map on how to get there. This thesis looks at what is necessary to transform the military from a platform-centric industrial-age institution to this new agile organization operating efficiently as a self-synchronizing war machine.

Through the study of historical evolutions and transformations, this thesis will look to establish patterns which would help identify the course for the future. A fundamental question to be addressed in the thesis is the difference between evolution, reform and transformation. History is full of examples of continuous evolution, but true transformations are major events in history. We will look to identify indicators of transformation and what is required to achieve it in this thesis.

Section 1.2 - Define Scope/Goal

The goal of the thesis is to architect a system which will ensure the transformation of the military for dominance in the Information Age. The scope of the problem is based upon the needs of the architectural changes required. Other theses carefully scope out the problem to ensure self-contained solutions to their questions. As the defense system is studied to produce the required transformation, whatever change in scope is necessary will be explored.

The initial scope was to look at the transformation roadmaps of the Department of Defense and the three branches. This is in itself a very large scope since it entails all aspects of each of the military branches and the operations at the Joint Forces level. But if the regulations and national laws need to be changed to facilitate the fundamental transformation (as required by the Department of Defense) then such change is also inside the scope of the thesis.

The outer bounds of the thesis are systems which operate in and around the systems studied here. Personal management systems, facility management, educational systems and others that are periphery systems are considered but are essentially follow-along-systems. In other words, if the fundamental transformational changes are made to the primary systems, then those other systems will fall in line. The smaller follow-along-systems will not be discussed but the have been considered during the study of the major systems.

The final bounds of the thesis include the military acquisition system, national intelligence agencies, joint forces commands, defense industry partners and the functions of the national government. All of those large systems have major effects on the transformation of the Department of Defense. Therefore, they are included in the scope of the thesis, though the resolution on each of those systems is minimal to simplify modeling.

Section 1.3 - The Process of Architecting NCW

Network-Centric Warfare (NCW) theory proposes significant military advantage through novel applications of digital technology providing situational awareness and self-synchronizing actions. To achieve the awareness required to achieve self-synchronization NCW must have a high degree of inter-connectedness between military units, leaders and other information. NCW capabilities are thus an emergent property an organization displays when it has complete situational awareness and clear objectives. Chapter 2 provides detailed explanations of the primary concepts of NCW and its purpose. After studying Network-Centric Warfare Theory and fully understanding all the inter-connectedness it requires, it became apparent that the theory itself requires an appropriate organization to exist prior to the emergence of NCW capabilities.

A fundamental difference exists between understanding how a network works and the theories behind NCW. The problem is most people (Moray 164-169) do not see the subtle but important differences and worse yet they think that just connecting something with another something produces NCW Effects.

Moreover, some people (Fayette) have advocated the position that Effects-Based Operations (EBO) is more important than NCW. Effects-Based Operations essentially is decision making based on effects of the action[2]. This is fundamentally different than NCW which builds the architecture to allow military elements on the scene to make decisions supporting the leaders' intent. EBO is focused on the exact effects and directs specific actions to that end. The two theories are philosophically different and a cursory understanding of them does not give either theory its just merits.

Therefore a fundamental understanding of NCW is critical, because the emergence of that theory integrated with today's new technology and new threats is what constitutes a fundamental transformation. This thesis works to illustrate that the concepts, principles and theory behind NCW, when appropriately employed with fundamentally different tactics, will produce this military transformation. The process of understanding the theory, looking at the threat, understanding the current system and building an acquisition process that supports all of those issues *is* the process of architecting NCW.

NCW Theory requires a cultural change in each of the branches. It also requires a new culture between each of the branches, and it requires the DoD to employ the branches with those cultures aligned. This process has been started with the Joint Forces Command and the Joint Chiefs but there are still very strong rivalries between those branches and leadership which fundamentally limits the application of NCW Theory and its benefits. (Franks, 207, 274-278) This rivalry increases the scope of the thesis since it will require congressional action to enforce changes at higher levels. That is also part of the process of architecting NCW into the DoD.

In summary, it is not the purpose of this thesis to question the ideal of NCW and the benefits it brings; there are numerous examples of the great advantages NCW theory will bring to the DoD, which are presented in Chapter 2. The problem is how to institute such massive change in the

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[2] http://www.afrlhorizons.com/Briefs/June01/IF00015.html - States that: EBO consists of a set of processes, supported by tools and accomplished by people in organizational settings, that focuses on planning, executing, and assessing military activities for the effects produced rather than merely attacking targets or simply dealing with objectives.

government which normally will not happen unless a catastrophe befalls the country; even then it may not happen. (Kean, et al) Regardless, that is the purpose behind looking at how to architect NCW Theory into the DoD.

Section 1.4 - Project Description/Method

The thesis will look at the DoD Transformation Planning Guidance (TPG) and compare that to the responses each of the branches provided, as directed by the DoD TPG. Careful review using system architectural framework analysis and by building system dynamics models will help illuminate good alignments or weaknesses between the plans and the guidance given. The project will then take those dynamics models and analyze them for waste, competition and other issues involved in limiting the transformation process.

By studying the dynamics models and understanding NCW Theory and the transformation goals, a new model will be proposed that best integrates all the needs of the various branches and the DoD as a whole as they are described in the course or the research presented here. In addition if there are other issues, such as the management of the Defense Industry, that arise in the process; those issues will be taken into consideration. The first two parts of the thesis will describe the background information required to be understood prior to any new transformation architecture recommendations. It will be through the process of understanding the issues currently at hand which will allow the Part III recommendations to support the proposed new acquisition architecture. This new model will implement solutions to the issues identified in Part I and Part II and then connect those solutions together to develop the new acquisition architecture.

After the new dynamics model is built to address the operational flow of resources, money or support, the new model, further refined based on procedural requirements and oversight could then be discussed. This new model is not intended to provide a final perfect solution, but rather is a starting point for further refinement and development. Again, the thesis was conceived with an unbounded scope to allow freedom of concept development, uninhibited by politics and to

allow the introduction of new ideas or concepts which could better support the transformation of the DoD to the Information Age.

The new model will work to integrate all the issues associated with the transformation and offer a new possible solution to the question of transformation. But of course one can not look forward clearly until they have studied the past.

Chapter 2 - NCW Concept A Revolution in Military Affairs

There are numerous books and papers written on the Network-Centric Warfare (NCW) concepts and how to best employ them in modern war. In this chapter I will briefly introduce the most important aspects of NCW as it effects or drives the transformation of the Department of Defense. It is important to understand that this new thought process is driving the transformation goals of the military and it effects or touches on all aspects of the transformation programs[3]. This transformation is also a critical time in military warfare since it represents another epic change in war. In each epoch change inevitability causes friction amongst the leaders and shapers of the establishment, but worst of all it is a competency-destroying activity. This results in having many high level leaders worry about the security of their areas of responsibility and often times resist such changes. As a result, this transformation has been compared with the transformational impact of the French concept of the *levee en masse* during the Napoleonic period. Thus begins the struggle to transform the U.S. Military to the Information Age.

Section 2.1 - New Face of War – Future Missions

It is important to understand why this transformation is taking place and the very important reasons why it must take place. Of course, before I can talk about the future it is important to look at the past. Sun Tzu and Carl Von Clausewitz are two of the leading figures in military theory[4]. Today their theories and tenets are still valid but modern technology is causing a modification or adaptation from those theories. Throughout the modern age, there have been two dominant theories of war: attrition and maneuver. Previously, *attrition*, the ability to mass forces, proved the dominant method for waging war generally successfully. This was followed by

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[3] The transformation goals and programs are explained in chapter 3 and it is the application of NCW Theory on those goals which is causing the major transformation to occur.

[4] *The Art of War* by Sun Tzu and *On War* by Carl von Clausewitz are widely regarded as classic theoretical works on war. Other well known theorists on war include Niccolo Machiavelli, Baron Antoine-Henri Jomini, Mao Tse-tung, and Alfred Theyer Mahan.

maneuver[5], which was exemplified by the Germans' blitzkrieg tactic, although it predates it. This change in tactics required an adaptation of equipment, techniques and procedures used in war. The result was a fundamental transformation in how war was waged.

Today, the introduction of GPS and over-the-horizon precision guidance has introduced tools and weapons which are capable of taking advantage of information systems. With satellite communication, lower costs and ruggedized electronics, the individual component technologies have developed to the point where massive high scale integration will produce a fundamental power shift in war. The ability to see over the horizon, and "know" the situation much sooner, better allows the decision maker a greater number of choices. These choices, when taken in aggregate, to meet a common goal, are likely to provide the next fundamental shift in warfare from maneuver to information warfare. NCW is the organized integration of those elements, when applied, will produce the transformation being described.

NCW is a very valid and highly explored concept which is very nearly fully developed. There are numerous case studies to show the effects of NCW tenets in training, and in combat. Many of those cases argue that NCW tenets will provide the advantage a military force will need to counter future world threats. In the *Joint Operational Environment Draft, 11 January 2005*, the United States Joint Forces Command, points out threats of tomorrow are unlikely to fight a conventional war against the United States. Our direct military might has caused a shift in tactics of enemy forces. Put most simply, the enemy will not present himself for combat but will attempt operations other than war and work to hide from our forces as much as possible. This requires U.S. forces to find and destroy numerous small yet still politically potent enemy forces while limiting collateral damage. These force the military to provide direct coverage of larger geographical area while still maintaining rapid response with all the necessary warfighting components. This shift in the nature of the threat is the motivation for NCW, a highly integrated

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[5] A **maneuver** (spelled **manoeuvre** in Commonwealth English) is a tactical or strategical move or action. The term can be used in a general sense for games or business although its origin is military. In the military sense, a maneuver can also be a large, real-life combat simulation involving many different units. Another type of maneuver refers to a set of movements designed to perform a specific function, for example a u-turn or aerobatic maneuvers. Source http://en.wikipedia.org/wiki/Maneuver.

method of connecting reconnaissance assets (spotters) with combat units (shooters) and integrating them with all the necessary support assets (supporters). And at the same time, NCW seeks to reduce decision-making times and allowing geographically close combat units to self-synchronize for maximum efficiency of operations. The future war will be a complex blend of communications, digital integration, and command and control integration. The DoD's goal now is how to integrate the advantages of NCW as espoused into the DoD transformation plan.

Section 2.2 - NCW Background

Network-Centric Warfare (NCW) is an emerging theory of war in the Information Age. It is also a concept that, at the highest level, constitutes the military's response to the information age[6]. The term network-centric warfare broadly describes the combination of strategies, emerging tactics, techniques, procedures, and organizations that a fully or even a partially networked force can employ to create a decisive warfighting advantage[7].

The NCW warfighting advantage is produced by the following:

- NCW is an information superiority-enabled concept of operations that describes the way U.S. forces organize and fight in the information age.

- NCW generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, high tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization.

- NCW translates information superiority into combat power by effectively linking friendly forces within the battlespace, providing a much improved shared awareness of the situation, and enabling more rapid, effective decision making.

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[6] Vice Admiral (Ret.) Arthur K. Cebrowski, Director, Office of Force Transformation, interview with Frank Swofford, Defense AT&L, March-April 2003.
[7] John J. Garstka, "Network-Centric Warfare Offers Warfigting Advantage," Signal, May 2003.

The benefits of NCW are summarized in Figure 2-1 NCW Advantages, provided by the Office of Force Transformation (OFT) in its NCW pamphlet.

Figure 2-1 NCW Advantages (Network-Centric Warfare 3)

When these attributes are integrated, the military advantage of such a system should be significant. To further emphasize the importance of NCW transformation, the President and the Secretary of Defense have stated that it supports four major defense policy goals: assuring allies and friends; dissuading future military competition; deterring threats and coercion against U.S. interests and if deterrence fails, decisively defeating any adversary[8].

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[8] *The Implementation of Network-Centric Warfare*, Office of Force Transformation, January 2005.

A critical component in the development of NCW theory and its ability to be realized is based on of Metcalfe's Law[9], which states that as the numbers of nodes in the system grow linearly the value of the network grows exponentially. This fundamental law is what produces the benefits of NCW theory. Thus the above warfighting advantage is dependant primarily on the number of nodes in the system and their interconnectedness. In Figure 2-2 Platform vs. NCW Node Count, a direct comparison of the generally conventional platform-centric system is compared to a NCW node value creating configuration. Figure 2-3 Metcalfe's Law, illustrates Metcalfe's Law in more detail with two graphs.
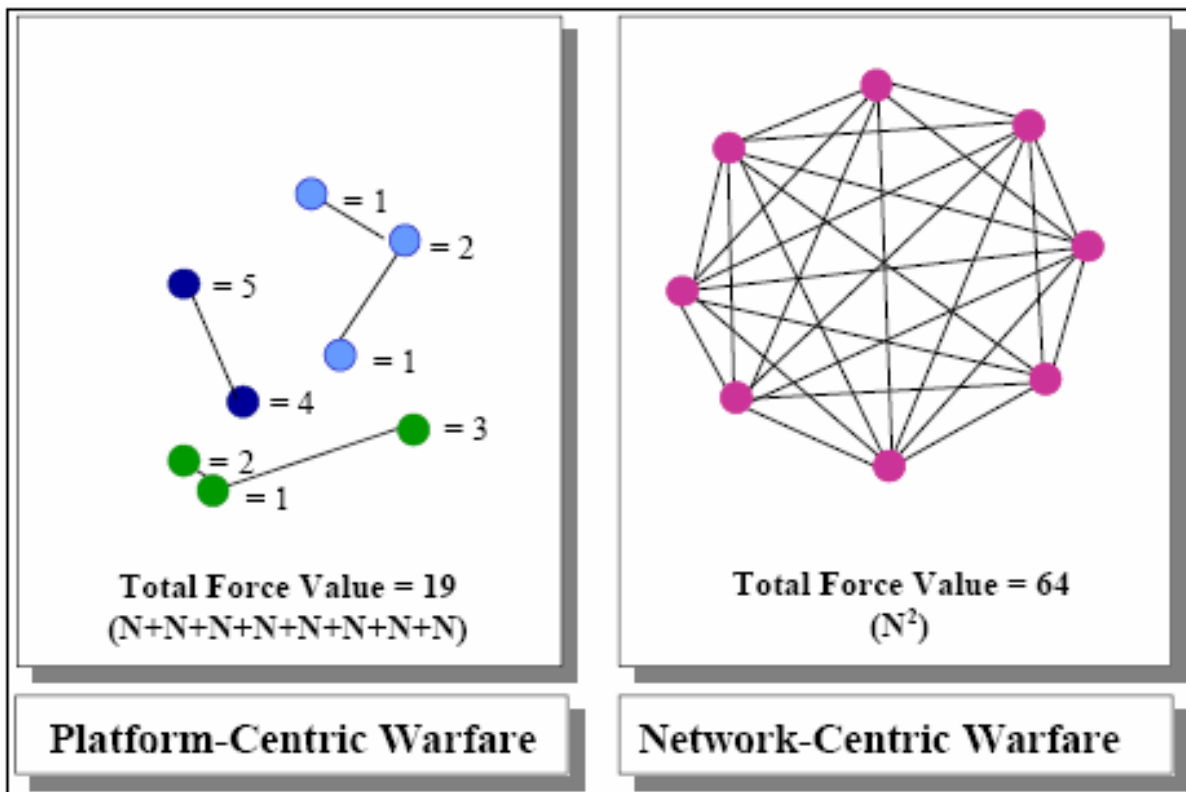
Figure 2-2 Platform vs. NCW Node Count (Booz 1-1)

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[9] George Gilder's Telecosm: Metcalfe's Law and Legacy, Forbes ASAP 152, Supplement (September 1993) pages 158-166.

Non-linear relationship:
power is proportional to N^2

Linear relationship: power is proportional to n

POWER

1 2 3 4 5 6 7 8 9 10
NODES
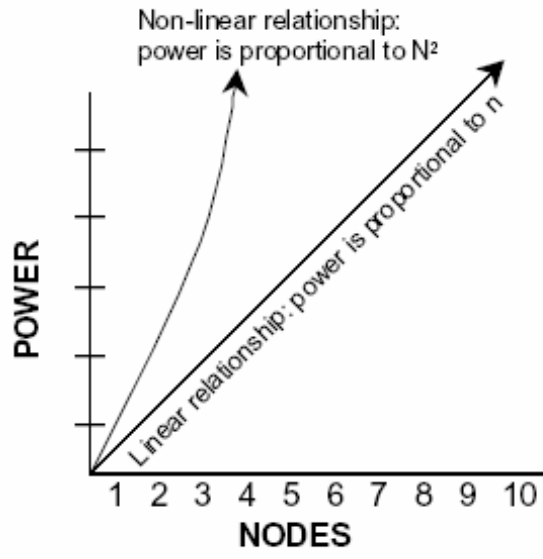
Each node in a network of "N" nodes is capable of initiating "N-1" interactions

Total number of potential interactions between nodes in the network
is:
$N \cdot (N-1)$ or N^2-N

Node 1

Node 2

Node 3
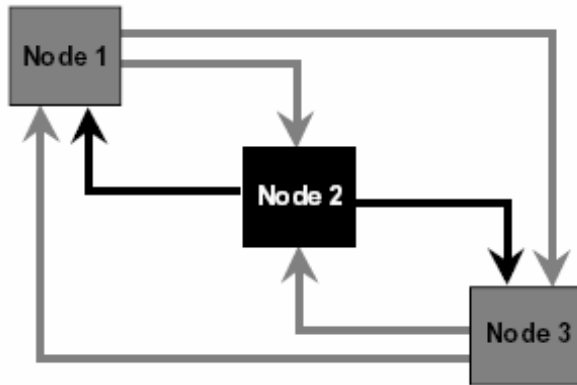
Network with N=3 has

$3 \cdot 2=6$ Potential Information Interactions

Figure 2-3 Metcalfe's Law (Alberts 33)

The change of focus on the dimensions of war is a standard progression caused by technology changes over time. As mentioned in Section 2-1, the movement of war strategy from attrition, to maneuver, and platform-centric warfare was directly linked to the most advanced technology at the time. Attrition warfare achieves victory by eroding the enemy's strength with superior mass

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and killing power and annihilating them through complete destruction and occupation[10]. This method of war was based on the advancement in command and control and learning the importance of focusing effort. Maneuver warfare was the migration from having mass of force to moving those forces around in an effective method based on geography, time and other factors. The use of cavalry or chariots started this shift, but it was the German Blitzkrieg and the introduction of massive mechanized forces that fundamentally changed the way war was waged. The post-industrial age saw advancements in tank and other mechanized technology on a massive scale, which produced the transition to platform-centric warfare after World War II. Examples of this are individual weapon platforms that are positioned and coordinated to have the desired effects. The focus on the use of battleships, aircraft carriers, strategic nuclear submarines, tanks and long range rocket systems changed the face of war from maneuver to geographic range overlays of various weapons platforms. The Network-Centric Warfare model takes those weapons and places them on the edge of the net and distances the decision makers from the shooters but allows instantaneous situational awareness for the commanders. This shift is based on new digital technology created by over-the-horizon communication and data links. This method relies heavily on information gathering, self-synchronization and integration of the effects of previously un-integratable weapons platforms. Figure 2-4 Evolution of Warfare, shows the transition between the war methods.

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[10] *Measuring the Effects of Network Centric Warfare*, Information Assurance Technology Analysis Center, Falls Church, VA, page 21.
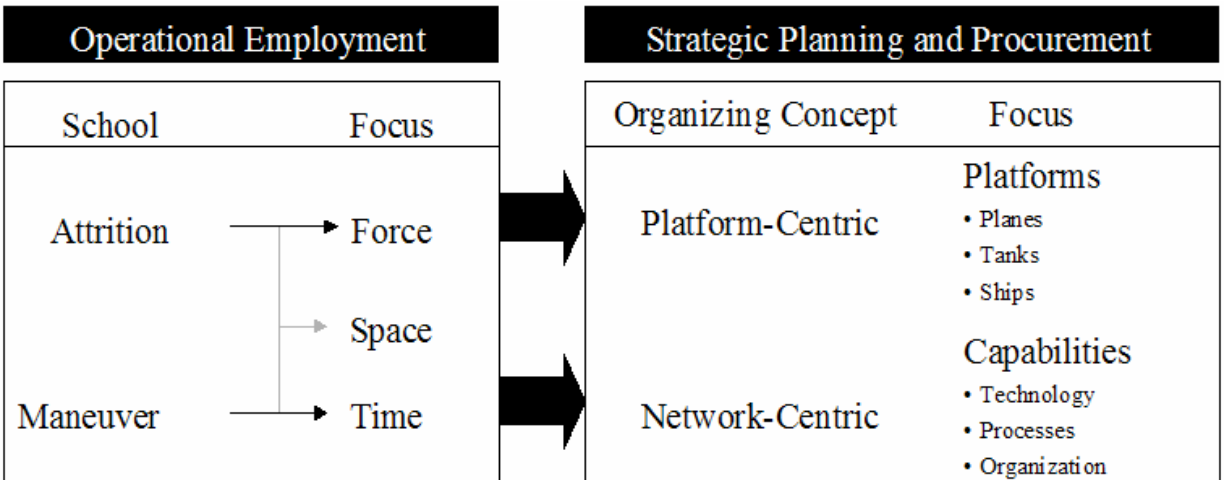
Figure 2-4 Evolution of Warfare (Hasselinger 23)

Section 2.3 - NCW Tenets and Principles

Network-Centric Warfare is composed of four basic tenets and nine principles. The tenets and principles comprise the core of the emerging theory of war in the information age[11]. The tenets are defined below:

- A robustly networked force improves information sharing

- Information sharing enhances the quality of information and shared situational awareness

- Shared situational awareness enables collaboration and self-synchronization, and enhances sustainability and speed of command

- The sum of these, in turn, dramatically increases mission effectiveness[12]

It is important to note that the tenets and principles of NCW do not replace the time-tested principles of war such as, mass, objective, security, maneuver, unity of command, simplicity and surprise. These should be considered additive properties of future war in which their successful employment will significantly increase the effectiveness of the conventional principles in the information age.

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[11] *The Implementation of Network-Centric Warfare*, Office of Force Transformation, January 2005, page 7.
[12] These four basic tenets of NCW were initially set forth in *Network-Centric Warfare: Department of Defense Report to Congress,* 27 July 2001.

Governing Principles

- Fight first for *information superiority*
- Access to information: *shared awareness*
- *Speed of command* and decision making
- *Self-synchronization*
- *Dispersed forces:* non-contiguous operations
- *Demassification*
- *Deep sensor reach*
- *Alter initial conditions* at higher rates of change
- *Compressed operations* and levels of war

Figure 2-5 NCW Principles (Implementation 4)

The principles are summarized in Figure 2-5 NCW Principles, with expanded description which will be important in future analysis of the NCW implementation plans.

1. Information superiority is to be achieved by understanding what the enemy is doing and how our friendly forces are postured, and by economizing the data transmission requirements by effectively utilizing all currently deployed sensor assets.

2. Shared awareness is critical since it is the primary means for building the self-synchronization benefits from the NCW theory. This is achieved by having highly interconnected systems between all the warfighters and ensuring that all sensors and data are posted to the net without delay.

3. Speed of command and decision making is to be realized by the availability of timely, accurate and refined data that allows commanders to understand the situation and make decisions which support their commander's intent. This reduces the amount of

permission gathering activities and fratricide prevention tasks which speeds response times for targets of opportunity.

4. Self-synchronization allows the low-level forces to rapidly assess a situation and act in accordance with the commander's intent more quickly. This principle capitalizes on our professional soldiers and empowers soldier initiative that has always been a source of U.S. military competitive advantage.

5. Dispersed forces allow the over-the-horizon intelligence gathering and virtual presence while still allowing synchronization of fires over greater distances. This helps ensure more efficient use of shooters in the battle space since, because they have a greater range of and responsibility for fires.

6. Demassification is moving away from massing forces geographically to massing effects locally. This means that geographic location of shooters or spotters can be more dispersed but still achieve the same effects on the target. An additional side benefit is the lack of target rich locations for the enemy to engage, thus better protection for our forces.

7. Deep sensor reach is a critical component of the NCW theory and is becoming more dependent upon duration of surveillance over increasing the quality of surveillance. Based on anti-IED operations in the Middle-East persistent surveillance is becoming a more critical aspect of this principle than just deep sensor reach.

8. Alter initial conditions at higher rates of change is critical since the warfighting axiom that no plan survives first contact is still valid. The ability for commanders to quickly read the situation and make changes to the plan quicker than the enemy can react to the plan is of critical advantage. This ability depends upon commanders being able to rapidly develop the battle situation and react.

9. Compressed operations and levels of war, as alluded to in the earlier principles, gives the low-level soldiers more ability to read, understand and react to the changing battle space. This removes or reduces the need for authority granting activities and helps speed the flexibility and effectiveness of units.

These tenets and principles summarize the change of focus in the domain space of war from previous eras. The dimensions of war have classically been described as time, space and force. I

will discuss the evolution of the dimensions of war in more detail in Section 2.5, but it is important to note here that the key tenets directly affect all three of the dimensions of war. But the single most important change in the dimensions is the effect of time. "The principle utility of information superiority is time – the immense advantage of being able to develop very high rates of change."[13] A concise graphic if this change in dimensional focus is presented in Figure 2-6 Dimensions of War.
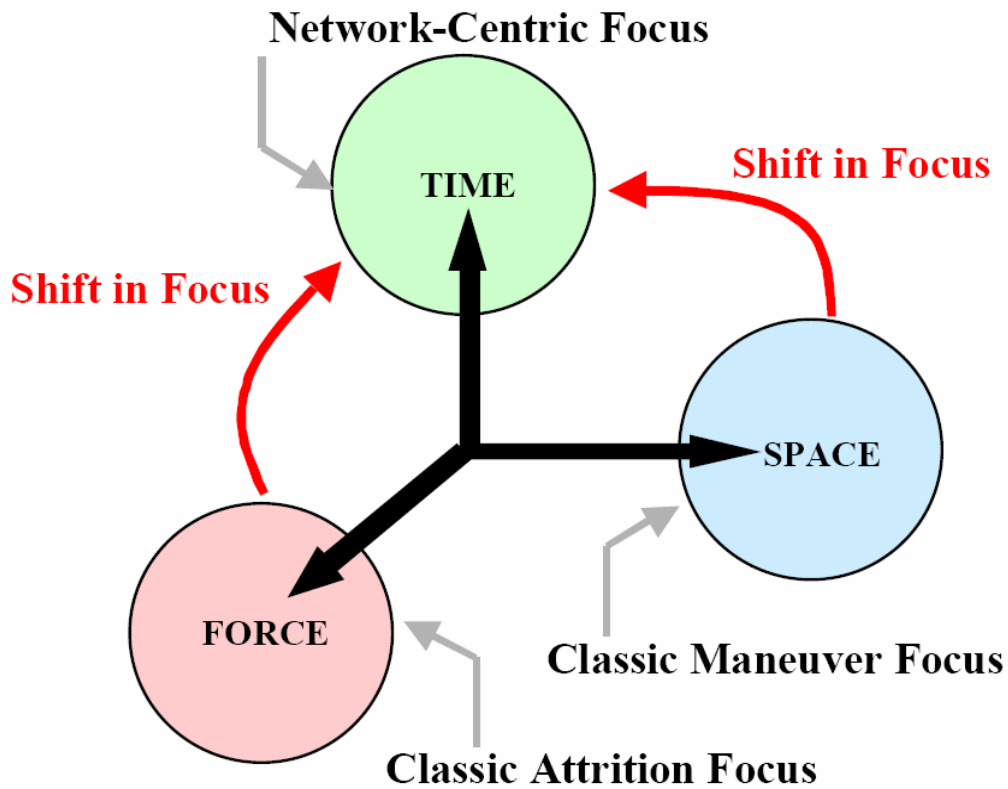
Figure 2-6 Dimensions of War (Booz 3-2)

The tenets and principles of NCW are presented in this section to understand how NCW is theoretically constructed. The benefits and application of the NCW tenets and principles are more easily understood when considered in the context of mission accomplishment. Figure 2-7 Military as a Network-Centric Enterprise, shows the how all the tenets and principles interact with the Command and Control (C^2) to produce the benefits. The whole theory of NCW is based

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[13] VADM Arthur K. Cebrowski, "Sea Change," Surface Warfare, November/December 1997, page 4.

in the amount of interconnectedness which occurs in the organization. The interconnectedness is then interpreted into values and benefits, both of which are not directly measured by any one metric. This fact makes it hard to quantifiably measure the benefits of NCW but numerous experiments are proving that the theory is holding up to the test. I will discuss the verification process in much greater detail in the Section 2.4.
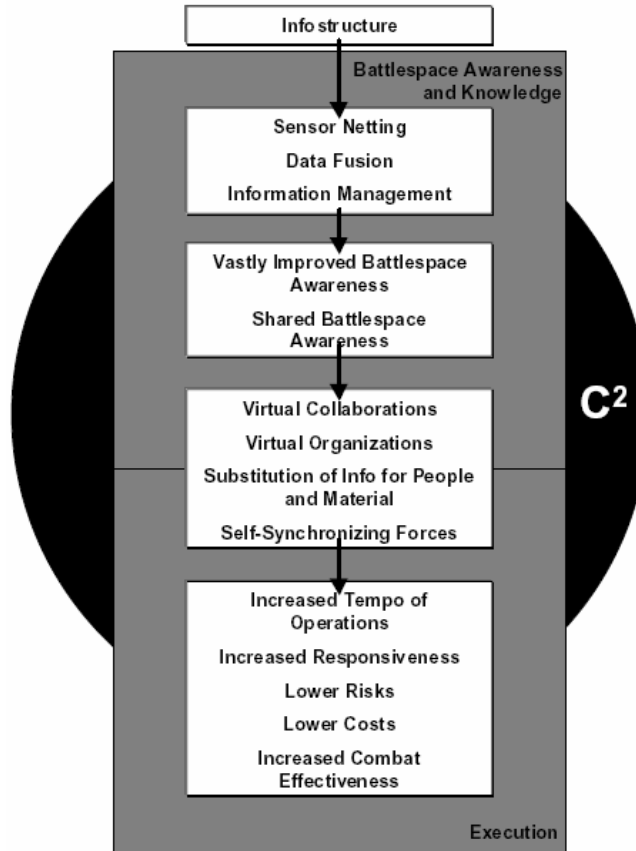
Figure 2-7 Military as a Network-Centric Enterprise[14] (Alberts 86)

The purpose of the tenets and principles is fundamentally to improve the capabilities and effectiveness of the military. When the principles employed and the systems are in place, the value of the sum of the systems will be much smaller than the value created by the integration of the parts. By looking at both Metcalfe's Law and evaluating value creation concepts it becomes

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[14] *Network-Centric Warfare, Developing and Leveraging Information Superiority*, Alberts, Garstka, Stein, CCRP, page 86.

clear that NCW theory should really provide the anticipated benefits. In the book, *NCW Developing and Leveraging Information Superiority*, Alberts et al also evaluate the value building framework NCW will bring to the battle field. They argue that the complicated interaction of several technologies and integrations points is the source of the real value creation for the NCW theory.
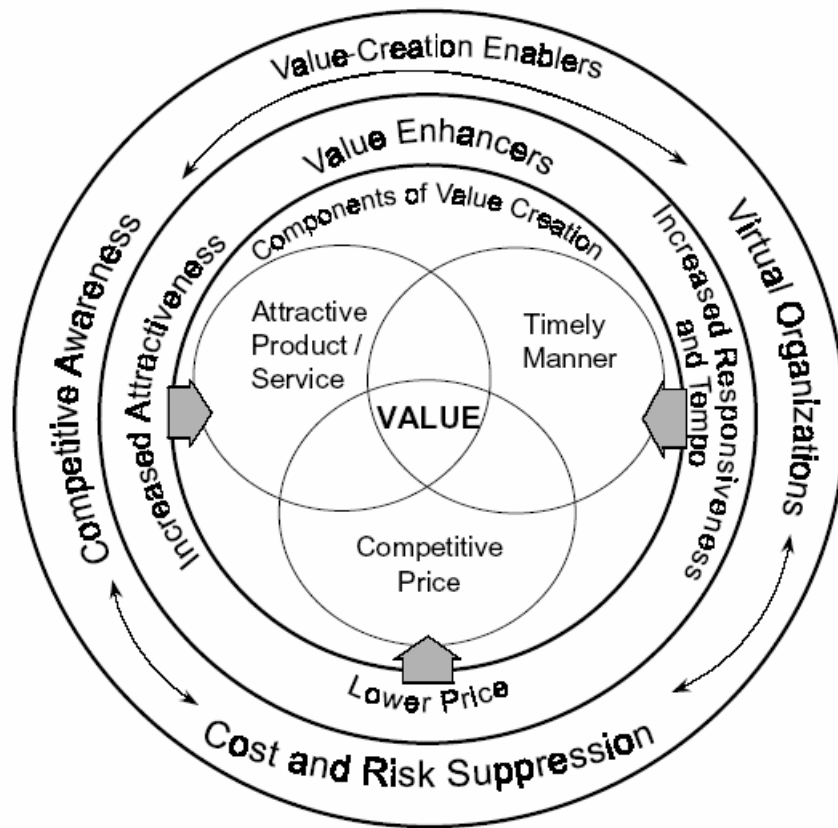
Figure 2-8 Value Creation Diagram (Alberts 31)

Section 2.4 - NCW Proof of Concept

For any theory – including NCW – to be accepted, there must be proofs to verify the assumptions and principles. When the concept was originally being explored, there were many people (Congressional 33)(Burke) who believed that NCW would not be nearly as revolutionary as it is currently appears to be. In *Network-Centric Warfare, Developing and Leveraging Information Superiority*, originally printed in 1999, there were several case studies already proving many of

the tenets and principles of NCW. Now, NCW is such a well studied theory of war, now, that it does not require more justification for further development. But it is important to study these cases to understand how best to employ or implement the principles. The principle of business is buy low and sell high. Clausewitz commented, that understanding the principles of war does not make one an expert in waging war, nor are we experts at employing NCW merely by having the principles, yet.

The Office of Force Transformation is the lead proponent for implementation of the transformation of the military, and they are especially concerned with verifying the value of NCW theory. To do this, they have commissioned several case studies, and they are collecting Network-Centric Operations (NCO) information from current and past combat and training missions. Here is a list of the formal NCO case studies approved for public release. As Figure 2-9 OFT NCO Case Studies indicates there are several more cases in progress.

Figure 2-9 OFT NCO Case Studies[15]

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[15] http://www.oft.osd.mil/initiatives/ncw/studies.cfm

Network-Centric Operations are the examples of networking on the battle field to support or prove NCW tenets or principles. The study of memoirs from leading generals, operators, soldiers and my personal experience with networked military equipment in combat continuously indicates that NCW is not only a solid theory of war but proving to be a tremendous advantage. Examples of the value of NCW continue to become ever more complicated and diverse. The result is a sudden and almost uncontrollable development of weapons and sensors which espouse to be NCW-capable but may in fact be developing at a fielding rate which may be counterproductive to the NCW Theory as a whole. We will discuss that in more detail in Part III of the thesis. In the near term, NCW is causing fundamental and radical change in development purchasing, and in the way future wars will be waged.

Section 2.5 - NCW – A Revolution in Military Affairs

NCW is causing a revolution in military affairs[16]. This statement can be confirmed simply by looking at how the military is waging war and what it is using NCW to leverage advantage from our technology base. The question that remains is how to best employ and most quickly integrate the most advantageous combination of equipment, tactics and training to realize the maximum effects. Alberts, of NCW, *Developing and Leveraging Information Superiority*, says, "NCW, for the first time, allows us with the possibility of moving beyond a strategy based upon attrition, to one based upon shock and awe."[17] More recently, experiences from the newly fielded Stryker Brigades are showing rapid synchronization and integration of combat multipliers never before seen. This real-world combat experience, introduced from the generals to the privates is changing the way war is waged, and the mindsets of all those conducting it. They will

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[16] Two books which further explain this concept are summarized by the Chief of Staff of The Army Professional Reading List: *The Dynamics of Military Revolution, 1300–2050* / Edited by MacGregor Knox and Williamson Murray, The editors provide a conceptual framework and historical context for understanding the patterns of change, innovation, and adaptation that have marked war in the Western world since the fourteenth century. Case studies and a conceptual overview offer to all senior leaders an indispensable introduction to military change**.** *Transformation under Fire: Revolutionizing How America Fights* / Douglas A. Macgregor Building on the success of his first work, *Breaking the Phalanx*, the author lays out a blueprint for revolutionary change in how America's Army is organized and fights. Macgregor argues that America needs a radically different military force to fight the global joint expeditionary warfare required by the Global War on Terrorism. *Transformation under Fire* is important reading for senior Army leaders, providing a starting point for any discussion on transformation.

[17] Harlan Ullman, James Wade, Jr. Et al., Shock and Awe; Achieving Rapid Dominance, Washington, DC: National Defense University Press, 1996.

bring back personal lessons, just like they have from every other war, place new demands on technologists "back home" and continue to bring new capabilities to the future warrior. To think that there is not a revolution in warfare going on now is to naively believe that the computer and digital revolution is just a passing fad.

The enemy is embracing technology just as quickly as it can be sold on the internet. During my experience in Iraq, cell phones were not available when we arrived nor was the internet. The insurgents were quickly located with conventional FM methods during the initial stages of the operation and we exploited that opportunity until the insurgents learned how to use the internet. Now, high quality handheld FM radios are used with GPS capabilities and cell phone networks are being used with deadly effect against Coalition forces. The "enemy" will very quickly adapt and use technology in the most creative ways to gain every ounce of advantage they can.

The US military is a large machine which prides itself in creative solutions and efficient use of technology. Now, during the revolution, the force which most quickly finds, utilizes, and creatively employs technology will have the advantage. Just as great forces in the past have been defeated by new technologies, the US advantage is vulnerable to lagging technological advancement. This revolution in military affairs will require rapid employment of new technology, but what makes the NCW concept so much more powerful than the individual technologies is their integration. The revolution towards integration is what will measure advantage and success on the future battle fields. The US is attempting to rise to that challenge but, true to the spirit of individualism, each branch is doing so independently. An overarching plan for developing the information structure to support the NCW Concept is the key that will allow all the other NCW capable systems to integrate and produce the theoretical advantages.

The revolution is occurring, and now is the time to organize for it and embrace innovation and systematically apply it. Numerous papers and articles have been written discussing the need to meet this rising challenge of transformation.(Butler, Cebrowski, Garstka) Just as businesses have needed to learn to alter their fundamental operating concepts; the military needs to adopt a culture of flexibility in order to embrace this revolution for the duration of its development.

Chapter 3 - Review of Transformation Plans

The transformation process includes the plans and roadmaps that each major subordinate command will use to effect the change. It is important to see if the guidance given by both Department of Defense and Joint Operations Command aligns with the "Roadmaps" of the three major branches. Additionally, this review will be used to validate that NCW concepts are incorporated into the plans. The transformation plan documents used in this thesis are the most current publicly available documents as of October, 2005. Because the U.S. is currently at war with Iraq, it is likely that other classified documents issuing guidance at higher fidelity exist. This analysis, however, is not intended to check for technical details or any classified alignment of strategy or weapon systems. Rather, the purpose of this analysis is to study the high-level guidance professed by each branch, and to identify the overarching architecture and how it will be developed.

The Office of Force Transformation[18] (OFT), Office of the Secretary of Defense is the primary coordinator for the transformation, but each branch is responsible for its own transformation plan. As a result the OFT has produced two documents to explain the transformation plan to the public. They are, *Elements of Defense Transformation[19]*, and *Military Transformation: A Strategic Approach[20]*. The formal Department of Defense plan is the *Transformation Planning Guidance, April 2003,* (TPG). The TPG provides the fundamental transformational guidance and is what the government will use to integrate both the NCW Concept and transformation plans of each of the branches.

Upon completing the review of these documents, we will analyze them for practical implementation and for coordination of interaction of the plans. The purpose of the transformation is twofold: To continue to prepare and maintain the US's military advantage, and

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[18] http://www.oft.osd.mil/
[19] http://www.oft.osd.mil/library/library_files/document_383_ElementsOfTransformation_LR.pdf
[20] http://www.oft.osd.mil/library/library_files/document_297_MT_StrategyDoc1.pdf

to provide a flexible interconnected force that leverages technology for added power. Understanding the transformation plans is the first step in analyzing this process.

Section 3.1 - DoD Transformation Plan

The Secretary of Defense, Donald Rumsfeld, introduces the DoD Transformation Plan by pointing out the significant changes that have occurred in the world since Sept 11, 2001. He notes that both current and future missions will be significantly more difficult than those of the past, and complex and change is required of the total military to meet these challenges. He defines he successful transformation to be characterized by a process of clear guidance, commitment and attention from senior leaders all focusing on clear goals and objectives. While the DoD TPG acknowledges that the end-state of the transformation can not be fully defined in advance, the prerequisites of a large part of the transformation are known and are presented in the DoD TPG. The DoD TPG is the document which will describe the DoD's strategy for, and assigns roles to, specific senior leaders to ensure the implementation of this strategy. Finally, the TPG cites a strategic imperative that the DoD transforms, for five key reasons:

1) The difficulty with Status Quo: The current revolution from industrial age to information age societies threatens that even with significantly large expenditures on military spending there is no guarantee conventional forces will continue to be able to meet future world challenges.

2) Growing Asymmetric Threats: The emergence of larger numbers of terrorists, extremists and subversive acts are causing changes in operational tactics and mission requirements. These trends represent significant challenges and further confirm the difficulties of using force-on-force large scale conventional combat against asymmetric threats.

3) Rising Force-on-Force Challenges: There are concerns that while such a large and active asymmetrical threat against the US is currently going on, other countries are hoping the US will neglect to ensure consistent power in conventional forces.

4) Historic Opportunity: With a transition from industrial to information age, the military needs to embrace this change as an opportunity to lead the information revolution.

5) High Stakes: If the US fails to embrace this transformation, it could lose its position as a world leader and will see a rapid emergence of regional competitors and a world prone to major conflict.[21]

Section 3.1.1 - Scope of Transformation

The scope of the transformation is all-encompassing, and generically covers three areas: *"Transforming How We Fight", "Transforming How We Do Business", and "Transforming How We Work With Others."*

Transforming How We Fight is the general transformation of the war fighting capabilities. It will include a detailed approach to transformation, and its key component is embedded in joint operations. Joint operations are both inter-branch operations and operations with international allies.   The transformation will cover all military capabilities areas, defined as: Doctrine, Organization, Training, Material, Leadership, Education, Personnel and Facilities. (DOTMLEPF)   This acronym, DOTMLEPF, is often used to assess the effects of a new technology application. For example how does introducing GPS effects DOTMLEPF. Since it is a common military measure of change I will use it throughout this paper for equal comparison of transformation decisions.

Transforming How We Do Business is the plan for how the DoD can implement state-of-the-art business practices, innovative problem solving, adaptive planning schedules, and a "more entrepreneurial future-oriented capabilities-based resource allocation planning process to accelerate acquisition cycles built around spiral development." The DoD has acknowledged the need to rapidly change its business practices, to embrace the changes in world technology and speed its bureaucratic system. In another document, *Defense Planning Guidance*, the DoD

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[21] The Five points are summaries of the points presented in the TPG.

discusses how business practices in the military need to evolve. We will not need to go into greater detail, but it is important to be aware that this document exists and these issues are under discussion and review. When the DPG and TPG are taken together they represent a significant change taking place in the business of US Defense. But, when considered in this context, there is very little guidance for specific transformation presented in this document.

Transforming How We Work With Others discusses how the military will integrate both with other agencies in the US, and with other agencies in the Department of Defense. This is the fundamental interoperability concept and joint operations concept at its highest level. In short, it is a transformation of the interaction process between all aspects of the US Government and military. The only new point raised here is that there is a concerted effort to effect policy change to ensure better interagency communication and coordination.

Section 3.1.2 - Strategy for Transformation

The DoD sees Strategy Transformation to occur in three parts: Transformed Culture, Transformed Processes and Transformed Capabilities. Each of those steps is further defined with the following summaries from the TPG.

Part I - Transform Culture Through Innovative Leadership: Here the DoD recognizes that innovation during transformation is critical and key to the success of the transformation. In acknowledgement of these insights, it calls for commitment from senior leaders to recognize and promote innovative leaders and to be equally ready to eliminate current practices that stifle innovation. These are important concepts that are easily stated but the implementation of innovation in a large organization rooted in a long history of success may prove challenging. We will analyze this point in much greater detail later in the thesis.

Part II - Transformed Processes – Risk Adjudication Using Future Operating Concepts: This requires the DoD to balance transformation with the ability to continue current operations. This process dilutes transformation risk by using joint capabilities to share requirements, allowing one

system to be transformed while other legacy systems support current operations. This is a simplification of the concept but illustrates the need and concern of the DoD to maintain operations at any cost. This portion of the strategy has two parts:

1) Reformed Capabilities-Identification Process: The DoD must reform the requirements system to better identify and assess specific options for mitigation of future risks. This will be accomplished by investing in transformational capabilities based on joint operating concepts.

2) Transformed Strategic Analysis: The DoD recognizes the need for analytic capabilities that can identify and assess risks for strategic planning, and must support a capabilities-based planning process to mitigate the greater uncertainty of future threats.

Part III – Transformed Capabilities through Force Transformation is defined by four "Pillars" in the transformation process. These four pillars are to permit the DoD to transform and still be able to fight and win the current military missions. Figure 3-1 Military Transformation Pillars (OFT), is the advertised transformation strategy based on four fundamental areas of transformation, each of which is a large area of discussion.

Figure 3-1 Military Transformation Pillars (OFT)

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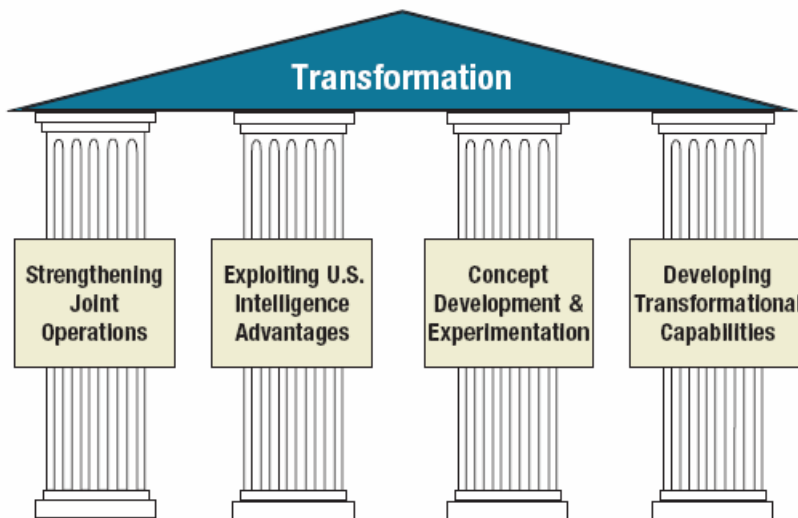
As alluded to above, this transformation implementation is to help the DoD manage the transformation while both ensuring that warfighting capabilities are sustained and that expenditures on new technologies and concepts are protected to completion or termination. This is very real and large tension between planners and combat leaders. To better reduce this tension, the ability to field new technology rapidly helps the warfighter to gain advantages quickly and fielding the new concepts through an iterative process of fielding and testing. The goal of this strategy is to reduce platform-centric systems and employ a more net-centric technology base.

The DoD has described what it expects the future force to be able to do and look like when implementation of this strategy is complete. Additionally, the results of the above transformation will be defined by six goals and directed by the DoD in the 2001 Quadrennial Defense Review. Because the goals that define future success are short and concise, they are repeated here verbatim. These points will also be the basis for the evaluation of the Transformation Roadmaps of the three branches, so clarity of DoD expectations is critical.

- Standing joint force headquarters will conduct effects-based, adaptive planning in response to contingencies, with the objective of defeating enemy threats using networked, modular forces capable of distributed, seamlessly joint and combined operations.
- U.S. forces will defeat the most potent of enemy anti-access and area denial capabilities through a combination of more robust contamination avoidance measures, mobile basing and priority time critical counterforce targeting.
- U.S. forces will leverage asymmetric advantages to the fullest extent possible, drawing upon unparalleled Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) capabilities that provide joint common relevant operational situational awareness of the battlespace, rapid and robust sensor-to-shooter targeting, reachback and other necessary prerequisites for network-centric warfare.
- Combined arms forces armed with superior situational awareness will maneuver more easily around the battlefield and force the enemy to mass where precision engagement capabilities may be used to maximum effect.

Military forces with the ability to execute these types of operations will be better able to implement the new defense strategy and accomplish the six operational goals identified in the 2001 QDR:

1) Protecting critical bases of operations (U.S. homeland, forces abroad, allies and friends) and defeating CBRNE weapons and means of delivery will ensure our ability to generate forces in a timely manner without being deterred by adversary escalation options.

2) Projecting and sustaining U.S. forces in distant anti-access or area-denial environments and defeating anti-access threats will enable us to preserve and utilize the most effective avenues of approach while rapidly engaging adversary forces.

3) Denying enemies sanctuary through persistent surveillance, tracking and rapid engagement with high-volume precision strikes will permit the United States to prosecute a rapid campaign that reinforces deterrence by denying any adversary hope of achieving even limited objectives, preserving escalation options or maintaining command and control of forces over an extended period.

4) Assuring information systems in the face of attack and conducting effective and discriminate offensive information operations will deny the adversary hope of exploiting a new dimension of the battlespace as a low-cost and powerful asymmetric option while providing us an unwarned strike capability that contributes to a broad, simultaneous and overwhelming range of effects that increases the likelihood of rapid collapse of an adversary's will to fight.

5) Enhancing the capability and survivability of space systems and supporting infrastructure will provide sustained, protected, global C4ISR capabilities that permit rapid engagement of American power and reinforce deterrence by promoting earlier warning of adversary intentions while denying the adversary similar capability.

6) Leveraging information technology and innovative concepts to develop an interoperable, joint C4ISR architecture and capability that includes a tailorable joint operational picture will guarantee our combat leaders decision superiority and enable our forces to maneuver effectively to gain positional advantage, avoid battlefield obstacles and successfully attack the adversary even in the face of numerically superior forces.(Rumsfeld, 2001)

Section 3.1.3 - Implementation of the Transformation Strategy

The implementation architecture for transformation is just as important as the transformation goals themselves. The DoD has presented this plan to develop the transformation in an organized fashion by decomposing it into responsibilities, and describing in detail how each of the four pillars will support the transformation.

The Roles and Responsibilities of the transformation are defined concisely in the TPG document. Because they represent an important evaluation of the system architecture, I will include them here verbatim from the TPG.

- *The Secretary of Defense* is the final approval authority on all major elements of the transformation strategy. He will set the Department's transformation policies and objectives, and define the roles and responsibilities of the Department's senior leadership in executing the transformation strategy.
- *The Chairman of the Joint Chiefs of Staff (CJCS)* will advise the Secretary on the best approach to balancing the four QDR risk areas, especially operational and future risk. The Chairman also is responsible for overseeing development of joint concepts and validating joint warfighting requirements.
- *The Director, Office of Force Transformation (OFT)*, will monitor and evaluate implementation of the Department's transformation strategy, advise the Secretary, and manage the transformation roadmap process. He will help ensure that joint concepts are open to challenge by a wide range of innovative alternative concepts and ideas.
- *The Commander, Joint Forces Command (JFCOM), and other Combatant Commanders* are responsible for developing joint warfighting requirements, conducting joint concept development and experimentation and developing specific joint concepts assigned by CJCS. Commander, JFCOM, is responsible for coordinating concept development and experimentation efforts of the Combatant Commands. He is also responsible for concept development and experimentation on CJCS directed joint concepts and other joint concepts, integrating the results from these and other Combatant Commanders' experiments, and for recommending to the CJCS modifications to existing joint concepts. The Commander, JFCOM is also responsible for a joint transformation roadmap to achieve joint capabilities required by joint concepts.
- *The Secretaries of the Military Departments and the Service Chiefs of Staff* are responsible for developing specific concepts for supporting operations and core competencies. They will oversee Service experimentation, modify supporting concepts accordingly, and build transformation roadmaps to achieve transformational capabilities to enable those concepts.

The Secretary of Defense, with the advice of the Chairman, ultimately rules on the appropriate balance in apportioning resources to mitigate risks. The Commander, JFCOM, and the Director, OFT are the advocates for transformational requirements. Their responsibility is to provide input that will better balance the existing requirements and resource allocation system in the Department, which in the past was too heavily oriented toward near-term operational requirements.(Rumsfeld, Transformation)

Additional specific guidance and roles are included in the following figures which describe the decision authority level, activity lead, participants and mechanism. This chart is an important

part of the policy architecture of the transformation process and will be included verbatim here for continuous future reference.

Transformation Task	Page	Approval Authority	Lead	Coordination	Mechanism	Timeline
Shaping Transformation Policy						
Establish Transformation Objectives	-	SECDEF	USD (Policy)	D(OFT), CJCS, JFCOM	*Guidance:* Transformation Planning Guidance	As necessary
Set Transformation Policy	-	SECDEF	USD (Policy)	D(OFT), CJCS, JFCOM	*Guidance:* Transformation Planning Guidance	As necessary
Coordination of Interagency Transformation Efforts	-	DEP SECDEF	USD (Policy)	D(OFT), CJCS, JFCOM, ASD(C3I)	As appropriate	Ongoing
Develop Multinational Transformation Recommendations	8	SECDEF	USD (Policy)	D(OFT), CJCS, JFCOM, Services, USD(AT&L), ASD(C3I)	*Document:* Develop recommendations for inclusion into the Security Cooperation Guidance to govern bilateral and multilateral cooperation on transformation consistent with the new defense strategy and the six QDR goals.	May 30, 2003
Transform Strategic Analysis	8	DEP SECDEF	USD (Policy)	D(PA&E) and CJCS	*Briefing:* Provide new approach to analysis of current and future requirements synchronized with PPBS and QDR. Will include an alternative to DPG IPS, a broader set of analytic tools, and a joint scenario data management approach.	May 1, 2003
Oversee and Allocate Resources	-	SECDEF/ DEP SECDEF	SECDEF	SEC, DRB, D(PA&E)	Program/Budget Review	Aug-Nov annually
Concept Development and Experimentation						
Publish Joint Operations Concepts	15	SECDEF	CJCS	Combatant Commands, Services, D(OFT)	*Document:* Develop one overarching Joint Operations Concepts that describes joint warfighting just outside of the FYDP.	May 1, 2003. Biennial-ly there-after.
Develop Joint Operating Concepts	15	SECDEF	CJCS	Services and Combatant Commands, with comment from D(OFT)	*Briefings/Documents:* Develop four cornerstone JOCs to be updated annually. Will also keep transformation roadmap developers in the Services, Defense Agencies, and JFCOM informed during JOC development.	June 1, 2003. Sept. 1 thereafter

Figure 3-2 Transformation Roles #1

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Transformation Task	Page	Approval Authority	Lead	Coordination	Mechanism	Timeline
Define list of Supporting Operations	15	SECDEF	CJCS	Services, JFCOM, USD(Policy)	*Briefings/Documents:* Provide list of required operations necessary to support JOCs. Will update list as joint/Service roles change and new JOCs are developed.	May 1, 2003. Part of JOCs thereafter
Develop Joint and Service Concepts	15	SECDEF	Services, JFCOM, and Combatant Commands	CJCS	*Briefings/Documents:* Service leads and designated Combatant Commands will develop concepts for the supporting operations. The Service Transformation Roadmaps will plot the development of capabilities necessary to support these operations and JOCs. The Joint Transformation Roadmap will plot the development of capabilities to support joint operations and JOCs.	Ongoing
Develop Integrated Architectures for Supporting Operations	16	CJCS	CJCS	Services, JFCOM, and Combatant Commands	*Briefings/Documents:* Develop integrated architectures for each supporting operation. The architectures will describe in greater detail the relationship between the tasks and activities that generate effects on enemy forces and also those tasks and activities that support functional operations. JFCOM, consistent with Management Initiative Decision 912, shall develop the Battle Management Command & Control architecture.	Ongoing
Publish Joint Vision	16	SECDEF	CJCS	Combatant Commands and Services, with comment from D(OFT)	Joint Vision Document	April 1, 2003
Issue Joint Experimentation Guidance	App. 5	SECDEF	CJCS	D(OFT), JFCOM, and Services	*Guidance:* The CJCS, in coordination with D(OFT) and Commander, JFCOM, will recommend to the Secretary modifications to the guidance in this document.	As necessary

Figure 3-3 Transformation Roles #2

Transformation Task	Page	Approval Authority	Lead	Coordination	Mechanism	Timeline
Joint Experimentation Assessments	18	SECDEF	JFCOM	CJCS, Combatant Commands, Services, Agencies, with comment from D(OFT)	*Report:* Report the status of achieving stated experimentation/ interoperability priorities, experimentation infrastructure, and provide recommendations for follow-on activities.	June 1 annually
Develop experimentation plan	App. 5	SECDEF (through CJCS)	JFCOM	CJCS, Combatant Commands, Services, Agencies, D(OFT)	*Plan:* Develop Joint Concept Development and Experimentation Campaign Plan based on guidance in appendix five.	Dec. 1 bienn-ially
Provide Experimentation Criteria	18	D(OFT)	D(OFT)	CJCS	*Memo:* Expand upon experimentation criteria in TPG.	May 1, 2003
Interoperability						
Achieving Interoperability Priorities	16	SECDEF	JFCOM	CJCS, ASD(C3I), USD(AT&L), Combatant Commands, Services, Agencies	*Plan:* Develop Integrated Interoperability plan for achieving stated priorities within the decade (to include DPG 05 recommendations)	July 1, 2003
Transformation Roadmaps						
Interim Progress Report	19	D(OFT)	Services and JFCOM		*Briefing:* Present interim briefing that addresses status of roadmap revision.	August 1 annually
Revised Transformation Roadmaps	19	D(OFT)	Services and JFCOM	Joint Roadmap developed in coordination with CJCS	*Roadmap:* Submit revised transformation roadmaps to D(OFT). Combat support Defense Agencies will provide input into the Joint Transformation Roadmap as requested by Commander, JFCOM.	Nov. 1 annually
Review of Roadmaps	19	SECDEF in Nov. 2003 and Service Secretary thereafter	D(OFT)	Services and JFCOM	*Memo:* Submit roadmaps to the approval authority with comments on adherence to guidance and recommend ways to address shortcomings.	No later than 1 month after roadmap submiss-ion to D(OFT)

Figure 3-4 Transformation Roles #3

Transformation Task	Page	Approval Authority	Lead	Coordination	Mechanism	Timeline
Roadmap/POM Analysis	14	DEP SECDEF	D(PA&E)	D(OFT) and Services	*Briefing:* Evaluate POMs based on their consistency with transformation roadmaps and provide recommendation for resolution of issues in program review.	Prior to program review
Innovative Processes						
Fostering Trans-formation Initiatives	20	D(OFT)	D(OFT)	CJCS, Combatant Commands, and JFCOM	*Transformation Initiative Program:* Programs must be consistent with joint concepts and interoperability standards.	FY05 DPG
Promote Rapid Acquisition of Transformational Programs	20	JFCOM	JFCOM	CJCS and USD(AT&L)	*Joint Rapid Acquisition Program:* Programs must be consistent with joint concepts and interoperability standards.	FY05 DPG
Testing, Training, and Education						
Develop Plan to Transform Military Education	21	SECDEF	CJCS	D(OFT), Combatant Commands, Services, USD(P&R)	*Plan:* Conduct an assessment of the current joint military professional education system and present a plan to change it as necessary to meet the requirements of the future.	July 1, 2003
Joint Test and Evaluation Capability (JointTEC)	20	DEPSEC DEF	D(OT&E)	USD(AT&L), USD(P&R), JFCOM, Services	*Plan/Briefing:* Brief options and implementation plans for a JointTEC. At least one option will consider an integrated approach with the Joint National Training Capability.	June 1, 2003
Establish Policy for Transformation of Training	-	USD (P&R)	USD (P&R)	USD(Policy), D(OFT), Services, CJCS	Training Transformation Implementation Plan	Ongoing
Establish Joint National Training Capability	-	USD (P&R)	JFCOM	CJCS, USD(Policy), Combatant Commands, Services	Joint National Training Capability	October 2004 IOC
Measuring Progress						
Strategic Transformation Appraisals	21	SECDEF	D(OFT)	USD(AT&L), ASD(C3I), JFCOM, Services, Agencies, with comment by CJCS	*Report:* Address specific issues outlined in the TPG. D(OFT) is responsible for managing inputs from the coordinating offices which are due no later than November 1.	Jan. 30 annually
Program/Budget Review Output Report	22	D(OFT)	D(PA&E)	USD(PA&E)	*Report:* Summarize the status of the transformational elements of the program.	Jan. 15 annually

Figure 3-5 Transformation Roles #4

A summary of the implementation process for the transformation is composed of five steps. The first step is to develop the Transformation plan embodied in the TPG, which will allow the Joint Command produce the Joint and Service Concepts, which will be pushed down to the major branches, who will each create a Transformation Roadmap. Second step, to facilitate the development process the roadmaps, as directed by the TPG, and step three will include Rapid RDT&E Programs, (Research, Development, Testing and Evaluation). Step four, an annual Strategic Transformation Appraisal will be written by the Director, OFT and step five, submit it the Secretary of Defense. This will provide the tool to keep track of the transformation process and provide the means to make recommendations as needed.

The implementation process of the DoD Transformation is broken down into four basic pillars. The pillars were created to help limit tensions between current world missions and investments into future technologies. These pillars are discussed in greater detail in both *Military Transformation: A Strategic Approach* and in the *Transformation Planning Guidance 2003*. A summary is provided here to be used for further analysis with the other Transformation Plans.

- *Pillar One: Strengthening Joint Operations*. The CJCS will be responsible to ensure that this key pillar of transformation is completed. The key to the transformation is the development of joint operating concepts. The CJCS will therefore be responsible for both the oversight production and annual validation of joint operating concepts. The operating concepts will be developed with respect to three timeframes. The near-term (2-3 year) timeframe will incorporate newly learned lessons from current missions into future plans and developments. Mid-term projects will include the development of future operating concepts and meet the six operational goals established in the 2001 QDR. These operating concepts will drive the roadmaps of the branches, and should align with the transformation process. Additionally, mid-term Joint Concepts must include linking integrated architectures to a reformed capabilities identification process to better understand interrelations of operations, branches and technologies for future evolution. Finally, Far-term Joint vision will produce visions and concepts to be developed around the 15-20 year timeframe. In summary, the CJCS is responsible for integrated

operational, command and technology to achieve the advantages espoused in the Net-Centric Warfare theory.

- *Pillar Two: Exploiting U.S. Intelligence Advantages.* One of the key advantages of the NCW theory is efficient use of intelligence to affect the enemy in unprecedented ways. Pillar Two directs a transformation of in the fundamental use of military capabilities. This includes early crisis warning, continuous monitoring capability, early target identification, target verification, and monitoring progress of missions and effects of dynamic weapons. It also calls for greater information dissemination and access. The desired result is a reduced command and control decision cycle, along with better situational awareness of combat commanders and strategic planners.

- *Pillar Three: Concept Development and Experimentation.* The DoD wants to have competitive concept development and experimentation to help develop transformational theory into reality. Concept Development and testing will be conducted by all the Combatant Commands and the services. The Director of the Office of Force Transformation will define criteria for successful experimentation and the Commander JFCOM will report the progress of the testing and on the adequacy of dedicated experimentation infrastructures. In particular, the report will address infrastructure issues on War Gaming, Modeling and Simulation, Joint National Training Capability, and Operational Lessons Learned.

- *Pillar Four: Developing Transformational Capabilities*. The DoD needs methods for implementing the recommendations and concepts from the previous pillars. Therefore the DoD requires development of Actionable Transformational Roadmaps of the branches, to promote Transformational RDT&E, supported by the Transformation Initiative Program (TIP). The TIP program will provide support to Combatant Commanders to rapidly pursue potentially high-payoff joint transformational initiative during a fiscal year. Develop a Transformation of Test and Evaluation capabilities by developing the Joint Test and Evaluation Capability (JointTEC) to rapidly test new architectures and finally develop a transformation of both the training and joint education process.

Section 3.1.4 - Analysis of Architecture Guidance

The DoD's TPG is an excellent example of a solution-neutral statement of needs. It provides the branches with a vision and objectives, which can be tailored by each branch to support the goal of the DoD, yet it still describes a joint vision and integration which will provide additional benefits from the emergent properties of the system – if properly executed. In fact, the TPG is so vague and generic that it could be given to another country and provide just as useful a vision statement as our own. But another country would produce a very different system, because of differences in culture and technology base. This is a true statement since the technology and cultures of each branch of the US military are different than the cultures and technology base of other branches in other nations. This is why each of the branches is proposing a different solution system, given the same guidance. The critical question is: Whose culture and technology base will produce the most capable system in the future? It would be naive of our nation to believe that experts from other countries are not reading the same documents that I have accessed for this thesis. In order to maintain superiority, the goal of the U.S. military's transformation must not be merely to develop a system that achieves the DoD transformation goals, but rather to develop the best possible architecture that achieves those goals.

The DoD TPG is what the DoD envisions the future transformation to be. While the DoD TPG is in my opinion a well thought-out vision and the requirements in the document are expansive, they do not generate the necessary changes that the true transformation requires. The reports to the Secretary of Defense and other agencies required in the DoD TPG will change neither the cultures nor the architecture of the system. They only require a different focus of development from the branches. As mentioned previously, this is not a transformation but an evolution.

In the next section, the structure and processes described in the DoD TPG will be compared with the Army, Navy and Air Force transformation plans. This analysis will further illustrate the differences between the DoD's espoused needs and requirements and the branches' espoused plans and actual actions. As is often heard in military circles, "the plan briefs well, but how will it really work?"

Section 3.2   Army Transformation Roadmap

The Army understands the need to change just as clearly as the DoD, and embraces this need completely. The Army is working to develop an Army Campaign Plan (ACP) to produce a force which balances its current and future needs. The ACP calls for transformation to be driven by operational experience to develop operational concepts and joint capabilities. This is a **prove-before-develop** methodology, designed to develop a force structure which will achieve full, joint interdependence. Furthermore, the Army is working to transform the mindset of it soldiers and leaders. In the Army Transformational Roadmap all of the guidance given by the DoD is addressed and incorporated into the transformation plan.

In short, the Army Transformation Roadmap methodically addresses all the transformational issues described in the various guidance documents provided by both the DoD and Joint Operations Command. In fact, the strategy of the Army is almost identical to the TPG document. Because the TPG is vague with respect to specific transformation guidance, the Army describes its specific transformation goals in the Roadmap as directed. A summary of each chapter in the Army Roadmap is provided here.

Chapter One in the Army's Roadmap discusses all the important reasons why it must transform. The primary reasons for change are:

- Development of the joint culture: The Army learned that it can neither deploy itself nor sustain itself without the other branches, so it has long ago learned the importance of joint operations. It is therefore working to increase the interoperability of the branches to maximize their total complimentary effects.
- Development of an expeditionary culture: No longer are fixed force-on-force situations the norm. Rather, the Army will have to respond to unknown forces at undetermined locations in short time. Therefore flexibility in strategic planning is critical in future situations.

How the Army views its transformation is briefly summarized here with its two major plans and associated objectives:

- The *Transformation Strategy* includes transformed culture through innovative leadership and adaptive institutions; transformed process through risk adjudication using current to future force construct; and transformed capabilities for interdependent joint operations through force transformation.
- The *Army Campaign Plan* objectives are described as supporting global operations; adapting and improving total army capabilities; optimizing reserve component contribution; sustaining the right all-volunteer force; adjusting global footprint; building the future force; adapting the institutional army; and developing joint, interdependent logistics structure.

Chapter Two in the Army's Transformation Roadmap discusses the importance of joint operations and interdependent operations. These lessons are hard earned but clearly understood by the Army and represent a significant movement to support joint operations. The chapter systematically addresses five of its key joint operational concepts and identifies gaps in each. They are presented in summary here:

- Joint Battle Command – The development and fielding of integrated joint battle management and command and control (JBMC2) capabilities will enable U.S. forces to collaboratively plan and rapidly share an accurate picture of the battlespace. Gaps in the plan include: absence of an overarching C4ISR architecture and data standard, non-interoperable communications and battle command systems, untimely and incomplete intelligence sharing, inefficient information dissemination, and sequential and stove-piped planning.
- Joint Fire and Effects – This capability frees commanders from reliance on organic fires and requires absolute dependence on joint fires. Gaps include the lack of a fully interoperable battle command and fire control system; limited linkages between operational net assessment sensor control data and joint intelligence surveillance and

reconnaissance data; interface seams between communications and computer networks; few flexible fire control measures; limited tactics, techniques, procedures and experimentation for validating interdependent joint fires control system of systems; and limited tactical air control parties at lower echelons.

- Joint Air and Missile Defense – This capability should provide a fully networked, interdependent, joint theater air and missile defense network of space-, air-, sea- and land-based elements that provides a very high degree of protection beyond the JOA to include regional forces from atmosphere-delivered WMD. Gaps include seams in communications and protection from advanced technology.

- Joint Force Projection – The goal of Joint Force Projection is to provide rapid strategic responsiveness of the Joint force. Gaps include over-reliance on improved air- and seaports, limited deployment options, large time gap between expeditionary and heavy force deployment, limited volume of transportation assets, and limited continuous operational maneuver with air assets.

- Joint Sustainment – This capability requires a transition from service-centric to a regionally centric single fully integrated joint distribution system. Gaps include factional pipeline management and process ownership, gapped ad hoc command and control, limited end-to-end control, and limited ability to support rapidly changing, high-tempo operations.

While all of these joint operational concepts are discussed and their gaps are identified, the Army is recommending a very complex gap solution process shown in Figure 3-6 Army Gap Solution Process (Army 2-14). The solution process, as proposed, is a classical process working to maximize input from the various users. While the system appears to be a logical process, in practice it is extremely cumbersome to manage and control. A more streamlined approach could achieve the same ends using a better management process, but that is outside the scope of this thesis. I therefore, would not recommend it for further analysis here, but it is presented for review.
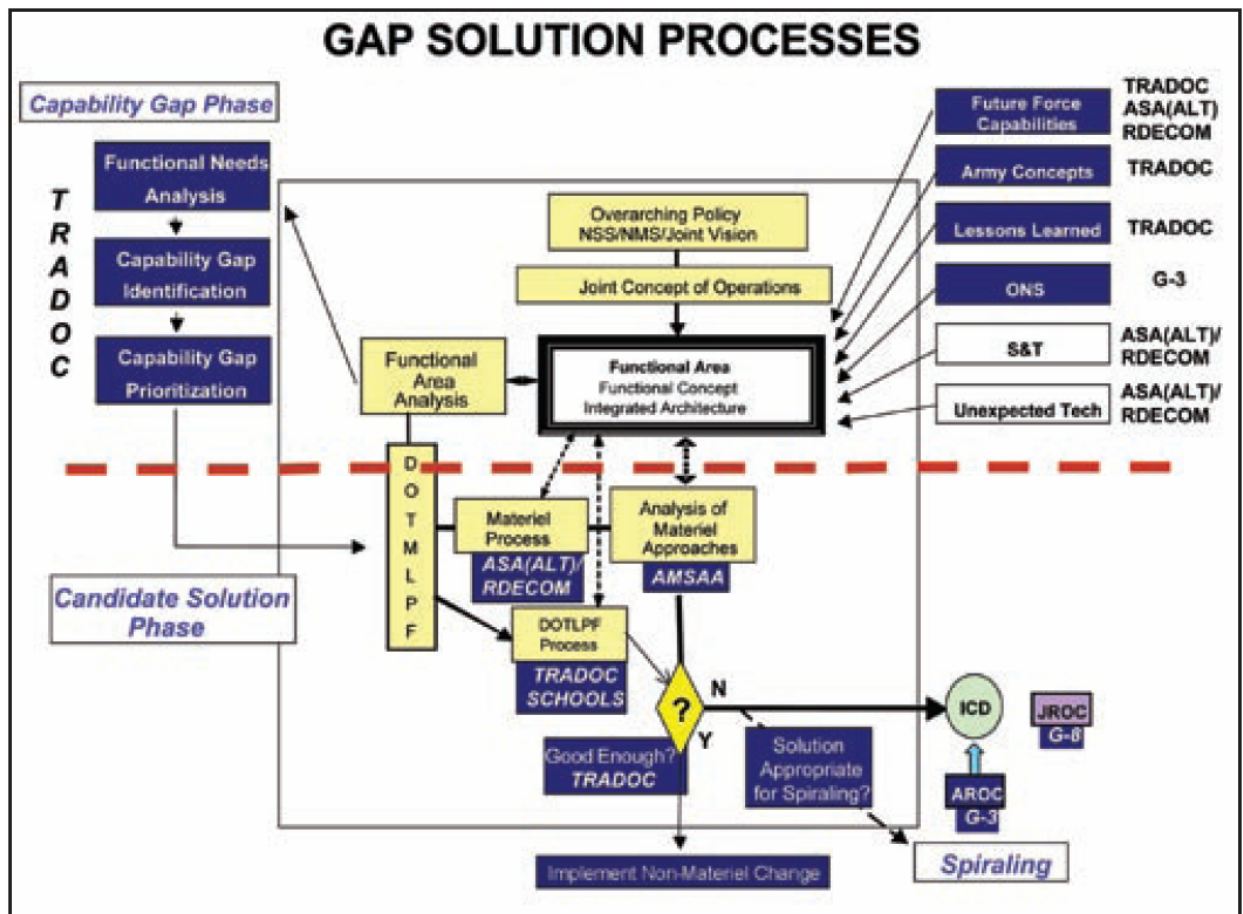
Figure 3-6 Army Gap Solution Process (Army 2-14)

Chapter Three of the Army Transformation Roadmap provides a clear description of how the Army is now providing forces which are capable of using transformational technology. The forces are employing new and advanced technologies to be used on the battlefield now. The initiatives include modular commands and Unites, improving Army Aviation units, providing force stabilization, and creative solutions to balance the reserve and active component force structure. This chapter is focusing on Army support issues.

Chapter Four of the Army Transformation Roadmap summarizes the Future Combat Systems (FCS) which will provide the center of power for the army in the future. The Future Force concept is founded on six main operational themes:

1. **Operational Maneuver from Strategic Distances** is the rapid projection of modular, scalable, combined arms formations, tailored in force capability packages to meet the requirements of each contingency. Employing advanced lift platforms without depending on improved ports, the Army will deploy much more rapidly into multiple points of entry and along parallel force flows to increase deployment momentum and close the gap between early-entry and campaign forces.

2. **Entry and Shaping Operations** seize the combat initiative, shape the battlespace and set the conditions for decisive operations. Use of multiple entry points will help overcome enemy anti-access points, enhance surprise, reduce predictability, and, through the conduct of immediate operations after arrival, produce multiple dilemmas for the enemy.

3. **Intra-theater Maneuver of Mounted Forces** circumvents prepared defenses, extends the operational reach of the joint force commander, and exploits opportunities.

4. **Decisive Maneuver**, as conducted by the Future Force, will rapidly achieve strategic ends. Decisive maneuver operations encompass three critical strategies and are explained below.

   - First, simultaneous, distributed operations within a noncontiguous battlespace framework will fundamentally change the geometry of the enemy's defense and enables the Future Force to dislocate and defeat the enemy.

   - Second, direct attack of key enemy strike and maneuver capabilities will accelerate the disintegration of the enemy defensive integrity.

   - Third, continuous operations and increased operational tempo will overwhelm the enemy's capability to respond effectively, resulting in the physical destruction and psychological exhaustion of enemy forces.

5. **Network-Enabled Battle Command** provides the required base of situational understanding for the most effective application of combat capabilities and forces and enables self-synchronizing forces to respond quickly to changing battlefield conditions.

6. **Distributed Support and Sustainment** ensures freedom of maneuver with a minimum support and sustainment footprint throughout the battlespace

Chapter Five discusses all of the institutional transformation and other initiatives needed to complete the transformation process. Those other issues include soldier culture changes, institutional educational changes, concept development and experimentation changes, and science technology and logistic changes in the organization. Installation transformation, Army space and intelligence transformation are all included in this section and represent a significant effort to change the force. These are all identified as important areas inside the Army which will need to be reformed in order to meet the transformation guidance initiatives as directed. Additionally, the Army provides a limited tracking method for measuring the transformation of the Army in this chapter.

Chapter Six discusses specific changes in current operating forces which demonstrate the Army's commitment to transformation. Numerous examples illustrate the rapid purchasing and development processes which are occurring in the Army right now. Additionally, they are solutions to specific real-world issues in ongoing conflicts now. The most significant point in this chapter is the commitment of $17 billion in Program Objective Memorandum (POM) 2006-2011 to fund critical transformation issues.

Chapter Seven is dedicated to risk mitigation, because the Army must balance providing combat-ready forces for current and future missions while transforming itself. This is a complicated operation and the Army is well aware of the risks if managed poorly.

Section 3.2.1 - Analysis of Army Transformation Roadmap

Taken as a whole, the Army Transformation Roadmap (ATR) methodically illustrates how it meets and achieves each on the requirements and directed by the DoD TPG. The ATR also illustrates how much it is doing to support the transformation, but again merely applying technology is evolution, not transformation. On the other hand, the development of the Stryker Brigade and the development of the FCS is a transformation that integrates process, procedures and technology to be applied in fundamentally different ways.

The ATR points out that it needs the other branches to conform to the Army's system and even takes a stronger stand on the weaknesses between the Army and Air Force in several layers of the system. The Army also argues that it knows best the requirements for joint operations, because it must use both the Navy and Air Force to achieve its effects in ordinary combat operations. This is captured in the ATR and includes the Army's gap solution process. The ATR also argues that it is necessary for the Army to be the single point coordinator for future conflicts. This is counter-intuitive since JFCOM is already established as the coordinating agency for the joint environment. Due to this fact there is no need for the Army to establish itself as the lead branch in the next conflict.

In short, the ATR is written to position the Army to be the lead branch in future conflicts. This goes against the fundamental philosophy of NCW and basic vision of the DoD for a truly joint force. A rivalry between the branches, each vying for positional dominance in the future, could fundamentally undermine the vision of the DoD and both the application of NCW and the success of joint operations. This is critical because how, without support and cooperative operations, could the acquisition process and logistical system be improved? While the ATR "briefs very well" and illustrates great evolutionary activities on the part of the Army, the fundamental changes the DoD envisions are really not fully supported by the branch. The competition between the branches is the underlying cultural problem that must be addressed for the true transformation to occur. We will see this trend with the other two branches.

Section 3.3 Air Force Transformation Flight Plan

The Air Force, like the other branches, understands the need for transformation but there is a fundamental difference between the Army, the DoD Guidance and what the Air Force is discussing. The Air Force Flight Plan spends a vast majority of its discussion on the application of new technology and the fielding of new space and air systems with improved capabilities. The Air Force acknowledges joint operations but discusses it in only one chapter. Discussion on how the Air Force will work to integrate with the Global Information Grid (GIG) and other joint features as directed in the TPG is addressed in Appendix B in the Air Force Flight Plan.

Summary of the Air Force Transformation Flight Plan – 2004 is provided here to substantiate these statements.

Chapter One is a short summary of the guidance provided by the DoD for transformation. It summarizes the flight plan which includes the broad outline of the Air Forces transformation strategy. It is presented below for review.

- Work with the other Services, Joint Staff, and other DoD Agencies to enhance Joint warfighting.
- Continue to aggressively pursue innovation to lay the groundwork for transformation.
- Create flexible, agile organizations that continually collaborate to facilitate transformation and institutionalize cultural change.
- Shift from threat- and platform-centric planning and programming to adaptive capabilities- and effects-based planning and programming via the new Air Force CONOPS and the Capabilities Review and Risk Assessments (CRRAs)
- Develop "transformational" capabilities to enable the 2001 QDR's six critical operational goals of transformation, JOC, Air Force Vision, and the Air Force CONOPS.
- Break out of industrial age business processes and embrace information age thinking.

Chapter Two provides the broad strategic context by presenting the Air Force's conceptual view of the ongoing transformation of the U.S. military and why it is necessary. Its purpose is to scope the content of this document and transformation as described by the Air Force. There is no substantially new material here.

Chapter Three summarizes the Air Force's effort to enhance joint warfighting and how the Air Force is building its capabilities to support joint operations. Four of the eight pages of the chapter discuss how each of the three major branches worked together currently. The next three pages in the chapter discussed how the Air Force is working together closely on procedures and tactics or how it is sharing information via liaisons or other means of communication. The final page of the chapter discusses the Joint Operations Concepts and how the Air Force will integrate into those, again in procedural fashion. The final paragraph of the chapter summarizes the Air Force thinking on joint operations. "As joint concepts are developed, Air Force concepts will follow suit to underpin and support them. The Air Force has been deeply engaged in the JOC

development." The Air Force is not unique here, since all branches are required to be deeply engaged in the JOC by definition. In addition to supporting the Joint Operations development as directed, the Air Force is actively exploring a completely different concept called Decisive Coercive Operations, which is not being explored by any of the other branches. To facilitate the JOC development, the Air Force is sponsoring a war-game to test the JOC Major Combat Operations concepts to see if there is enough detail in the warfighting construct to permit identification and prioritization of transformation requirements for both the Air Force and DoD.

Chapter Four discusses the innovation processes currently in place in the Air Force while also improving DOTMLPF. To accomplish innovation, the Air Force has created the Innovation Panel, which is a champion of a "bright ideas" and works to test them using the scientific method. Subprograms which support the Innovation Panel include: Science and Technology Development through the use of research laboratories and product centers, Air Force Battlelabs, Advanced Technology Demonstrations (ATDs), Advanced Concept Technology Demonstrations (ACTDs), Agile Acquisition, Air Force Tactical Exploitation of National Capabilities (TENCAP), and development of a permanent Office of Lessons Learned. The Air Force offers all of these programs as means to further identify, develop, and prove technology and concepts for use by the Air Force in support of Joint operations.

Chapter Five focuses on Transforming the Air Force Culture and Organization. Just as the other branches are faced with the challenge of greater numbers of missions with little to negative change in personnel numbers, the Air Force is developing new methods to adapt its processes to current and future mission demands. This is accomplished through better personnel management systems, supplemented with Base Re-Alignment and Closing (BRAC) activities. BRAC is working to align warfighting capability with effective realignment of Air Force infrastructure. Finally, the Air Force is working to develop a Warfighting Headquarters concept which will replace the current main operating base concept. The idea is to continue to change the mindset of the Air Force to a more expeditionary mentality. All of these actions are to support Air Force organization and cultural change.

Chapter Six explains how the Air Force will change to a capabilities-based force. The Air Force envisions six types of contingency operations to occur. For each operation type to be executed, the Air Force will establish a set of requirements which will both support the mission as defined by the CONOPS and clearly convey how air and space power capabilities should be used as instruments of military power. The six types of CONOPS are summarized here:

- **Global Mobility** – supports global force projection and sustainment
- **Global Persistent Attack** – is the application of capabilities-based planning to achieve full-spectrum dominance in any region or nation state.
- **Global Strike** – is power projection to enable joint forces to meet access and time challenges across the entire combat environment.
- **Homeland Security** – is to aid in homeland security planning, programming, requirements and acquisition process in support of the National Strategy objectives.
- **Nuclear Response** – is to support the employment of nuclear Triad strategy and ensure safe, reliable and proficient nuclear forces.
- **Space and C4ISR** – is designed to identify and define Space and C4ISR capabilities needed by the Air Force to achieve the right mix of assets to support joint operations in all environments.

Chapter Seven reviews the development of transformational capabilities. Originally, the Air Force identified 16 transformational capabilities the Air Force possesses in support of the DoD directives. Currently, the Air Force cannot meet those goals, but it has broken the 16 capabilities down into six categories which the Air Force will work to dominate in the future.

- **Information Superiority**: The ability to control and exploit information to the Nation's advantage to ensure decision dominance.
- **Air and Space Superiority**: The ability to control what moves through air and space to ensure freedom of action.
- **Precision Engagement**: The ability to deliver desired effects with minimal risk and collateral damage to deny sanctuary to the adversary.
- **Global Attack**: The ability to engage the target anywhere and at any time, to hold any adversary at risk.

- **Rapid Global Mobility**: The ability to rapidly position forces anywhere in the world to ensure unprecedented responsiveness.
- **Agile Combat Support**: The ability to sustain responsive, persistent, and effective combat operations.

All of these capabilities are discussed in detail in the Flight Plan and focus primarily on how the Air Force will accomplish these missions. At the end of the chapter there is a two page summary of what the Air Force needs from the other branches for it to achieve these goals. These points will be discussed in greater detail later in the thesis.

Chapter Eight discusses how the Air Force is working to change its business process. It will do this through both Enterprise Architecture changes and by implementing the use of business best practices similar to those used by commercial industry but defined differently through various Air Force programs. The Air Force also suggests that the goal of its business transformation is to achieve the following:

- A twenty percent shift in business operations resources (dollars and people) to combat operations and new/modern combat systems.
- A work load that enables its people to conduct routine (non-crisis, non-exercise) organizational missions safely within a 40- to 50-hour work week.
- A compression of average process cycle time by a factor of four (relative to current established process baselines).
- The empowerment of personnel and enrichment of job functions.

Chapter Nine discusses what the Air Force believes the six most important areas for science and technology to focus on in for the future: finding and tracking, command and control, controlled effects, sanctuary, rapid air and space response, and effective air and space persistence. Each of those areas is discussed in detail in the Flight Plan and the Air Force wants to develop each of those areas primarily internally.

Chapter Ten is the conclusion and points out all the modernization and benefits the Air Force will bring to the fight in the future. It also points out that these changes will support the Joint Force Commander. Additionally, the Air Force believes it supports the TPG by strongly supporting the C4ISR system and providing combined forces superior situational awareness.

Section 3.3.1 - Analysis of Air Force Flight Plan

The Air Force Flight plan is very similar to the Army's Transformation Roadmap such that it establishes the Air Force as the premier branch leading the DoD in future conflicts as a result of the capabilities developed in the Flight Plan. The Air Force spends the vast majority of its Flight Plan on all the technology and communication systems being explored. But it also states, less than subtly, that after the requirements for the concepts are developed then it will work to implement the transformational plans. The Air Force espouses numerous projects which are novel in the application of technology and communication, but everything the Air Force has must in any case be networked. It employs extremely specialized and limited number of systems. Their benefit is in the communications not just the presence of advanced air systems. So it could be argued that the transformation on which the Air Force has embarked is necessary, regardless of the guidance given by the DoD.

The Air Force points out that the vast majority of its systems will have open architectures. Nearly every system should be an open architecture or it fundamentally fails the concept behind network-centric warfare. The Air Force also indicates that it is working closely with the Joint Forces Command and Concepts; it must just like all the other branches. Again, indicating that the Air Force is working with the JOC and is taking part in mandatory joint evaluations is not something to laud as a transformational capability or plan.

At least twice in the Flight Plan, the Air Force points out that it will support transformation after the requirements are fully developed. This process rule will keep the Air Force capabilities one evolution behind the other branches that work to test and implement new concepts rapidly. But in defense of the Air Force's statements, aircraft and space craft are extremely complex products

and the requirements drive the design of those systems much more closely than other military systems.

The Air Force provides two pages of things the other branches need to do to support the Air Force Transformation. These requirements are similar to the Army's needs, but the Flight Plan also points out that the Air Force is strategically developing its capabilities to ensure independence and give it a level of control over the other branches by maintaining control over C2 and ISR. Additionally, requiring the rest of the DoD to adhere to the Air Force GIG protocols establishes it as the *de facto* leader in that area. In short, the competition between the branches for strategic importance in future conflicts is also reflected in the Air Force Flight Plan.

The Air Force Flight Plan is fundamentally different than the DoD TPG since the Air Force is working to develop six CONOPS plans to develop future requirements before it continues investment in future systems. The Air Force appears to be developing those contingency operations plans with minimal inter-service requirements. In a Joint Forces environment all the branches should be developing contingencies based on a common CONOPs plans.

As mentioned above, there are many subtle issues in the Air Force Flight Plan that also allows the document to appear to better support the DoD directives than it really does. However, an analysis of the issues that are not discussed in the plan reveals many gaps between the DoD TPG vision and where the Air Force is flying.

Section 3.4 Navy Transformation Roadmap

The Navy's Transformation Roadmap provides a very optimistic look at how the Navy both supports Joint Operations and is planning for future JOC, at the same time it argues that the Navy is already providing the best working model for future concepts. Additionally, the Navy views its current Navy Pillars to be fundamentally supportive of the TPG goals and reiterates how committed the Navy is to joint operations. This is of course a consequence of the fact that the Navy and Marines have learned how to work joint operations and considers their relationship a shining example for the DoD and other branches.

Chapter One introduces the overall summary of the how the Navy supports the TPG. The Navy's Transformation plan is unquestionably centered on the concept of Seabasing: the concepts and capabilities that exploit our command of the sea to project, protect, and sustain integrated warfighting from the maritime domain. The Navy's transformational plan is based on four basic Navy Pillars which are condensed titles for broad groups of naval capabilities: Sea Shield, Sea Strike, Seabasing and FORCEnet. The convergence of these four pillars will support the DoD's directed transformational requirements and support the goals of the Joint Operational Concepts. In fact, the Navy views itself as a shining example of a successful joint operational experiment and feels it will provide the model for future joint operations. The Navy provides a concise table that illustrates how its four pillars support the four JOCs at this time.

		Major Combat Operations	Stability Operations	Strategic Deterrence	Homeland Security
Sea Shield	Air & Missile Defense	√		√	√
	Anti-Submarine Warfare	√			
	Mine Warfare	√	√		
	Anti-Surface Warfare	√	√		√
	Force Protection	√	√	√	√
Sea Strike	Deliberate & Time-Sensitive Strike	√	√	√	
	Ship to Objective Maneuver	√	√	√	
Sea Base		√	√	√	
FORCEnet	Networks	√	√	√	√
	Intelligence, Surveillance & Reconnaissance	√	√	√	√
	Common Operational & Tactical Pictures	√	√	√	√

Figure 3-7 Navy's Transformation Crosswalk (Navy 5)

Additionally, the Navy also provides a convenient cross-walk of the Naval Pillars with the QDR's six Critical Operational Goals. This chart shows how the different Sea Concepts directly or indirectly support the four major types of DoD military planning.

		Protecting Critical Bases of Operations	Protecting and Sustaining U.S. forces in Distant Anti-Access or Area Denial Environments and Defeating Anti-Access Threats	Denying Enemies Sanctuary Through Persistent Surveillance, Tracking, and Rapid Engagement With High-Volume Precision Strikes	Assuring Information Systems in the Face of Attack and Conducting Effective and Discriminate Offensive Information Operations	Enhancing the Capability and Survivability of Space Systems and Supporting Infrastructure	Leveraging Information Technology and Innovative Concepts to Develop an Interoperable, Joint C4ISR Architecture and Capability That Includes a Tailorable Joint Operational Picture
Sea Shield	Air & Missile Defense	♠♠	♠♠	♠			
	Anti-Submarine Warfare	♠♠	♠♠	♠			
	Mine Warfare	♠♠	♠♠	♠			
	Anti-Surface Warfare	♠♠	♠♠	♠			
	Force Protection	♠♠	♠♠	♠	♠	♠	
Sea Strike	Deliberate & Time-Sensitive Strike	♠	♠♠	♠♠	♠♠		
	Ship to Objective Maneuver	♠	♠♠	♠♠	♠		
Sea Base		♠	♠♠	♠			
FORCEnet	Networks	♠	♠♠	♠	♠♠	♠♠	♠♠
	Intelligence, Surveillance & Reconnaissance	♠	♠♠	♠♠	♠	♠♠	♠♠
	Common Operational & Tactical Pictures	♠	♠♠	♠	♠	♠	♠♠

Legend: ** - Strongly Supports   * - Supports

Figure 3-8 Navy QDR Crosswalk (Navy 6)

Chapter Two discusses the Navy's Transformation in operational concepts, consisting fundamentally of enhanced employability. In order to support this enhanced employability, six areas are presented which represent change in the Navy:

- **Global Concept of Operations** changes the mindset from Cold War style Carrier Battle Groups to a new forward deterrent and rapid response structure which is comprised of the Carrier Strike Group (CSG) and Expeditionary Strike Group (ESG). These forces will provide global rapid response for wide range of contingencies.

- **Fleet Response Plan** (FRP) is the ability of the Navy to rapidly respond to large-scale threat situations by providing rapid surge capability. This is accomplished by fundamentally changing the fleet readiness cycle to provide quicker surge response times.

- **Flexible Deployment Concept** allows the Navy to alter the length of deployments to allow greater Presidential flexibility while still balancing the number of days at sea.

- **Enhanced Networked Seabasing** (ENS) gives the Joint Force Commanders a platform from which to conduct command and control operations without relying on land-based facilities. This is in direct support of the JOCs and provides a great platform to develop interoperability.

- **Streamlined MAGTFT Scalability** will allow for greater flexibility in providing force projection.

- **Maritime Contribution to Joint Forcible Entry Operations** provides flexible and adaptable warfighting capacities, staying power and self-sufficiency for early entry forces. This allows for a compressed timeline for planning and movement.

Chapter Three is a summary of the transformational capabilities on which the Navy is working at this time. This chapter provides an overview of how each of the four pillars is supported by subprograms. The Navy also shows how the subprograms are developed, funded and conceptually planned to support joint operations. A review of the subprogram can be found in the summary chart provided in Figure 3-8 Navy QDR Crosswalk (Navy 6). The programs are all transformational and include both short- and long-term concept plans. Additionally, the Navy is working to integrate a vast majority of the concepts into the FORCEnet plan to ensure that NCW/NCO is integrated into the transformation. A unique feature in the Navy Roadmap is the inclusion of funding, timelines and metrics for assessment of progress. Similarly to the Air Force and Army, the Navy delineates the support it requires from each of the other branches needed to enable its successful transformation.

Chapter Four describes the transformation process of the Navy culture and processes. Here the Navy breaks down transformation of the culture into four parts:

- **People and Culture** discusses how to develop future Marines and Sailors to embody the transformational values of the future. This includes education, training, leadership and use of reachback capabilities.

- **Naval Support and Joint Concept Development and Experimentation** is the Navy's process to develop and prove future concepts by use of the Sea Trial Process.

- **Science and Technology** use is primarily supported by the Office of Naval Research (ONR) who sponsors technology programs. This aspect of transformation is funded by approximately $500 million annually and is comprised of 225 projects. It must be noted that this quantity is an extremely small percentage of the total Navy budget for 225 projects.

- **Sea Enterprise** is the flagship effort for freeing up additional resources to support military transformation initiatives by streamlining naval business processes. This program is designed to create fundamental changes in the organization of the Navy to practice lean operations.

Section 3.4.1 - Analysis of Navy Transformation Roadmap Flight

The Navy Transformation Roadmap shows exactly how its transformation plans are aligned with the DoD TPG. The Navy transformation is an evolutionary plan, with networking capabilities injected into the system to meet information age requirements. The Seabasing concepts are excellent examples of technology evolution and capability expansion. Each one of the concepts works to provide better capabilities to combatant commanders but it also has other alternative motives. The Navy is working to establish itself as the de-facto Joint Forces leader in the event of war bordering naval terrain.

To ensure the Navy will be the dominate branch in future conflict the Navy plan requires the other branches to adhere to its system requirements so it can provide offshore Command and Control (C2) capability to Joint Forces Command. This is a great capability but fundamentally the Navy is challenging both the Army's and Air Forces's C2 structure. Offshore C2 capability is not new – war was waged in the Pacific during WWII from the decks of battle ships and, in more recent memory, from aircraft carriers. What is unique about this system is merely the information connections. But in its defense, the Navy is working to provide great advances in capabilities for the Joint Forces Commanders just like all the other branches. The question still lingers, which system of C2 will be developed for use in future conflicts? This is the third system presented and each system requires the other branch to conform to the other's standards.
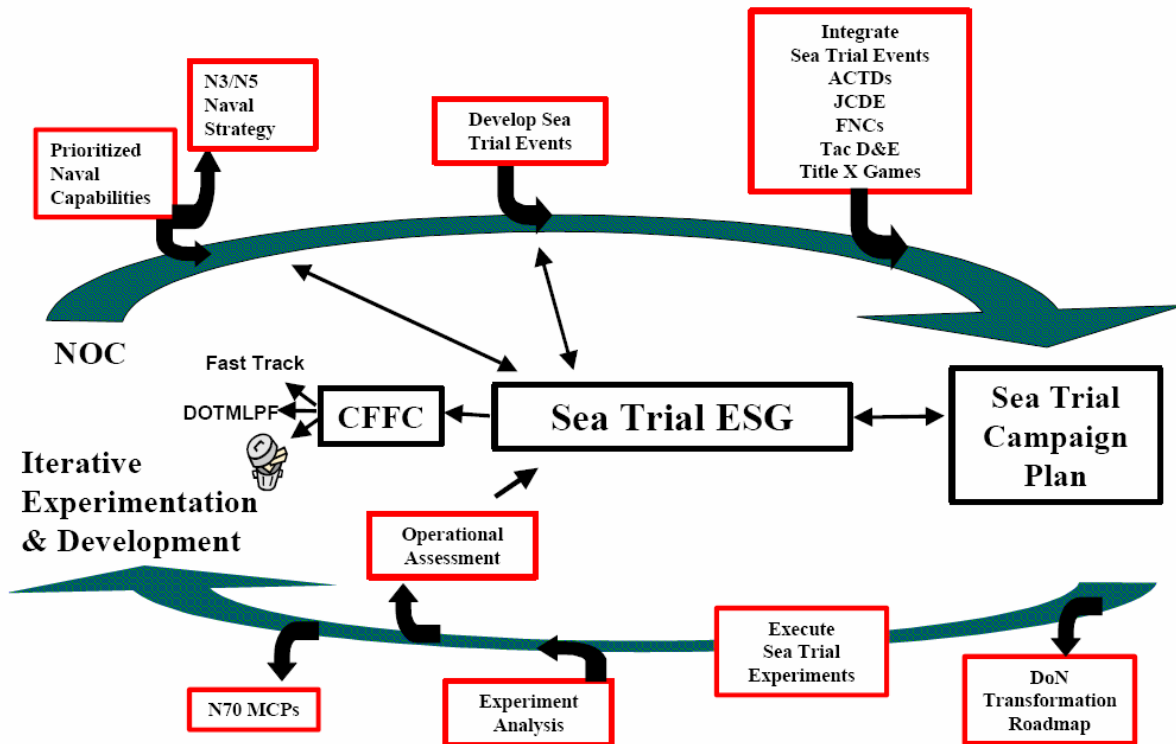
Figure 3-9 Navy Transformation Process

While the Navy is working to evolve and become more efficient, there is still only minimal integration of other branch needs into future Navy development plans. The Navy is balancing its own internally-motivated goals against pressures placed on it by both the DoD and the Joint Forces Command. Figure 3-9 shows the Navy's Transformational process and supports the previous comment by illustrating the late integration of Joint requirements in the development process. This fact is further discussed during the development of the Navy systems dynamics model in chapter 7.

To achieve the DoD vision as espoused in the DoD TPG, there are still a lot of architectural considerations which need to be included by the Navy from both the Army and Air Force. It appears the Navy is working for its own best interests, with only cursory regard for the other branches. This philosophy is in fundamental conflict with the DoD network-centric warfare theory of inter-branch networked coordination.

Section 3.5 - Architectural Comparison from a Systems Perspective

Reviewing the above documents revealed interesting omissions of details have led to divergent paths which each of the branches took to meet the DoD TPG. Some may argue that this allows freedom and flexibility of innovative development but the fundamental feature of NCW tenets requires a higher level of interconnectedness and jointness than is currently available. This has resulted in three completely different development and transformation focuses by the branches than what is intended by the DoD. The DoD TPG calls for joint and interoperable capabilities across all warfighting spectrums. Additionally, it calls for a list of adjectives to be implemented in the future force including, fast, rapid, flexible, redundant, networked, agile, lethal, and responsive. These adjectives can be fulfilled any number of ways, but to be most closely integrated into joint operations, the primary focus of each branch should be on joint operation's first attempt to develop the system with all the appropriate adjectives. This is increasingly not the case, even when branches plan to work together. (Grossman 2006)

To illustrate this point, the Army understands joint operations and the critical role it plays in deployment, sustainment and battle management. Since the Army can independently manage its warfighting capability, its primary focus is on a high level battle management system which happens to fulfill the JOC requirements. This places the Army in a position to lead future Joint Operations since the Joint C2 system may be primarily Army. The Air Force on the other hand is focusing primarily on Global Rapid Response and Sustainment with an ultimate goal of providing the Joint Combatant Commanders with more capabilities. The Air Force talks about better networking but wants the other branches to accommodate its development plans. The Navy also has a focus which is definitely Navy-centric; Seabasing. This concept allows all the above adjectives to be fulfilled through force projection using the Navy's floating sovereign property as the platform. The Navy believes this meets the joint requirements since the Navy platforms can be used as command and control centers to project power without the need for land bases. This is also a way the Navy ensures its future dominance in the DoD system, by providing an C2 structure where it holds the dominate capability in a war. After reading these three documents it becomes apparent there is strong competition between the branches to

position themselves for future funding and prestige. This does not foster an environment which moves towards better joint operations.

Interesting facts arise when the Transformational Architectures process developments are aligned for review. Figure 3-10 Concept Comparison shown below, is a summary of the first to third order breakdown of the transformation process as proposed by each element in the analysis. The Focus describes the primary goal or system to be developed in each level of organization. For example, the Navy is working on the Seabasing concepts focusing on floating national C2 capabilities. The Goal is described as the true end objective when the Focus is completed. Here, the DoD is striving for Joint Warfighting capabilities but each branch is working to keep its dominance in the defense department secured. Each organization describes their plans with continuing levels of clarity by providing a Primary Process and a secondary process view both of which will support the Focus.   This chart shows that each branch has the same goal, which ironically, is conflicting with the essential goal of the DoD. This chart also illustrates that each organization has roughly the same decomposition of concepts which further demonstrates fundamental similarity in transformation management. This alludes to a universal process of transformation management.

Transformation Process Levels	Organization			
	DoD TPG	Army	Navy	Air Force
Focus	Transform to Information Age Rapidly	Develop Global Battle-Management system	Develop Floating national C2 capabilities	Develop Global Strike and sustainment capabilities
Goal	Joint Warfighting	To dominate the DoD with its capabilities	To dominate the DoD with its capabilities	To dominate the DoD with its capabilities
Primary Process View	4 – Pillars support Transformation	5 – Operational Concepts	4 – Operational Concepts	6 – Contingency Operations
Secondary Process View	6 – Operational Goals	6 – Operational Themes	11 – Sub-groups	6 – Technical capabilities

Figure 3-10 Concept Comparison

Looking closer at these transformation plans reveals further insights into the process the transformation plans are describing. To illustrate further trends in the transformation plans a process analysis method introduced by M.I.T. Professor Ed Crawley[22] is used below. This chart helps organize a comparison of the transformation architectures and it also distills out trends and conflicts between the branches and the DoD.

The charts are divided into three primary attributes: product, design process and implementation process. Each of the primary attributes then addresses the why, what, how, where, when, who and how much questions to help draw some further conclusions about the process. For clarity, the charts will have branch agreement with the DoD highlighted in green and branch goals divergent from the DoD highlighted in red. The amount of agreement and disagreement is another way to illustrate that the ultimate objectives of each branch relative to the DoD guidance.

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[22] Professor Ed Crawley developed this method while teaching System Architecture at Massachusetts Institute of Technology, called the "Just Another Method" aptly named a JAM Chart.

Attribute		DoD TPG	Army	Navy	Air Force
Transformation Product	**Why?**	- To ensure national dominance in future conflicts	- To ensure Army dominance in war fighting and provide maximum capability to the JOCs.	- To ensure Navy dominance in war fighting and provide maximum capability to the JOCs.	- To provide the JOC with Global Air Dominance
	What?	- A completely interconnected system of communication for rapid C2 and situational awareness	- A completely networked battle-management system integrated directly to every asset on the battle field.	- A completely networked floating command and control platform for JOC employment.	- A completely networked suite of air assets which provide rapid global dominance on short notice for extended durations.
	How?	- Through Joint directives and by branch development processes.	- Through the Future Combat Systems project including the Battle Management system	- Through the Seabasing Concept which integrates increased situational awareness with target engagement capabilities.	- Through technology development in both air and space systems and reform in business operations
	Where?	- Globally	- Globally	- Globally	- Globally
	When?	- In the future – specified between 1 year to 20 years depending on the technology gap	- Unspecified time frame 1 – 20 years	- Unspecified time frame 1 – 20 years	- Unspecified time frame 1 – 20 years
	Who?	- All Branches of the military	- The Army	- The Navy	- The Air Force
	How much?	- N/A	- N/A	- N/A	- N/A

Figure 3-11 Transformation Product Attribute Comparison

Figure 3-11 Transformation Product Attribute Comparison, illustrates the fact that each branch is working to produce a different product which they each believe will be the backbone architecture for the rest of the Department of Defense. It also shows that while each of the branches is working to provide increased capability for future conflicts, there is a obvious competition over the command and control structure that will be used. The product the DoD is trying to develop is

a joint operational and C2 environment, the problem is each branch is working to develop a different product. This is logically counter productive to joint operations.

Attribute		DoD TPG	Army	Navy	Air Force
Transformation Design Process	Why?	- National need	- To meet TPG Directives and to maintain branch world dominance	- To meet TPG Directives and to maintain branch world dominance	- To meet TPG Directives and to maintain branch world dominance
	What?	- Warfighting capabilities concept development process	- Develop a transformation design method – example Striker Brigade	- Develop advanced requirements gather to ID future ship needs	- Identify future mission requirements to develop a process for study
	How?	- Through the use of knowledge workers and growing a culture which fosters innovation	- Through concept development and battlelab testing. Plus, developing concepts based on real-world lessons learned.	- Through concept development and naval research testing	- Through Contingency Concept development to identify mission requirements to build to specifications.
	Where?	- In the military system	- Across the entire Army	- In the Naval research laboratories	- At the Air Force Research Laboratories
	When?	- Now forward	- Now Forward	- Now Forward	- Now Forward
	Who?	- National Research and Development programs	- Combat feedback, Army Research Labs, Army local and National Training Centers	- Naval Laboratories and research facilities.	- Air Force Laboratories and through best business practice studies in the commercial world.
	How much?	- N/A	- N/A	- N/A	- N/A

Figure 3-12 Transformation Design Process Attribute Comparison

Figure 3-12 Transformation Design Process Attribute Comparison, illustrates the fundamental fact that each branch uses a similar process to develop transformational capabilities and technologies. By using their research organizations to develop and plan future concepts each branch is directly supporting the DoD directive. This confirms that the development process in

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the DoD and the branches is a robust system and is capable of producing products which meet DoD and branch requirements.

Attribute		DoD TPG	Army	Navy	Air Force
Transformation Implementation Process	**Why?**	- Operational National needs	- TPG directed it and identified through current world experiences.	- TPG directed it and to provide future capabilities to the JOC	- TPG directed it and to provide future capabilities to the JOC
	What?	- Develop transformation Implementation goals	- Develop a culture of innovation and transformation	- Develop a culture of innovation and transformation	- Develop a culture of innovation and transformation
	How?	- Through the 4 Pillars of Transformation supporting the 6 Operations Goals	- The development of the new Stryker Brigade provided the proof of implementation process for use by the Army	- Through the development of 4 operational concepts	- Using a 6 CONOPs framework for developing future requirements and implementation processes.
	Where?	- In the Joint Forces Command and at the Branch level.	- At the Army Laboratories, training centers and research and development labs.	- At the Navy Laboratories, training centers and research and development labs.	- At the Air Force Laboratories, training centers and research and development labs.
	When?	- Immediately – 20 year timeline, but annual reports will be review by OFT	- Immediately – 20 year timeline, but annual reports will be review by OFT	- Immediately – 20 year timeline, but annual reports will be review by OFT	- Immediately – 20 year timeline, but annual reports will be review by OFT
	Who?	- Secretary of Defense, Chairman JCoS, JFCOM, all service chiefs and all branches	- All levels of leadership in the Army are charged with looking for Innovative processes for the organization.	- At the Naval Laboratories and through Leadership initiatives	- At the Air Force Laboratories and through business and leadership initiatives
	How much?	- N/A	- N/A	- N/A	- N/A

Figure 3-13 Transformation Implementation Process Attribute Comparison

Figure 3-13 Transformation Implementation Process Attribute Comparison, illustrates the fact the each branch uses a similar implementation process for transformation. Figure 3-13 also illustrates that the implementation of each branch is different than the DoD, however that is expected in this case. Each branch has different missions, cultures and requirements so they can not be expected to implement transformation in the exact same way as the DoD envisions it. But the figure also illustrates that each branch is currently quite capable of developing their system of choice.

These three architectural charts show that there is significance redundancy in the development and acquisition process and each branch is working to field a different substantial networked system. The fact that each branch is fully capable of developing a concept, testing it and implementing it shows that each branch has the same capabilities and they are therefore redundant. Redundancy is a force of resilience in a organization but at the same time too much redundancy equates to waste. And yet, several redundant concept development systems are good since it helps develop innovative solutions. While, on the other hand, redundant acquisition processes may just be waste in the system. The fact that each branch is working to field a different network is also very troubling since the C2 is the most important aspect of NCW tenets that three independent C2 systems will prove to be harder to integrate after they are developed since Metcalf effect also works for complexity of integration. When it is time to integrate the three major C2 systems, each system with its large number of connections will result in greater integration difficulties and greater probability of an unstable system. (Moffat)

In summary, the Army, Navy and Air Force have each developed a transformational roadmap with objectives to dominate the leadership position of future conflicts and all increase the capabilities of the forces. Increasing the warfighting capabilities of all the forces is a definite goal of the DoD, but the ability to gain the multiplicative advantages of a better integrated and interoperable force is not fundamentally supported by this architecture.

The DoD does not tell the branches how to work together rather it provides a joint operational concept which the branches are to develop their capabilities around. This would work if each the

branches wanted to work under the Joint Forces command but the desire to maintain dominance in each of their respective domains has caused a competition to occur between the branches over the best architecture to use in the future joint fight. This result is not due to an inherently subversive leadership climate but based on how the current incentive process works and the basic culture/history of the general officer development. The combination of these two effects fundamentally limits interoperability as each branch develops its own plan for which the Joint Combatant Commander could select from. This may be beneficial if the conflict will be waged primarily from land or sea or air, but will not be the most advantageous arrangement should a protracted three domain (air, sea, land) conflict occur.

There are many conclusions presented here but they will be further supported and explained in the following dynamics models. It can be summarized though that the current acquisition process and transformational architecture is fostering inter-branch competition. This competition will slow the convergence of a final national warfighting information architecture that fulfills all the adjectives requested by the Department of Defense. Finally when the above charts are looked at in detail it becomes very clear that competition is in full swing and significant changes in DoD organization will be required to bring the branches into sync and produce the desired Information Age domination that the Secretary of Defense envisions.

PART II Analysis of Current Transformation Architectures

Chapter 4 – Introduction of the Analysis Method

Part I focused on NCW, the DoD TPG, and each of the branch transformation plans. Part I also provides the background information that identifies where the DoD wants to go and the theory behind such a radical transformation, which is embodied in the NCW Principles. The analysis of each branch's transformation plan examines how the transformation is currently architected to verify that espoused plans will actually achieve the DoD vision. Part II of the thesis will provide the analysis of Part I's information.

Part II of the thesis will introduce the use of systems dynamics as a method to look at the total transformation system to evaluate it from a policy level perspective. Use of the system dynamics model is not commonplace, but the best single summary of what systems dynamics does is captured in the below quote.

> *"The approach proposed uses the modeling techniques of system dynamics. The field of system dynamics, created at MIT in the 1950's by Jay Forrester, is designed to help decision makers learn about the structure and dynamics of complex systems, to design high leverage policies for sustained improvement, and to catalyze successful implementation and change. Drawing on engineering control theory and the modern theory of nonlinear dynamical systems, system dynamics involves the development of formal models and simulators to capture complex dynamics and to create an environment for organizational learning and policy design."*(Leveson)

System dynamics is a technical method which provides a systematic means of tracking the stocks and flows of material, money, effort or time. It also allows the inclusion of factor effects on the stocks and flows. A factor effect could be anything which has an effect on the system. This process will develop a graphical model which will link the numerous effects on the transformation system. Once these models are developed, a new analysis of the transformation plans will appear for comparison and study.

This new perspective will change the focus of the transformation from a purely branch specific or DoD specific plan to a new view of governmental policy on transformation. This change in scope will allow inclusion of any factor to the system dynamics model which has some effect on the transformation process. The model must have some stock and flow[23] elements in it for analysis and so our model will use the acquisition system to measure transformation.

There are numerous reasons to use the acquisition system as a basis for measuring the transformational activities but most importantly the acquisition system also has the most factors which are directly linked to transformation.

Section 4.1 - The Goals of Transformation

The goal of the transformation was summarized in the DoD TPG and in other documents supporting the transformation.[24] Most notably the Office of Force Transformation provides the best packaged documentation supporting transformation. But, the purpose of this thesis is to look at the enterprise architecture of the DoD and evaluate its fundamental ability to transform. One of the goals of the transformation is to have an agile and flexible military culture capable of transformation, it may not be apparent at this point that the same organization that espouses those goals established rules preventing it. Government regulations and personnel laws inhibit that espoused flexibility.(Williams) Another goal of the transformation is to develop a military culture and architecture which is capable of transformation and agility. Unfortunately some of the transformation required and envisioned by the Secretary of Defense may require greater change of the military system than even that office can achieve.

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[23] "Stocks and flows track accumulations of material, money and information as they move through a system. Stocks include inventories of product, populations and financial accounts such as debt, book value, and cash. Flows are the rates of increase or decrease in stocks, such as production and shipments, births and deaths, borrowing and replacement. Stocks characterize the state of the system and generate the information upon which decisions are based. The decisions then alter the rates of flow, altering the stocks…" (Sterman 102)

[24] The website http://www.defenselink.mil/transformation provides a long list of transformation documents.

Section 4.2 - Unbounded Analysis

This new scope of analysis on the transformation, from an independent academic source, brings a different perspective than a report provided by either a DoD source or another federally funded research organization. This perspective has no limit on scope or scale of possible solutions or recommendations, which frees the suggestions for greater creativity. A common heuristics quote suggests giving an unsolvable problem to one who does not know that it is unsolvable; they will often naively find a solution. This thesis recommends major governmental change which could fundamentally alter the transformational capabilities of the Armed Services. Those recommendations, as potential possibilities, should be seriously considered.

In unbounded analysis, the complexity of the system could quickly grow out of control. When considering this model, the use of human capabilities studies and the application of Human and Automation Laboratory findings help construct this model on a scale that can be understood, quickly, on a conceptual level. Common military heuristics discuss the span of control should be between 3-7, depending on which article is read. In the classic psychology paper, *The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information*, presented by George A. Miller in 1956 from Harvard University he finds that humans are capable of managing, 7 plus or minus 2, concepts at a time without losing track of the effects of the elements upon each other and the system as a whole. (Miller) This fundamental cognitive limitation is one reason discussions on governmental policy reform are often incomplete or limited in scope to allow people to understand only the basic ideas. Cognitive limitations are important to consider during complex explanations. The system dynamics model uses the widest human information bandwidth to understand a complex system, the visual bandwidth. Since a model can visually manage any number of components, the human is then allowed to review 5-9 elements at a time and continue to build connections and inter-reactions. Over a period of time, these connections are aggregated and a systems dynamics process is revealed. To stay within cognitive capability, these models only use five different fundamental elements for analysis. This proves to be sufficient to clearly explain the complex dynamics of the government system.

Section 4.3 – Mechanics of the Model

System dynamics identifies effects in systems which are reinforcing factors. The ability to identify these effects is extremely important when conducting enterprise architecting. The DoD acquisition system has numerous control loops in it and patterns which are both reinforcing and rather counter productive. The rivalry between the branches can be healthy at times since they are each independently working to maximize the value they each provide to the Joint Forces Commanders, but they are doing it at the expense of working together and at the expense of other critical systems in the acquisition process.

In addition to looking at inter-branch competition, the systems dynamics model will look at how politics, culture and economics play in the acquisition process and ultimately the transformation process. Finally, the additional wild card that is not significantly discussed anywhere in the transformation process, other than how to do business, is the integration of the industrial partners of the branches. The commercial companies have a large effect on many other factors in the system dynamics model and are hardly discussed in the DoD and its transformation architecture. These are all elements which have very powerful feedback loops in the transformation process but are not discussed in the transformation plans of the branches. Those issues will be included in the analysis.

The model is comprised of five basic components: the effects variable, the effects connection, DoD Transformation Pillar stocks, transformation stocks and flows. The effects variables are any of the words in the model which are connected by an effect connection. An effect is anything which has an influence on other connection. This model considers any effect to include political effects, cultural effects, monetary support, leadership support or lack of support, and any other effect or factor that should be considered in the model which will have an influence on the acquisition or transformation process. The effect connection is the thin blue line which shows on what elements in the model the effect factor directly touch.

A series of connecting effects factors and effects connectors show that there are secondary effects pushed through the system through the effects connectors. The green/circle elements in

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the model are the DoD Transformation Pillars. These are included to show the link between the transformation pillars and how they are stocks of supporting or blocking effects on the transformation system. The Pillars are connected by flows, which are the double lined arrows that include valves described by words which explain how the flow moves. For example, a stock of concept developments requires a collection of technical requirements to occur which will allow the concept development stock to move to another stock point where technical requirement generation will be needed before the concept could move further. The flow should be conceptually thought of as a collection of something which needs another effect on that stock to move it. Just like the real world having great ideas is one thing, but having the money or political support to move the idea to future testing is another. Therefore every stock requires some other factor effect to be added to it to keep it moving. This results in a surprisingly realistic model of the real acquisition process. Since either money, necessity, political or military support is required at every step of the development acquisition process, this is the same perspective we will apply to the whole DoD Transformation process. The valves are on the flow and it is important to understand that the valve could be opened or closed based on the effects on that valve by the system. We now have all the basic components which in a simplified manner will yield emergent properties in the DoD Transformation process.

Chapter 5 - Department of Defense Transformation Plan Analysis

The Department of Defense Transformation Planning Guidance describes the vision for transformation as requested by the Secretary of Defense in conjunction with the Office of Force Transformation. This System Dynamics model, shown in Figure 5-1, represents the DoD Transformation architecture and dynamics as described in the DoD TPG. This could be considered the "ideal vision" for the transformation and represents what the DoD would like to have happen. The system dynamics model is a perspective of the transformation using the DoD TPG as the basis for the model and only includes factors and elements discussed in the DoD TPG. Numerous factors were discussed by the model and a significant portion of the document was dedicated to assigning responsibilities to subordinate organizations Those are not included in the model since this is not an organizational chart, it is an effects-on-process model. Additionally this model could be given increasing levels of complexity, as could all the models in the thesis, but this model provides only the necessary connections to illustrate the emergent properties of the DoD transformation architecture as espoused in the DoD TPG.

Included on the bottom of the models is a generic product development process to keep the transformation aligned with a more familiar mental model most people have. The DoD Transformation is in effect a massive product development process and it is important to not lose track of where in the process the transformation activities are in the generic development process.

Department of Defense Transformation Architecture and Dynamics Model - Ideal Vision

Figure 5-1 DoD TPG Architecture - Ideal Vision Model

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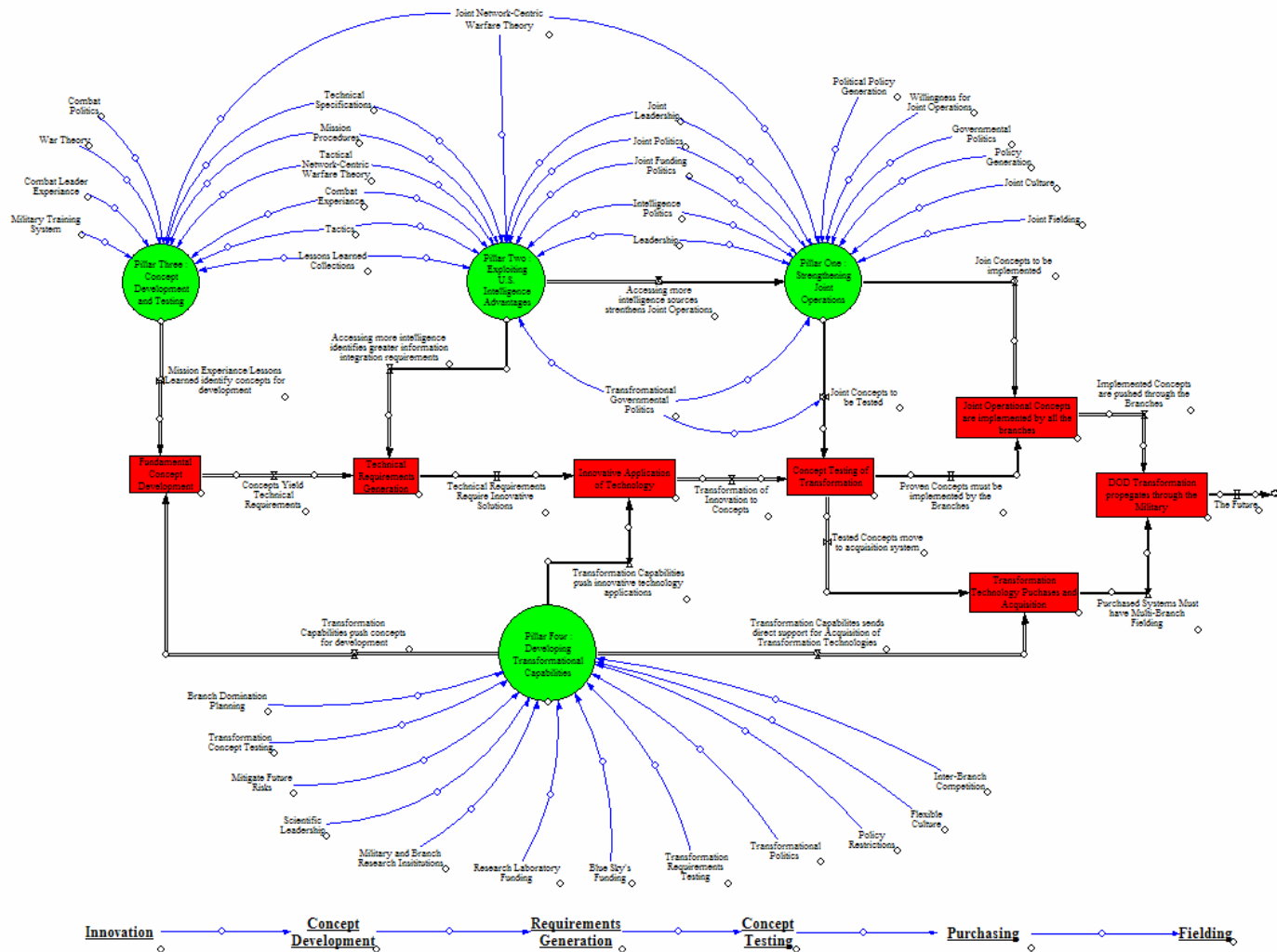
Section 5.1– Description of the DoD Transformation Vision

The system dynamics model of the DoD TPG Architecture is comprised of three major groups which represent the major factors in the transformation process. The first major group is the acquisition stock and flow elements which are described by the red boxes. This single acquisition development process represents all the branches of the military in a process model view only. Later views will show how each of the independent branches operates inside the DoD transformation process. The acquisition development process is supported directly by the Four Pillars of Transformation which are shown as green circles. They also provide stock and flow effects directly onto the acquisition development process. Finally, all the factor effects outside the stock flow system are shown above or below the stock flow models. They represent all the elements which have a nearly direct effect on the previous stock/flow elements. In the following figure the stock/flow process will be discussed from the DoD TPG Ideal Model.
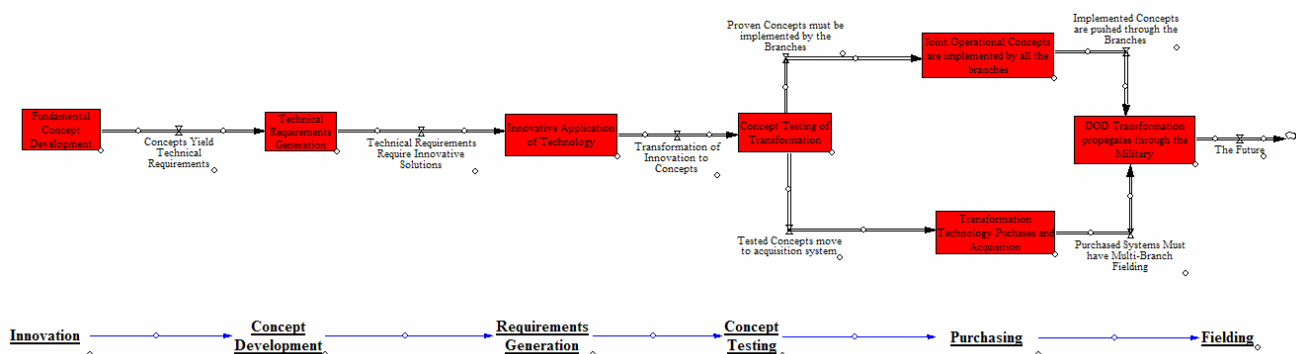
Figure 5-2 DoD TPG Acquisition Stock/Flow Section View

Figure 5-2 starts with "Fundamental Concept Development" stock which is moved forward in the process by developing the technical requirements for the fundamental concept. After enough technical requirements are developed, the concept is allowed to "flow" through the gate illustrated by the hour glass symbol on the arrow. A stock of "Technical Requirements Generation" occurs, and the concept development process continues to refine the concept by further refining the requirements. This is the iterative loop, better known as the spiral development process. This process is also used on concepts to grow and refine the requirements as necessary.

The next step in the process is a flow gate, which has identified sufficient technical requirements with enough resolution to require the application of innovative technology solutions. This is the flow gate which requires technology from industry or research organization to contribute to the problem-solving process needed to move the concept through another gate in the process. The next stock is the "Innovative Application of Technology." As mentioned previously, the requirements will necessitate innovative technology applications and architecting the idea into a working concept. The "Transformation of Innovation to Concepts" gate allows concepts which have both refined requirements and acceptable technology applications to move forward to another stock, "Concept Testing of Transformation." This point in product development concept phase is different than in the military acquisition process, as espoused by the DoD TPG. Here the "Concept Testing and Transformation" stock has to be supported in two places to move forward.

First the "Proven Concepts must be implemented by the Branches" gate flows to the "Joint Operational Concepts are implemented by all the branches" stock. At the same time, "Tested Concepts move to acquisition system" gate must flow to the "Transformation Technology Purchases and Acquisition" stock. This is where the idea of both joint concepts and joint purchasing fielding provides the stock of "DoD Transformation propagates through the Military." It is when both the acquisition system and the joint concepts are acting and purchasing along the same innovative concept that the true transformation occurs. If it is just a concept, then it is never more than an idea, and a concept employed without the right tools is doomed to failure. Additionally, purchasing technology without integrating it into the proper concepts is merely an evolution of tools with only technology being used to increase the effects of the military.

While this may appear trivial, understanding that both concepts and tools when employed in innovative and revolutionary ways is when true transformation occurs. This is a critical step the in the DoD TPG and is well understood in the document.

The below figure shows the application of the Four Pillars as described by the DoD TPG, represented here without the additional factor effects shown. The Pillars are considered stocks just like the red boxes in the acquisition process, but they embody additional factors the DoD considers essential to support the transformation process. Using that definition, they are applied and considered as stocks also. The Pillars represent support or resistance to the transformation process. The figure below shows how they work to support the transformation process.

Since the stocks and flows have been discussed in previous sections, it is obvious in the figure how the stocks and flows around the Pillars work. What is most interesting about the Four Pillars is their multiplicative effect on the transformation process. In the red blocks, the stock moves out with one flow, with the exception being the "Concept Testing and Transformation" stock, but that is an anomaly for this type of system. The Pillars have multiple flows out with the exception being Pillar Three. Pillar Three only has one point in the system where it substantially helps the transformation: at the beginning, so it is not a multiplicative stock. But one could argue that effective concept development may be one of the most important steps in the development process since it is required to start the whole thing. The other Pillars are all multiplicative stocks and feed into the acquisition transformation process at multiple places. This is essential to transformation success since there must be continued support for each concept as it is moved through the product development process.

For example, Pillar One requires strengthening joint operations, which means joint operations must have both support and work with Pillar One to meet its required goals. Additionally, since Pillar One must work with Pillar Two, stock flows from Pillar One to Pillar Two and provides additional stocks in the acquisition development process. This is because the concepts are joint concepts and require technical integration and it must be a joint operation/application to support the flow gate "Joint Concepts to be implemented." While difficult to describe, the bottom-line is shown graphically. When enough support from the pillars is gathered, there will be multiplicative support for the acquisition/transformation process. The challenge and goal is to ensure that ample support at the pillar stock level is available. Assuming all elements in the

model as shown are working positively both politically and financially with the appropriate leadership support this system as espoused by the DoD TPG should be very successful.
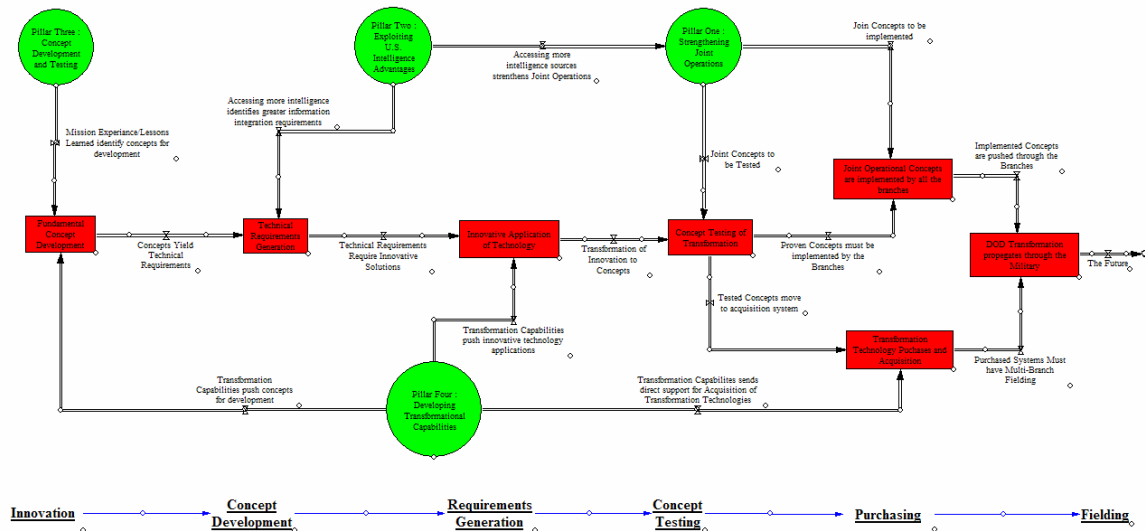
Figure 5-3 DoD TPG Pillars View

Section 5.2 - Dynamics of the Architecture

When the entire dynamics model is reviewed from the perspective given in Figure 5-1 DoD TPG Architecture - Ideal Vision Model, the additional factor effects are included in the system and it becomes significantly more complicated. Yet this model is still significantly simplified to allow for conceptual understanding of the transformation process. Through the course of this thesis, NCW theory has been extensively discussed and its effect on the model is extensive. If the Joint Network-Centric Warfare Theory were not included in the DoD TPG, the model would look nothing like this current model but rather a more typical waterfall type development process. The requirement of having the three pillars on one side of the process is essential to the NCW Theory. It is the integration of innovative concepts, with the intelligence agencies and joint military operations which is the heart of the NCW Theory and will be the backbone of the transformation to the Information Age. The connectedness of the effects factors between Pillars Three, Two and One is essential to develop useful NCW capabilities. The model shown here illustrates both how NCW is well understood by the DoD and that the DoD recognizes how it must be constructed to get the NCW effects as espoused.

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Pillar Four of the DoD TPG plan is also a critical pillar in the process. This is arguably the most important pillar since it provides a three fold supporting effect to the transformation acquisition process. Developing transformational capabilities supports concept development, innovative technology applications and the actual acquisition of the new equipment. Pillar Four also is fundamental in developing the cultural change in organization to help ensure flexibility in the branches and agencies. While it is not shown with a connection to Pillar One and Pillar Two, it is without a doubt connected to those pillars by its effects in the organizations. But Pillar Four is placed on the other side of the development process because it is more of a working and doing element in the transformation process, while the other three pillars are more concepts and plans. If the technology, innovative solutions and acquisitions did not occur, then the system will not transform but merely evolve.

The emergent property of this model reveals the insight and understanding of the DoD and that the process should work as described in the DoD TPG. It also shows that there are political and cultural issues to contend with, but they are considered and included in model none-the-less. The model also compares nicely with the standard product development process and represents very similar thinking to established development processes.

This model and the DoD TPG does not spend much time at all discussing two extremely important aspects of the transformation process, the effects of commercial industry on the process and logistical issues associated with the transformation. While the DoD TPG does mention a shortened "Logistics Tail" and other subtle indications that logistics are a concern there is very little specific discussion about how to manage those issues. While DOTMLPF is discussed many times and it could be argued that the logistics and business aspect of the transformation address these issues, they are left rather ambiguous in the DoD Ideal Model and will require follow up of those issues in later sections of the thesis.

Chapter 6 - Army Transformation Roadmap Analysis

Using the Army Transformation Roadmap as the primary document to develop the Army's Transformation Dynamic Model Figure 6-1 Army Transformation Dynamics Model**Error! Reference source not found.** represents the real dynamics of the Army transformation process. The model is at the core similar to the DoD TPG – Ideal Model but has several significant differences. The first significant difference is the movement of Pillar Three to the bottom of the product development process. Again, the red boxes represent the acquisition product development process and have significantly the same steps in the development process. The second major difference from the DoD TPG model is the movement of the "Integration of the Joint Forces Concepts" box. These two major changes produce a fundamental difference in the model and the Army acquisition process. These changes will be discussed in greater detail later in this chapter.

The Army Model includes numerous factors which are outside of the Army's direct control but the model shows how the Army deals with those interactions and the requirements placed on it by the DoD TPG. Additional outside factors on the Army system will be added in later models. This model also illustrates how the Army works to mitigate factor effects on its system which are outside of Army control. An example would be Joint Forces Concept development imposed on the Army Acquisition system. The Army system works by taking the guidance given by DoD TPG and includes it in its system but does so in the most minimalistic way possible.

When reviewing the Army Model it is important to understand how the real world affects the system and the difference between the "as briefed" version and what really happens. This model shows the "as briefed" version from the Army Transformation Roadmap but also illustrates how the Army is working to implement the DoD TPG. In summary, the Army is implementing the DoD TPG according to the solution neutral guidance given by the DoD.

Army Transformation Dynamics Model

Primary Goals : Field The Battle Management System and the Future Combat System

Office of Force Transformation Guidance

Joint Culture

Political Policy Generation

Transformational Governmental Politics

Willingness for Joint Operations

Joint Leadership

Governmental Politics

Pillar Two Exploiting U.S. Intelligence Advantages

Joint Politics

Pillar One Strengthening Joint Operations

Policy Generation

Joint Funding Politics

Joint Fielding

Intelligence Politics

Joint Network-Centric Warfare Theory

Army Senior Leader Vision

Army Senior Leader Concept Planning

Army Battle Management System Capitalizes on Joint Operational Concepts

Inter-Branch Politics

Battle Management System Requires Joint Operations Integrations accept Army interface

Transformational Politics

Policy Restrictions

Army Intelligence Needs Improve Joint Operations

Future Combat System and Concept Development

Technical Requirements Generation

Concepts Yield Technical Requirements

Army Compliance of Joint Operational Concepts are required of Tactical Army Operational Concepts

Political Motives to support project

Combat Politics

Congressional Funding

Innovative Application of Technology

Technical Requirements Require Innovative Solutions

Tactical Army Concept Testing of Transformation

Army Funding of Transformation Projects

Combat Experience/Lessons Learned identify concepts for development

Transformation of Innovation to Concepts

Transformation Technology Purchases and Acquisition

Army Transformation propagates through the Army System

The Future

Technical Specifications

Combat Experience

Pillar Three Concept Development and Testing

Fielding of New Systems

Tactics

War Theory

Army Transformational Capabilities push innovative solutions

Tactical Network-Centric Warfare Theory

Lessons Learned Collections

Combat Leader Experience

Mitigate Future Risks

Transformational Capabilities Push Concepts for Testing

Pillar Four : Developing Transformational Capabilities

Transformational Capabilities support the Acquisition of new Army Systems

Transformation Concept Testing

Military and Branch Research Institutions

Integrate Cutting-Edge Business Practices

Inter-Branch Competition

Transformation Requirement Testing

Blue Sky's Funding

Flexible Culture

Research Laboratory Funding

Military Training System

Scientific Leadership

Innovation — Concept Development — Requirements Generation — Concept Testing — Purchasing — Fielding

Figure 6-1 Army Transformation Dynamics Model

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Section 6.1- Army Current Architecture

At the core of the Army transformation is the acquisition process. It is very similar to the DoD – Ideal Model but the placement of the Joint Concepts block is more than halfway through the system and it is primarily focused on the Army Battle Management System which incorporates the Joint Operational Concepts. This fundamental difference means the Army is not considering the Joint Operational Concepts until the product in acquisition is nearly completed, or at least after the significant design parameters of the product have been established. Joint Operational Concepts are considered during concept development in the acquisition process but it is on the level of email traffic or requirements documents being passed for review. There is a very limited connection between Joint Operational Concepts and acquisition concept development at the initial stages of product development. A quick example is the Stryker Brigade. It was envisioned to be a rapid intern vehicle platform, and it was selected since it fit the majority of the concept requirements. That is not a product developed from the ground up on a Joint Concept. Others would argue the F-111, was but that project was marred by political influence more than technical/military requirements. Others would argue the Joint Strike Fighter is good example of joint concept and product development. The history of that project illustrates clearly the merits of that system and its development architecture.
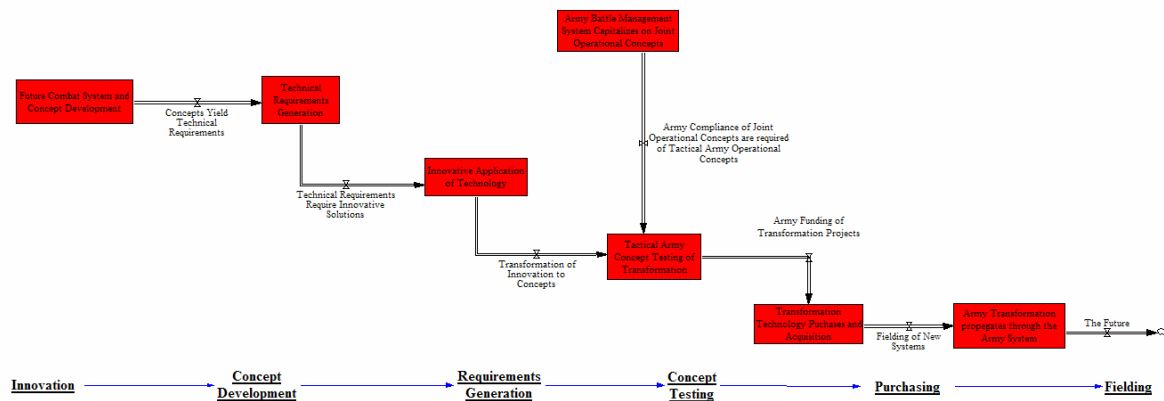
Figure 6-2 Army Transformation Stock/Flow Section View

The integration of joint operational concepts in the early development process of the branches is a fundamental feature in the development of the next generation defense acquisition architecture. To have joint functional concepts integrated late in the design process results in significant network-centric warfare theory principles being left out of the design at worst or added later as a modification at best. Developing an integrated joint concept with technology which maximizes tactics, operational theory and technology all in one system is the ultimate goal of the new acquisition system. Currently the Army is successfully getting two of those three elements in its development system; tactics and technology.
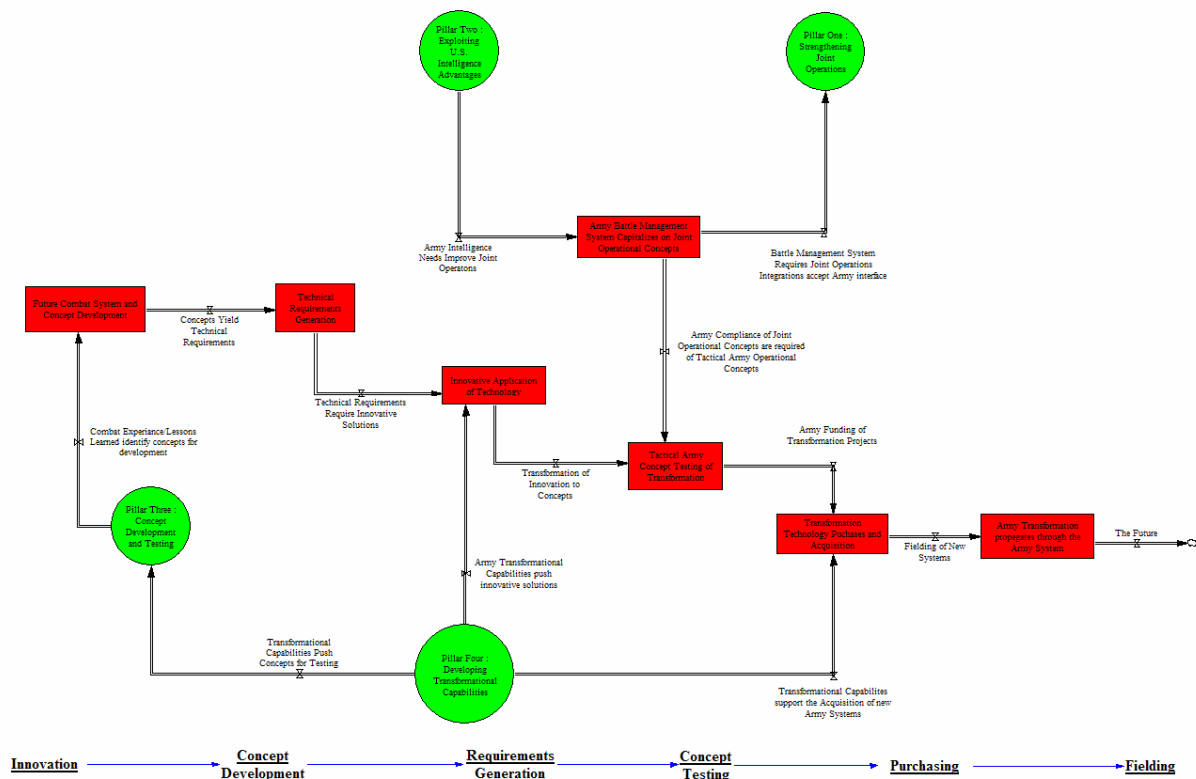
Figure 6-3 Army Transformation Pillars View

Another fundamental difference between the Army and DoD models is the placement of Pillar Three in the models as shown in Figure 6-3 Army Transformation Pillars View. The Army clearly and logically moves Pillar Three next to its transformational capabilities, then integrates it with the product development process and transformation capabilities pillar. This move is for several reasons, the biggest of which is the use of Army Lessons Learned. In fact, the Air Force

mentions that concept and its possible application in the Air Force Transformation Flight Plan. The advantage of this configuration is it leverages both of the Pillars Three and Four to help the acquisition product development process. It is a successful system since the Army, and other branches for that fact, are able to produce very technically complex and successful individual platforms for their respective branches.

However, in the information age, it is not necessary to build thousands of tanks, planes or ships, but rather to build completely integrated combat systems with similar fundamental architectures and key components. The Army system minimizes the integration of other branch requirements by pushing the joint forces concepts late in the development process and only allows limited connectivity. The concept development and testing process of the Army, as currently architected is a very capable and effective system. The concern is how to better integrate joint forces requirements and develop systems which will better allow the principles of NCW to emerge. This current architecture will not allow that to occur naturally.

Another key issue with moving Pillar Three near Pillar Four is the lack of connections between Pillar One and Pillar Three. This is a poor architecture if the point of NCW is to find innovative concepts using the intelligence agencies of the US to our advantage. It is common knowledge in both the military and commercial communities that users are the innovators of the world. (Hippel) If the vast majority of our military leaders and soldiers are exceedingly distanced from our intelligence communities, the national ability to tap the creativity of our soldiers, sailors and airmen will be neglected. The intelligence communities have a unique culture that needs to be modified or the interface improved. If not, our best users of the information will not even have an idea of what information is potentially available and a tremendous advantage will be missed. This is a great example of how the DoD TPG is espousing a great conceptual idea but does not have the ability to enforce or change that fact.

Section 6.2 - Dynamics of Army Transformation Architecture

Overall, the Army Model shows what the Army leadership wants: to maintain control over their own process. Their thinking is they know best and should decide what is best for the Army. This thesis does not argue that point, but only illustrates that the Army needs to integrate capabilities across all the branches. The best option for all the branches is to maximize the integrated development and tactics used in Joint Operations, and especially concerning issues around NCW Theory. The Army wants to architect its own command and control system and get the other branches to interface with it. This is an attempt to ensure the Army is the lead branch in future conflicts and hopefully secure more funding for future Army modernization. While it is noble to constantly strive to provide the best possible capabilities to the DoD, it is also a challenge to balance the tendencies to develop greater capability or developing Joint Capabilities. Again, cultural issues in the branches and at the joint forces level appear to be the primary factors for deciding this balance. (Grossman)

The Army model represents how it will work to meet the requirements placed on it by the DoD TPG and still maintain its own independence while also leveraging the other branches to work in the Army system. This goes fundamentally against the DoD NCW Theory and limits the transformation of the DoD to the Information Age Architecture.

Finally, there is little discussion on logistics and business practices. These are fundamental gaps in the architecture which are found by their omission. Realizing gaps of omission are often the most difficult ones to spot, but here the model allows enough factors to be discussed, organized and illustrated that additional considerations can be included and tracked. The integration of commercial industrial partners is only discussed by changing the acquisition process and business processes. Fundamental regulation changes are going to be needed to address these issues. This will be discussed in greater detail later in the thesis. It is sufficient for now to say that those two issues are critical and will need to be addressed in the future.

Chapter 7 - Navy Transformation Roadmap Analysis

The Navy Transformation Model is fundamentally the same as the Army's model but with different specific technical processes and institutions. However, this does not equate to a different development process. While the Navy Transformation Roadmap discusses the Seabasing concepts and the other concepts the Navy is developing, they use fundamentally the same process as the Army. Again, this is very simplified since a detailed analysis of the Navy system will produce subtle differences in the organization and the procedures used in its institutions there really is no major difference in the overall process. The Navy could be considered slightly more traditional in its development process since there is a very strong tradition based culture in the Navy that does not exist in the Army development process. In short, the Navy does the same thing as the Army by providing a patch work of stop-gap solutions to express how the Navy is meeting all the DoD TPG directives, yet it still maintains its own separate concept development process. The Navy is exploring capability-improving concepts that tack on network-centric warfare capabilities, but it is not fundamentally a joint concept development process.

The Navy actively works to develop its own platforms as it sees fit and then modifies the communications interface to meet the directives of the DoD. It is not fundamentally re-architecting the naval fleet to best balance the needs and capabilities requirements of all the branches but how to best achieve its own missions. This will be discussed in greater detail later in the thesis, but for now the purpose of the model is to illustrate that the Navy is working to keep its product development process under its own control.

The Model as shown in Figure 7-1 Navy Transformation Dynamics Model again it illustrates the fundamental architecture of the acquisition system and how the Navy works to keep factor effects not in its control as removed as possible from the development process.

Navy Transformation Dynamics Model

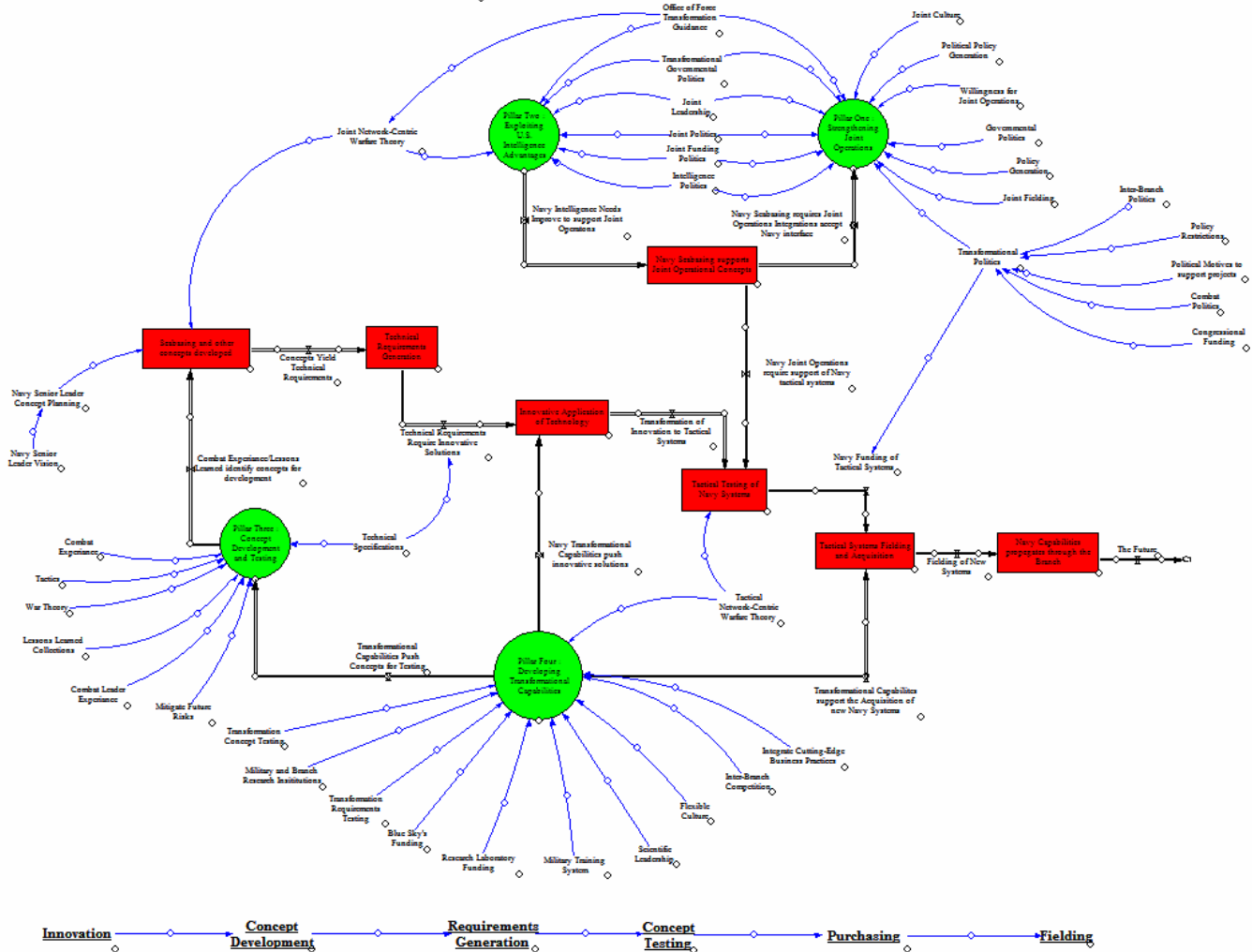*Primary Goals : Seabasing, Sea Shield, Sea Strike, and FORCEnet*

Figure 7-1 Navy Transformation Dynamics Model

Section 7.1- Current Navy Architecture

Since the Navy model is generally similar to the Army model, only differences will be discussed between the two branches. As shown in the following two figures, the core of the Navy system and its placement of the Pillars in the system is exactly like the Army's. As mentioned previously, the culture of the Navy wants to ensure its development is kept in house and works to limit its concept development between the branches. Also, there is still a large divide between the Navy concept development capabilities Pillar Three and Pillar One, Intelligence. This again is fundamentally flawed if there is to be creativity between the branches and the intelligence community.

A significant difference between the Navy and the Army is in the concept development process the Navy is working on. It is focusing on Sea Shield, Sea Strike, Sea Base, and FORCEnet. Based on a total picture perspective there is significant overlap of capabilities between the Army, Navy and Air Force. The current architecture does not consider that issue and should be looked at as a significant area where waste could be eliminated from the system. But a strategist always knows that it is important to have redundant research to maximize the probability of successful system development. This architecture is showing there may be too much overlap for efficient use of military funds at the DoD level. While this may appear a tangential discussion it is a critical point of omission that is occurring when considering each branch's architecture individually.

The Navy architecture is perfectly designed to develop large-scale platform type systems, just as the Army was designed to develop large-volume platform type systems. This architecture is also useful when considering that most naval projects span decades versus Army systems. Additionally the Navy's architecture is established well enough to continue regardless of the numerous project manager rotations that occur in naval project development process.
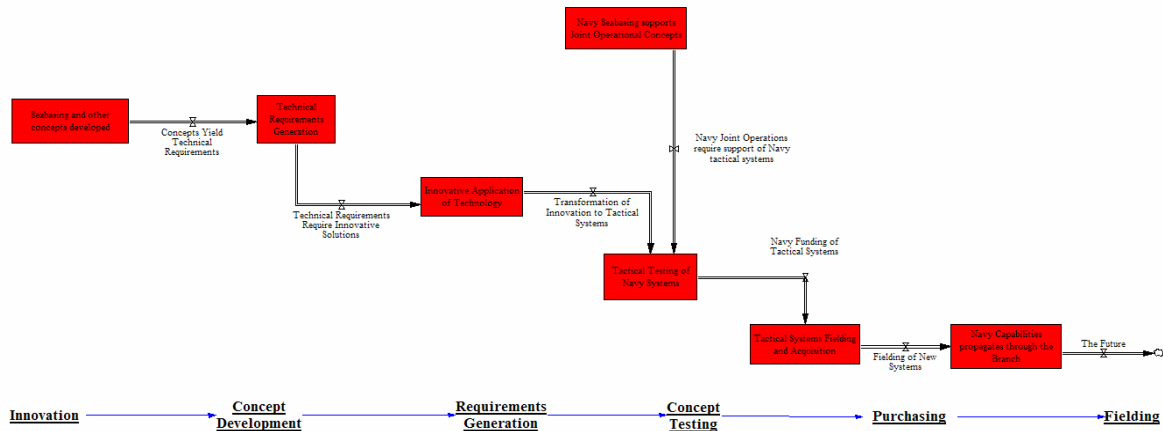
Figure 7-2 Navy Transformation Stock/Flow Section View
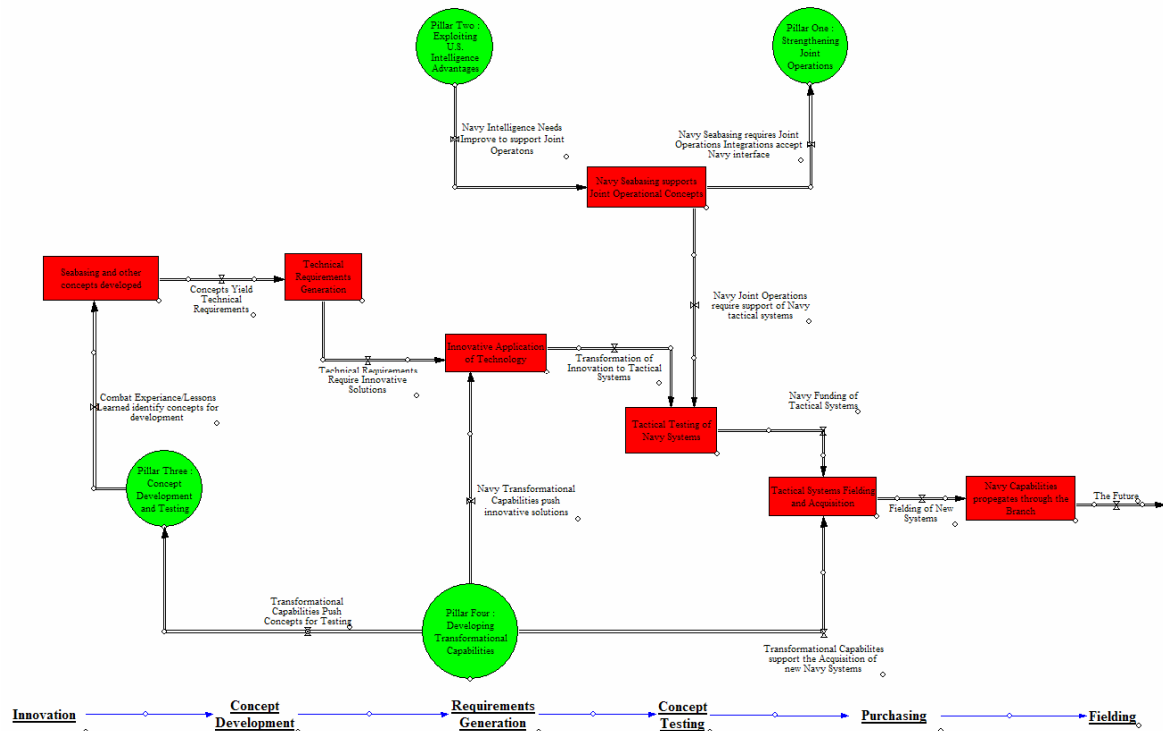
Figure 7-3 Navy Transformation Pillar View

Section 7.2 - Dynamics of Transformation Architecture

The Navy Model fundamentally illustrates that differences between the Army and Navy are in the product and cultures only. There is no great influencing factor anywhere in the DoD TPG that would suggest that either the Army or Navy should consider changing the acquisition

product development process fundamentally. This interesting fact relatively confusing since the DoD calls for the Navy to transform to meet the challenges the DoD TPG raises, but the fundamental changes required to meet those challenges needs to be instituted at the DoD level.

By establishing this architecture and set of goals, the Navy is working to ensure minimal required integration with the Joint Operational Concepts. However, if it is required to substantially take part in them, it is offering its services as the premier force for providing the command and control of the next conflict. This is interesting since the Army mentioned the same benefits of its system. Again, because the Navy has the same architecture as the Army, there is an inherent conflict or rivalry that is developing.   The trick for the transformation architects is to harness this rivalry into a competition which will benefit the DoD as a whole and not just the Navy or Army.

Chapter 8 - Air Force Flight Plan Analysis

The Air Force has a fundamentally different architecture in its product development process and reflects its mission and goals in its architecture. The Air Force moved the Joint Operational Concepts and requirement generation process to the beginning of its acquisition development process. This fundamental shift is relevant for several reasons. First, the technology and process required to develop military aircraft and spacecraft is fundamentally a much more complex series of trade-offs than on a ship, tank or truck. Therefore the requirements must be more precisely controlled prior to development.

Just like the other two branches, the Air Force works hard to keep its development process control and stay insulated from the effects of Joint concepts and intelligence organizations. This decision is to limit project scope drift and to ensure the Air Force maintains tight control over project development. What is fundamentally missing in the Air Force Flight plan is the integration of industrial partners and how to manage those relationships. This again is an error of omission in the architecture and will be discussed in greater detail later.

Section 8.1 - Current Architecture

Discussions of the Air Force Model have indicated that there is some very good logic in the architecture. The idea of not building a product until the concepts have been fully developed allows the requirements to be clearly developed and applied to the acquisition process. But there is another motive the Air Force embeds in this development process, which is the ability to take the fully developed requirements and work the system as they and their industrial partners see fit. This allows the Air Force the ability to keep DoD influence and changing trends in the DoD off its product platforms.
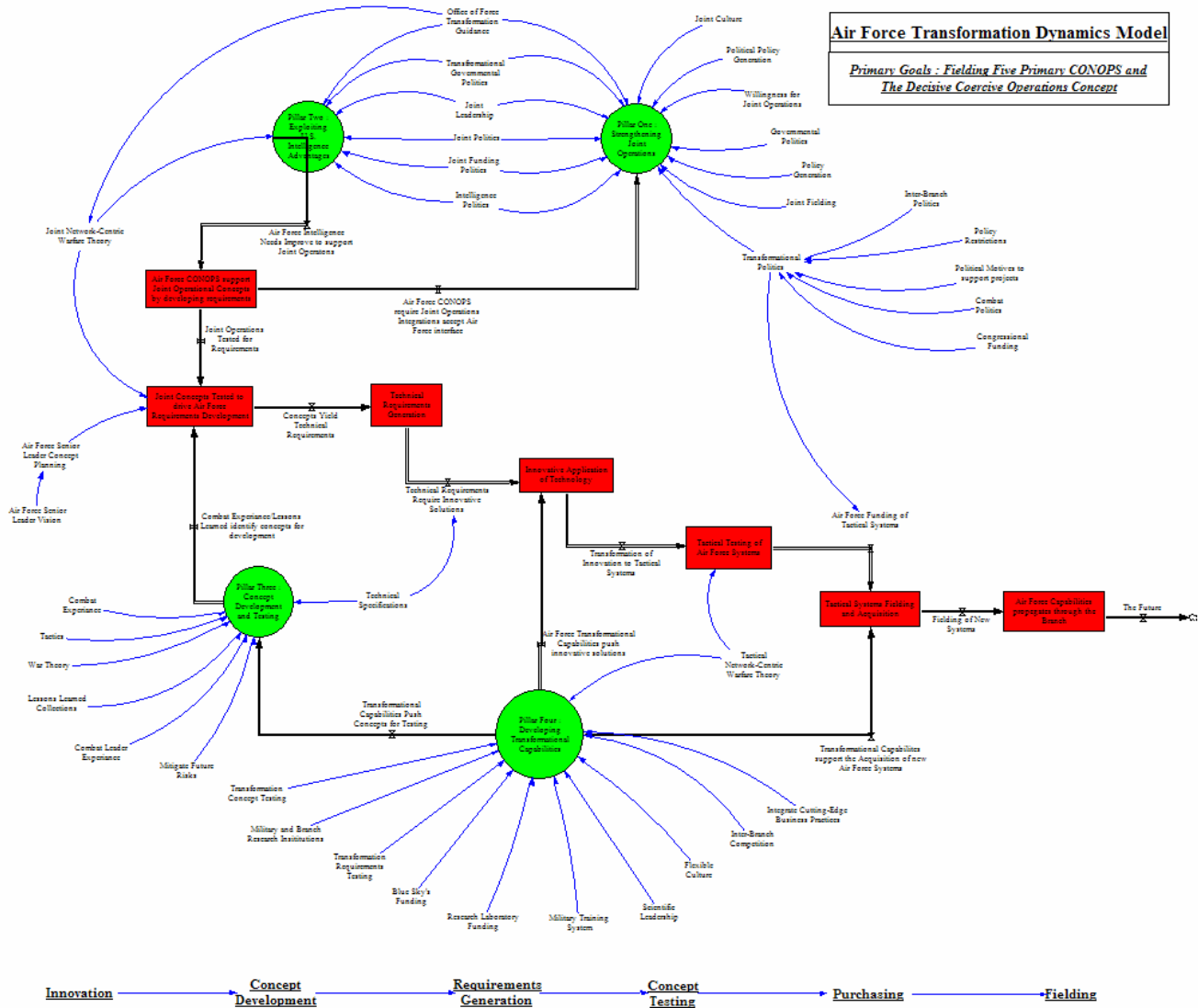
Figure 8-1 Air Force Transformation Dynamics Model

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More recently, the Air Force has been working to build more modular and flexible platforms, but it could be argued that this is the result of industry developmental and changes in manufacturing capability. The requirement that the Air Force be able to apply the expensive aircraft platform to many missions and to continue to get funding at the congressional level is essential to develop a project to completion in the Air Force system. But this is not an indication of transformation capabilities at work in the Air Force acquisition system.

This is the first mention of congressional funding on the branch product development process, but the issue is very real and much more complex than can be easily discussed here. But further discussion on the subject will be in the following chapter. Joint Concept requirements generation at the beginning of the product development process means that the Air Force approval given for a project can almost ensure that the project will get funding until completion. Since the Air Force can always point out that they are working to build a product that was jointly conceived and developed and with few other alternatives in the development process line, they can put pressure for continued funding. In other words, the Air Force Architecture is for both product development reasons but also political and financial reasons which allow the Air Force the ability to more independently develop and produce products of its choosing.

The Air Force has developed this architecture not to undermine the DoD but to ensure that it is capable of developing what it believes is the best most capable product. But the question is, "Does the product produce the most benefits across all the branches and best support the DoD as a whole?" Based on the architecture, it limits the ability for the other branches to put mission needs requirements on the Air Force development process and likewise for the Army and Navy. Granted, there is cross talk at professional meetings and collaboration, but these are informal and not always occurring. Additionally, powerful personalities could significantly hinder individual projects if this informal method is used.
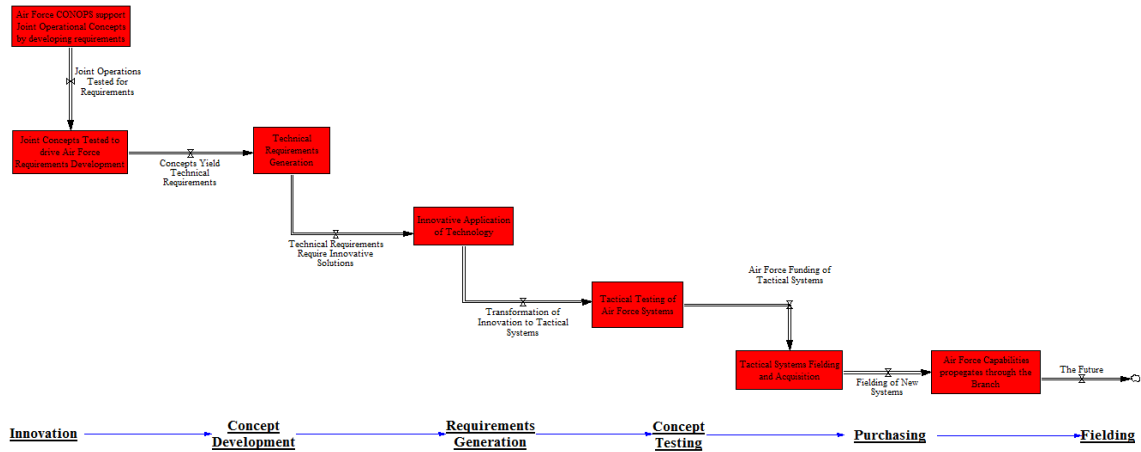
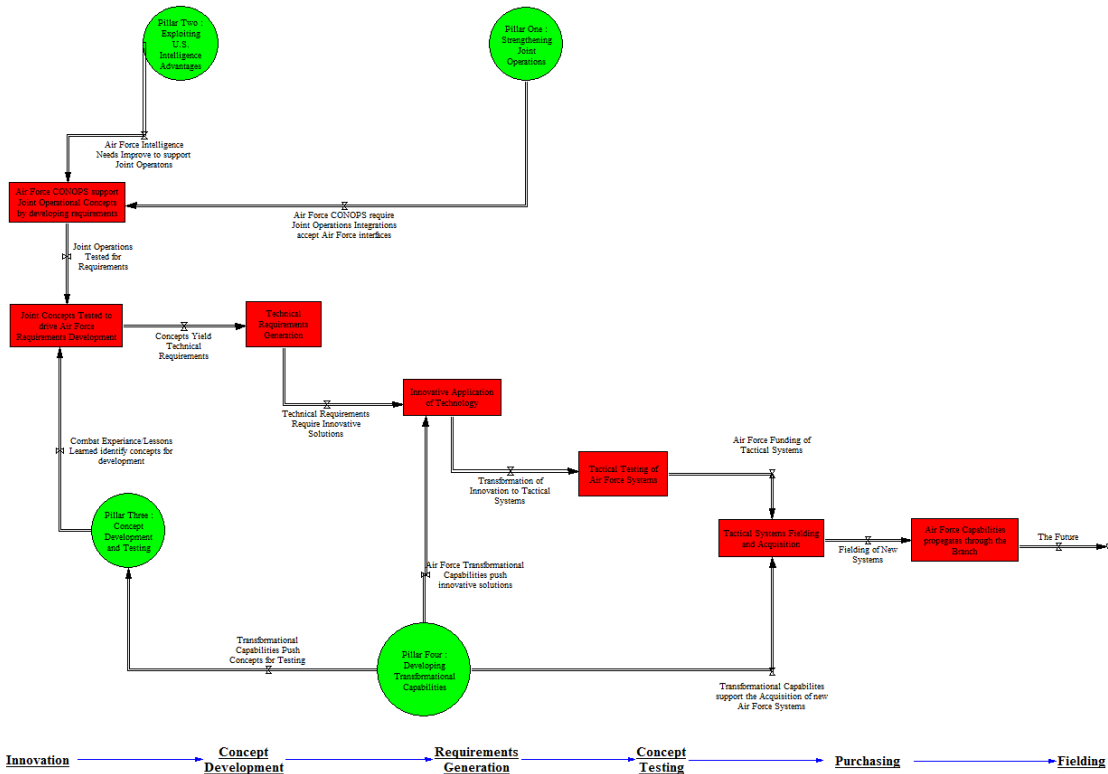**Figure 8-2 Air Force Transformation Stock/Flow Section View**

Figure 8-3 Air Force Transformation Pillars View

Section 8.2 - Dynamics of the Air Force Architecture

The Air Force model is a better example of how to get requirements into the product development process, but there is another error of omission here: time. The excessive time it takes to produce a concept, fully test the concept, and develop all the specific requirements prior to developing a product is not the method of choice in a competitive world. The model shows the benefits of the joint concepts integration up front in the process, but all the models lack input from the other branches to jointly optimize capabilities and share responsibilities clearly. Even today, there is a trend with more aircraft by numbers in the Army than the Air Force and more floating vessels in the Army than the Navy. De-lineated responsibilities by physical domains, land, water, air or space is no longer a viable solution. Due to technology, the boundaries of responsibilities have slowly yet steadily overlapped to the point where Air Force and the Army missions are so similar that large percentages of their missions could be easy given to either branch. This point could be discussed even more when we include the Air Force Forward Ground controller and special operators the Air Force trains and employs.

Again, the question or redundancy versus waste starts to be raised when we look at the architecture of the defense forces and the capabilities they all have. Using the Air Force model as the catalyst for discussion on this point, if the branches were truly integrated and interoperable, the capabilities of the Army Ranger units could be modified to serve also as Air Force coordinators, or some other mix. But the bottom line is if they train together and work together to share capabilities and funding, there could be orders of magnitude improvements in capabilities, training, interoperability and an increase number of personnel capable of completely a wide variety of missions. But more importantly, with technology providing so much more capability and the cost of fielding a front line combat person dramatically increasing, there could be great cost reduction benefits and capability improvements by studying this issue alone more carefully.

Chapter 9 – Complete DoD Architectural View

Understanding how each of the branches system works is just the first step in developing and understanding the total system. The first model introduced was the DoD TPG –Ideal Vision, how the DoD envisions the transformation and where it is suppose to go and the capabilities the new system should have. Here in Figure 9-1 Total DoD Acquisition Dynamics Model -Large View the total system is presented for analysis.

The model includes the three branches as they operate in reality and includes the connections to the joint operational concepts box. The model includes simplified connections between the major political effects on the system, and it shows the production line of joint concept projects, such as the Joint Strike Fighter, JSTAR, JTRS, etc. It also includes the effects of inter-branch rivalry and inter-branch needs and how this effects the product development process.

The model also shows the relative location of the intelligence agencies and further demonstrates the gap between NCW Theory and what the current acquisition system is producing. The pillars are still illustrated by green circles and shows that there are several redundant pillars in the acquisition system. The intelligence agencies are still removed from the concept development process and have an even smaller effect on concept development than illustrated in the branch specific models show.

The model is complex so to best understand the model one section of the model at a time will be discussed in detail to build a complete understanding of how the model represents the DoD acquisition system.

Figure 9-1 Total DoD Acquisition Dynamics Model -Large View

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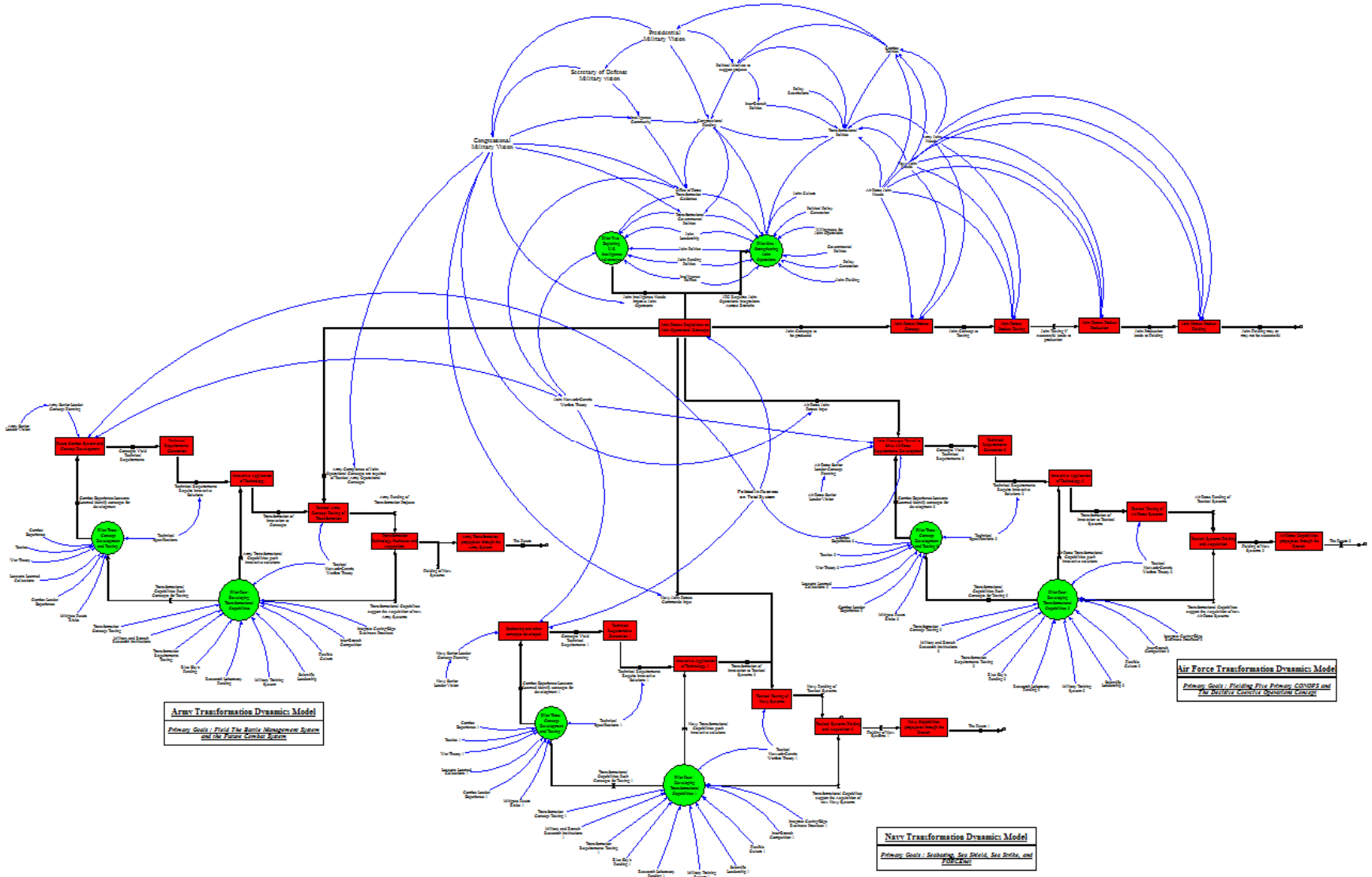
Section 9.1 - Current Architecture

From the upper right section of the model, Figure 9-2 DoD Joint Interactions Sectional View, the influence of the Army, Navy and Air Force Needs are shown to have effects on numerous other elements in the system. Most importantly the Army, Navy and Air Force each have an effect on the Joint Concepts development and acquisition system. This effect could have a change in the joint acquisition system at each step of the development process. This may be considered a positive as it allows changes and refinement at numerous steps of the process. The problem is each time there is a change or refinement to the scope or concept of a project that will require a certain level of rework. (Ulrich) This is often considered one of the largest factors for why joint concept and development is often slow and over budget.
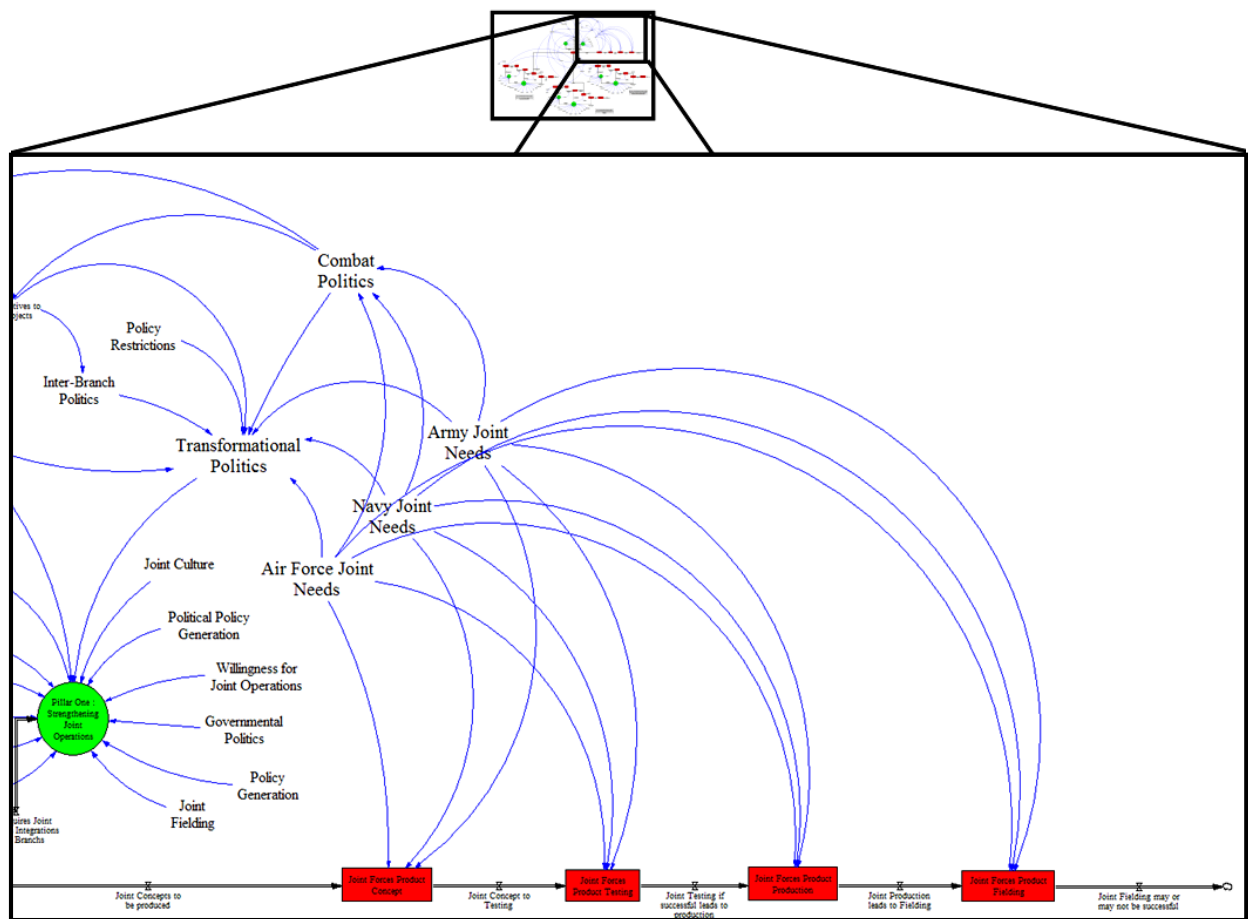
Figure 9-2 DoD Joint Interactions Sectional View

Another element in the model is "Combat Politics." This effect has all three branches influencing it also and those "Combat Politics" spill over into both "Transformational Politics" and Pillar One. It is important that the needs of the branches are heard, but the process in place now is complex and requires rigid control on the part of branch general officer leadership. It works, but to speed transformational concept development and group buy-in in today's threat environment is just as important as the concept itself.

"Inter-branch Politics" feeds into "Transformational Politics" and into Pillar One. This captures the fact that at all levels of bureaucracy they include branch politics. This also feeds down to the Joint Acquisition process and effects it at each level. The model represents these connects in a minimalistic manner, and it could be assumed that the real world is even more complex and requires much more feedback and agreement prior to forward movement of the acquisition process. This is very true but, to conceptually understand the model and the basic mechanics of the incentives on the acquisitions system, this level of refinement is appropriate.

While the previous paragraphs focused more on interactions between the branches and combat politics, Figure 9-3 DoD Congressional Interactions Sectional shows the simplified effects of congressional actions on the acquisition system. As shown in Figure 9-3, the congressional military vision affects all the branches at many levels of the process. The Secretary of Defense obviously affects numerous other transformational factors as well as the "Presidential Military Vision." "Intelligence Community" effects are also very prevalent at this point in the process and generally inhibit transformation due to the secretive cultures of those organizations. What is really important to pick out from this section is the numerous different factors pulling or pushing the Joint Concepts and acquisition system. Politics have money issues, some politics have security issues and other politics are debts owed. This is not always the best for the system, but it is not always wrong or bad but a reality that must be embraced and included in future models. The complex interaction of all these factor effects on "Congressional Funding" is the final effect which really decides the architecture of the military. What is funded will be produced and fielded, but what is fielded may not be supported fully by the branches and end up as colossal waste.

The effect of the "Congressional Funding" on the Transformation and the "Office of Force Transformation Guidance" shows the difference between the innovative thought leaders in the DoD and what the politicians are willing to fund and want produced. What is even more important is to understand that in reality the vast majority of the budget decisions for the military are often worked by the staffers under each political leader.[25] The most important aspect of this sectional view is to understand that politics and congressional funding is an absolutely critical part of the acquisition system, but they should not use technical decisions to decide which systems to fund. The current dynamics system allows that to happen.
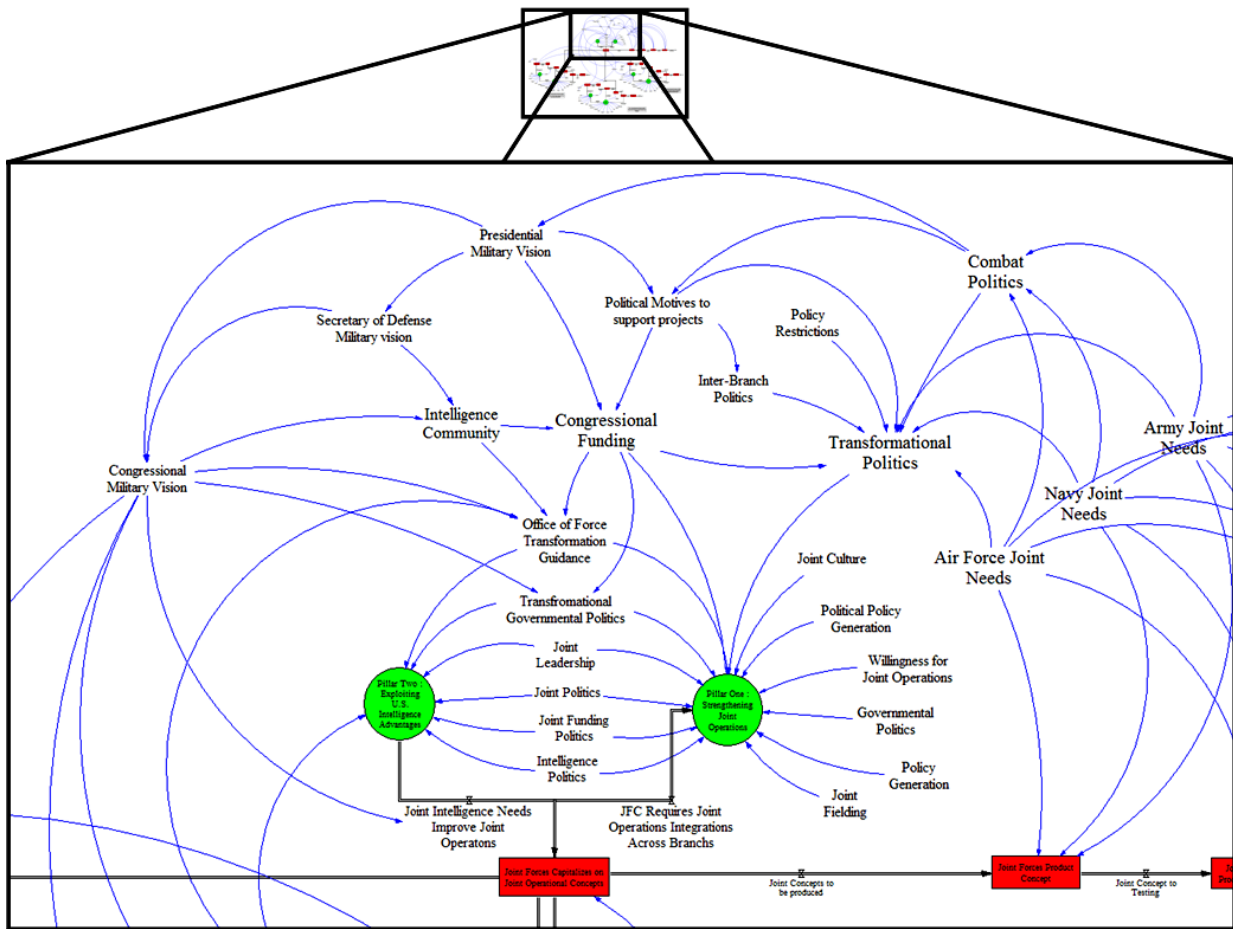
Figure 9-3 DoD Congressional Interactions Sectional

The two other major factor effects in the system not previously mentioned are the "Joint NCW Theory" and "Political Influences on Total System" effects. Both of those factor effects touch all levels of the system and on all the branches. The important part of the NCW factor effect is that it either effects at the very beginning of the development process or it is tagged on at later stages of the system to comply with DoD TPG directives. A large number of the projects fall into that category.

When considering how a system is being advertised, all the branches throw out the NCW buzzword, but if the only difference is a communication link, they are missing the point. Figure 9-4 NCW and Political Influence Sectional View shows how the branches connect to the Joint Concept Development stock of the total system. As mentioned in previous chapters, the integration of the Joint Concepts represents fundamentally different thinking and strategy across the branches. This figure illustrates those differences all on one graph for comparison. Again, the true novelty of the system dynamics models they allow complex systems and interactions to be visualized for further inspection. This model of the total system and the blow-up provide detailed perspectives of the system that have not previously existed.
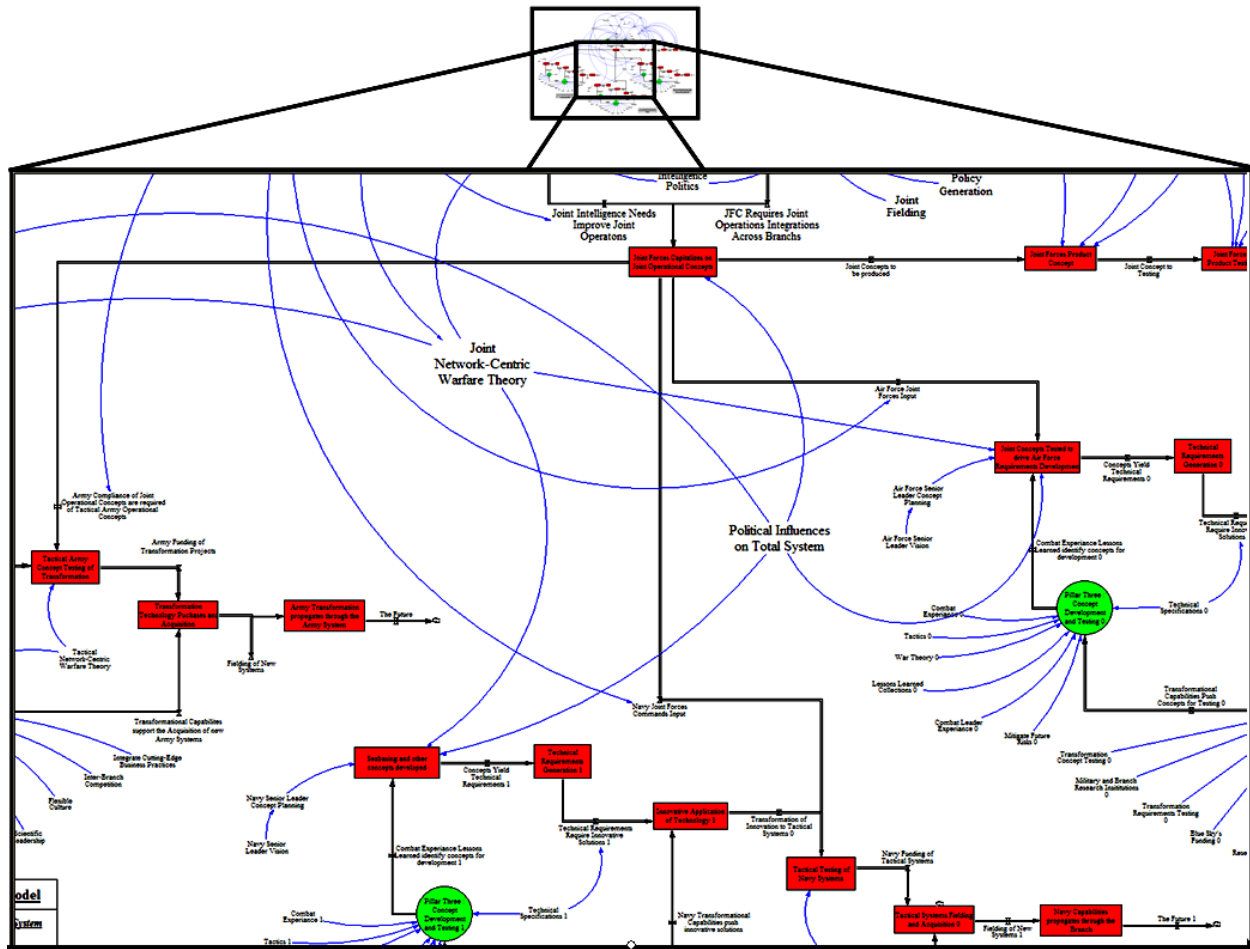
Figure 9-4 NCW and Political Influence Sectional View

To fully appreciate all the connections, factor effects and stock/flows in the system time must be taken to consider the model as a whole and the additional implications of the system. The following sections will summarize a number of the conclusions that were distilled from the model to help explain how the proposed re-architected transformation plan should be constructed.

Section 9.2 - Problems with the architecture

Figure 9-1 captures the essence of the problems with the current DoD transformation plan: the system is not designed to support the goals of the transformation plan. The system was developed to support platform architecture and platform development process. Figure 9-1 shows four major production lines: one for each branch and a relatively new joint production line, none

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of which fully employs all the principles of NCW Theory. The current architecture has the intelligence community effectively distanced from the concept development communities. The argument is that the intelligence communities only need to send information and they do not need to be closely linked to the operational elements in the DoD. The political factors of the DoD acquisition system exist at every level of the process. With the exception of providing funding, they do not bring many other technical solutions to the table. But the political influence on the policy and the methods of how to employ its implements of war are important and should be included in the joint forces arena. In the Phase 2 Report, <u>Beyond Goldwater-Nichols: U.S. Government and Defense Reform for a New Strategic Era</u>, by CSIS, the numerous reasons why the current system is not effective are discussed. It is not my purpose to duplicate that effort but rather highlight some other concerns illuminated by the system dynamics model. The model will not only agree with many of the conclusions in the Phase 2 Report but it will provide possible solutions to the problems.

Section 9.2.1- Error By Omission

A blindingly obvious omission from the models was the effect of industrial partners in the defense industry. The Boeings, Raytheons and others in the defense industry have significant international sales management on them but there is little national management with them on how to integrate their capabilities into the branch concept development process in an effective manner. Currently, every factor effect in the model is a possible port of business entry for the defense industry sales force. While this has worked in the past, it may be time to re-evaluate this system to maximized exposures of all the defense industry partners for mutual gain. One of the important aspects of modern business practice is to find ways to maximize mutual gain for both the supplier and buyer. (Simchi-Levi)

Another error of omission is the dispersion factors of fielding new technology, how to handle the logistics tail of the new technology as it is fielded. As the complexity of the new technology system increases it requires additional levels of maintenance support. As the complexity of the equipment purchased increases, supplier/vendor relationships will take them to all parts of the world. There is a substantial lack of standardized practices for integrating contracts to combat

zones and other places to both minimize their footprint in the military zone and to maximize their effectiveness while minimizing vender risk. Considering these issues in the acquisition process represents fundamentally far-reaching thinking in the acquisition process. While these issues are not new and have been dealt with in the past, the dynamics model has room to illustrate how industry partners can be integrated in the acquisition, fielding and support process.

The current model does not go into the fielding and support process in the model and could be a great area for further research.

Section 9.2.2 - Gap Between High and Low Level Thinkers

This issue is not new to our governmental model, but it is an issue that must be considered. The ideas and concepts of high level decision makers often lose track of the lower level thinkers and actual practitioners of the war arts, though current modern acquisition processes in several of the branches use warfighter's experience for input for future development. That is a tremendous improvement over previous practices but again the desire of high level thinkers to overrule the actual users of the technology creates a conflict. This conflict could be between a congressional member and a general or a science advisor or combat veteran. Regardless of the position, the issue is the same, who gets to make the decision and who has to live with the decision are different people.

The goal of the dynamics model is to illustrate that this conflict is occurring and the cost is in projects which are funded but not fully supported or employed by the users, or at worst are used and produce negative benefits. The gap between the high and low level thinkers either needs to be bridged or eliminated. Modern business practice suggests that establishing a business dynamic which supports cooperation for mutual benefit is the best option. To implement a system requires creativity at levels never before considered. This is the advantage of using the systems dynamics model to scope the transformation problem.

Section 9.2.3 - Who Makes the Final Decisions

Many people should be part of making the final decisions; the trick is to get the expert, at each level of each decision, making the authority to make the appropriate decision. For some reason, it is a human trait that if placed in a position of power, it also grants them better knowledge than experts at lower levels. The systems dynamics model illustrates how a congressional person or general officer could force a very technical decision from a level in which they are no longer the expert qualified to make that decision. Though this is supposed to be mitigated by expert consultants or through staffing actions, but in the end the decision is still made by someone other than the technical expert. This is a fundamental flaw in our current system.

Final design decisions should be left to the experts of the area in question. This concept requires either discipline, regulations or laws to help empower those at technical levels of expertise to overrule those who are in positions of pure power. This is not to undermine the power structure but to make efficient use of the time of the person in position of power and to empower technical experts to make good decision since they will be held accountable for them.

The current model shows that in reality the final decision is made by those who have the money. The question is how to better balance the movement of funding to support concepts which will in turn be supported by the most technically sound solution available. That is another issue present in the current model.

Section 9.2.4 - Too Many Participants and Motives

The current system is a complex web of participant and motives and finding the most optimal solution often times gets lost in just having congressional staffers fight out issues to only gain mostly personal victories. The motives of the branches, the military motives and the personal motives are all rolled together and the best technical solution again gets lost in the dynamics of the system. As the model illustrates, there are many factors that play into the current acquisition system and it is just a simplified model. Those participating in it as a profession should readily understand this point. The concern is, "how does a new system allow the concerns to be raised

but mitigate personal and political motives and focuses primarily on the technical, tactical and joint conceptual development motivations?" This concern will be addressed specifically in Part III.

The issue is raised not to illustrate a weakness in the current system but to help identify how it should be addressed in a future model. Not only are there too many participants in the current system, but the number of motives effecting the system needs to be reduced also. This again is a cultural issue and as proven time and time again it will take both fundamental organization change and leadership support to change the culture of an organization. But at least at this point there is a new perspective to help architect the next enterprise for success.

Section 9.2.5 - Industrial Community Mismanagement

As mentioned previously, the ability to effectively manage the commercial defense industry in the Information Age could be a complete thesis in itself. But for our purposes, architecting the basic interface method for the defense industry to integrate with the DoD is an excellent starting point.

In the past, numerous suppliers competed for contracts and the contracts were large enough that the system worked. Today's technology, and the mergers and acquisitions of companies have effectively reduced that industrial base and survival is a matter of national security concern.(GAO) To carelessly allow our industrial military production capacity to starve out should be considered criminal. But the inappropriate distribution of government funding based on illogical actions should also be considered criminal. A new system should allow maximum exposure and interface with all current or potential military vendors to ensure that a healthy balance is found between the industrial machine and the needs of the combatant commanders and their forces.

The model provides another illustration of how seeking interfaces and connection points or limiting connection points can help architect the future acquisition system and its products.

All of the aforementioned issues and concerns are integrated in the following model which represents the proposed architecture for DoD transformation. Many of the issues raised in Part II have extensive background research already completed and many of those findings and conclusions align with the recommendations in Part III. It is important to understand that the next part of the thesis represents a possible architecture that does not attempt to change the factor effects that exist in the system, but embraces them as part of the national culture and only tries to guide their influence. Part III will explain this concept in detail.

PART III – Architected Systematic Transformation Recommendations

Chapter 10 – Recommended DoD Acquisition Architecture

The following recommended DoD acquisition architecture uses several principles in its development. Each of the principle ideas is based on heuristics of working with the government, military or industry partners. Additionally, since political issues will always be a relevant and complicating factor, an assumption must be made that the recommended architecture should be the optimal organization in an apolitical environment. Political necessity can and will always be added to a system. Since the recommended architecture considers optimal operational efficiency before political needs, theoretically the result will be technically practical. To ensure a technical and practical architecture is developed, the flowing additional principles and assumptions were used during the new architecture development:

- Current organizations and capabilities must be kept in place
- Different concept development processes in each branch provide the benefit of additional potential solutions
- Each branch has a complete acquisition process with several redundant components
- Joint acquisitions is the most difficult and least economized
- Joint acquisitions will continue to grow in the future
- Competing visions are inhibiting joint acquisitions
- Efficiency in acquisition occurs when the buyer, supplier, user and appropriator are all in agreement
- The acquisition system is not highly regarded by combatant commanders
- An acquisition system's customers are combatant commanders, service members and congressional leaders; each must be served equally
- Rivalry restricts efficiency and it is inhibiting execution of NCW Theory

- Competition in an industry generally improves elements of an organization

- Prestige, recognition and financial reward significantly improve creativity, productivity and efficiency

- Political influence on technical decisions leads to sub-optimal designs

- High-level strategic thinkers are generally not best qualified to make technical decisions

- The finest technical experts are often forced to make decisions based on political desires

- Every member of the government is working to best represent their responsibilities in the best interest of the nation and service members

- Defense Industry partners are motivated by financial rewards above benefits to the nation

- The Defense Industry is poorly supported by the government and its continued survival is critical to national security

- Ensuring equitable distribution of Defense Industry contracts is a fundament requirement of a successful system

The goal of the new architecture is to address all the issues and problems mentioned previously in this thesis and to apply the most innovative use of modern business practices to date. In addition to the above fundamental considerations, simplicity of organization and minimal but effective oversight are also critical to a successful system. The next section will introduce the new system and provide a comparison between the current and new systems. The blocks and pillars are the key features to look at in the comparison. They represent the fundamental changes to the system, while the factor effects are kept since they can not realistically be removed from the system. Additionally, the factor effects represent numerous levels of oversight and needs requirements which also cannot be removed from the system.

Section 10.1 – The New DoD Architectural Model

For clarity of discussion the new DoD architectural model as proposed in Figure 10-2, will be henceforth referred to as, "The New Model". The existing acquisition system as modeled will be referred to as, "The DoD Current Model.
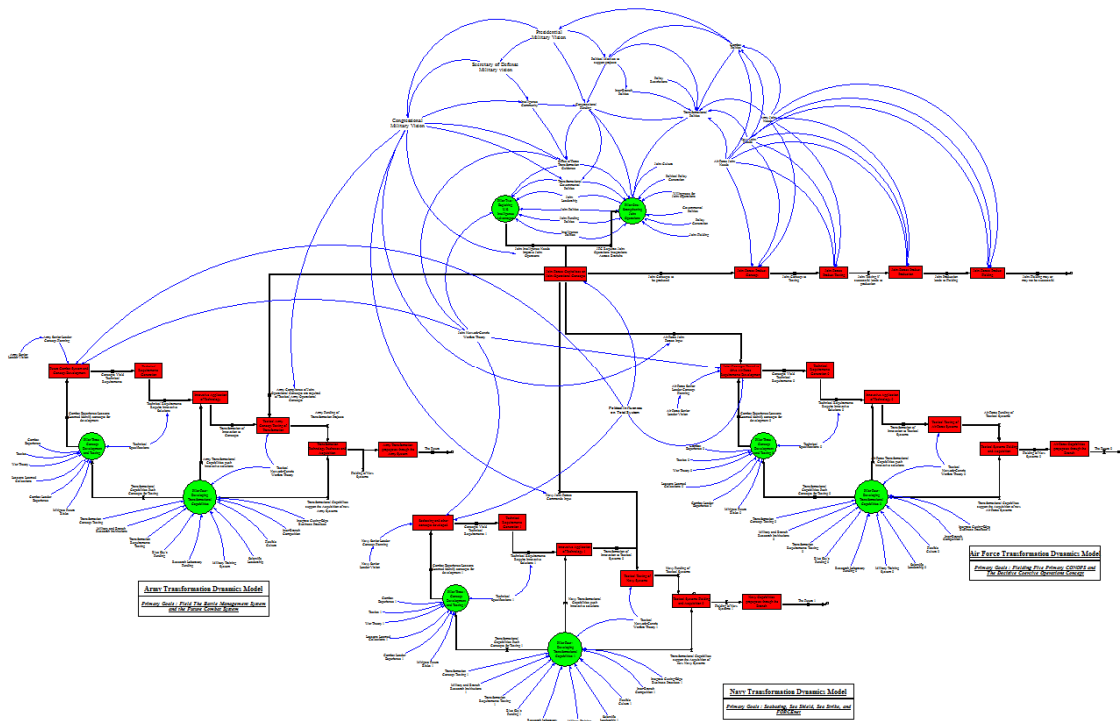
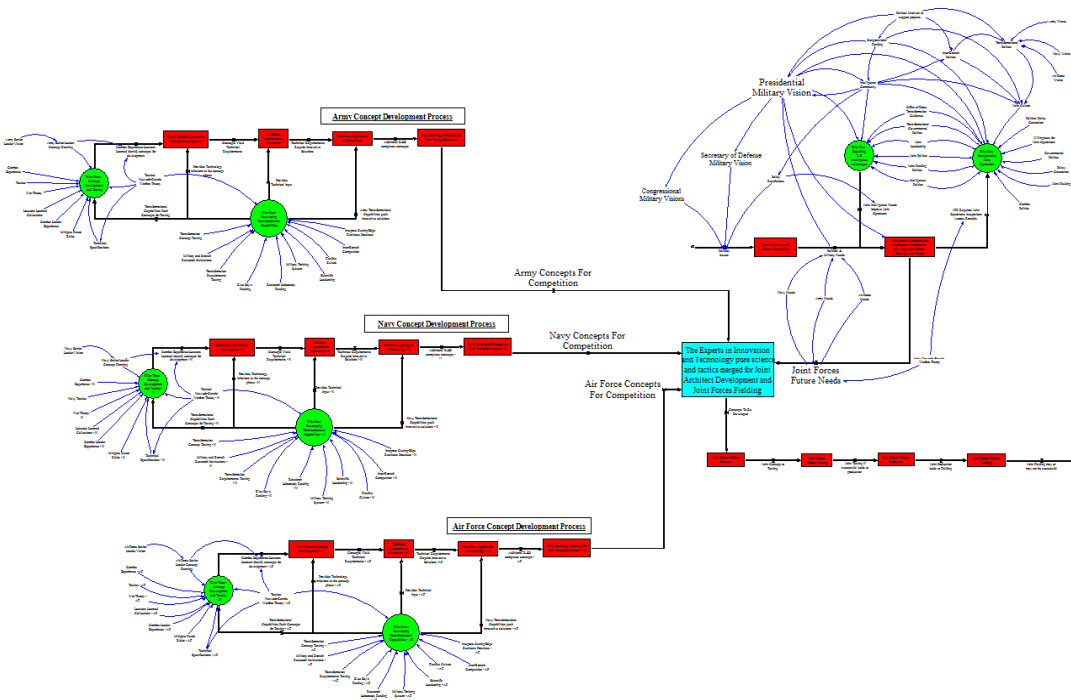**Figure 10-1 DoD Current Model Small View**

Figure 10-2 New DoD Model Small View

Although unreadable Figures 10-1 and 10-2 are provided on the same page for a direct visual comparison between the current model and the new model. There are numerous changes between the two models. The logic used to make those changes was presented in Part II and further benefits of those changes are presented below. Each of the major changes of the system will be discussed in detail, but a quick summary of the changes is provided here to understand the scope of the new concept model.

Each of the branches has major acquisition activities, with the actual procurement process removed and placed under "The Blue Box". "The Blue Box" will be introduced in the following chapter but for now consider it a new organization. "The Blue Box" name was selected for the thesis since it is a solution neutral concept name. Had another descriptive name been selected, readers would develop a pre-conceived idea on what the organization is supposed to do, and attribute current or similar organizational characteristics to the new proposed organization based on its name. In order to consider this new concept with an open mind it is better to have a name not associated with any known organization.

Again, "The Blue Box" will function as the major acquisition agent for the DoD, but each of the branches is left with extremely robust concept development capabilities and all original research laboratories, organizations and institutions which facilitate transformational capabilities. The three branches will send concepts forward for competition at "The Blue Box". Each branch will have more robust rapid combatant commander purchasing authority than currently allowed, but the major acquisitions process will be removed from branch operations to allow better branch focus on warfighting operations.

The political effects on the acquisition process can be mitigated by focusing political influence in the Joint Operational Concept development stage of the process. This would be the earliest point in the acquisition process where major system purchases are discussed. This is why it is important that the political effects factors are integrated at that point of the process rather than later in the process. Also, each of the branches has a controlled access point for joint concept development but after the requirements and concepts are developed, "The Blue Box" integrates

those requirements with the best current technology for purchasing and fielding. The idea is to keep high level strategic thinkers focused on their responsibility and allowing the technical experts to focus on the processes of screening, selecting, testing, purchasing and fielding the best total solution to the requirements jointly developed by the political system and the joint forces command.

The New Model effectively has three major components: (1)the political, intelligence and joint forces command; (2)"The Blue Box" acquisition system; and (3)the three branches together which represent major concept development and testing. Embedded in the model is a controlled interface method for Defense Industry partners.

In the DoD Current Model there are four major purchasing commands, three branches and the joint forces command, all of which have some level of interconnectedness. Overlaid on the system are political influences and inter-agency/branch rivalry. The Current Model is not fundamentally controlled or organized for efficient operation, but for double redundant oversight. Finally, impacting all of this are Defense Industry sales forces and lobby influence.

In Figure 10-3 Proposed New Model – Large View, an expanded view of the new model is provided for reference for detailed discussion of the major components in the New Model and the proposed effects of the changes. Again, the model is presented to illustrate a new conceptual view on the acquisition system recommended for use by the DoD. The New Model is recommended for several overarching reasons the reader should be mindful of when considering the specific aspects of the model.

First, NCW Theory requires a fundamentally different requirements gathering and acquisition process than that of the platform-centric Industrial Age. As the Information Age continues to evolve, the integration of military weapons systems and information tools will require both greater inter-operability and durability. Durability in a system can be accomplished in two ways: heavy duty, well designed simple systems; or lighter weight, cheaper and more easily replaceable systems. The new military age will require a combination of those two types of general features

in its systems. The current acquisition system is not capable of producing such systems on grand scale, especially with the level of complexity of new systems.

Second, necessity is the mother of invention and our service members are our competitive advantage for their creativity and innovative problem solving capabilities. This must be supported and fostered for greater use. Branch rivalry limits the effectiveness of creativity by building silos of knowledge and hindering inter-branch knowledge sharing, though intra-branch knowledge sharing is rapidly increasing.
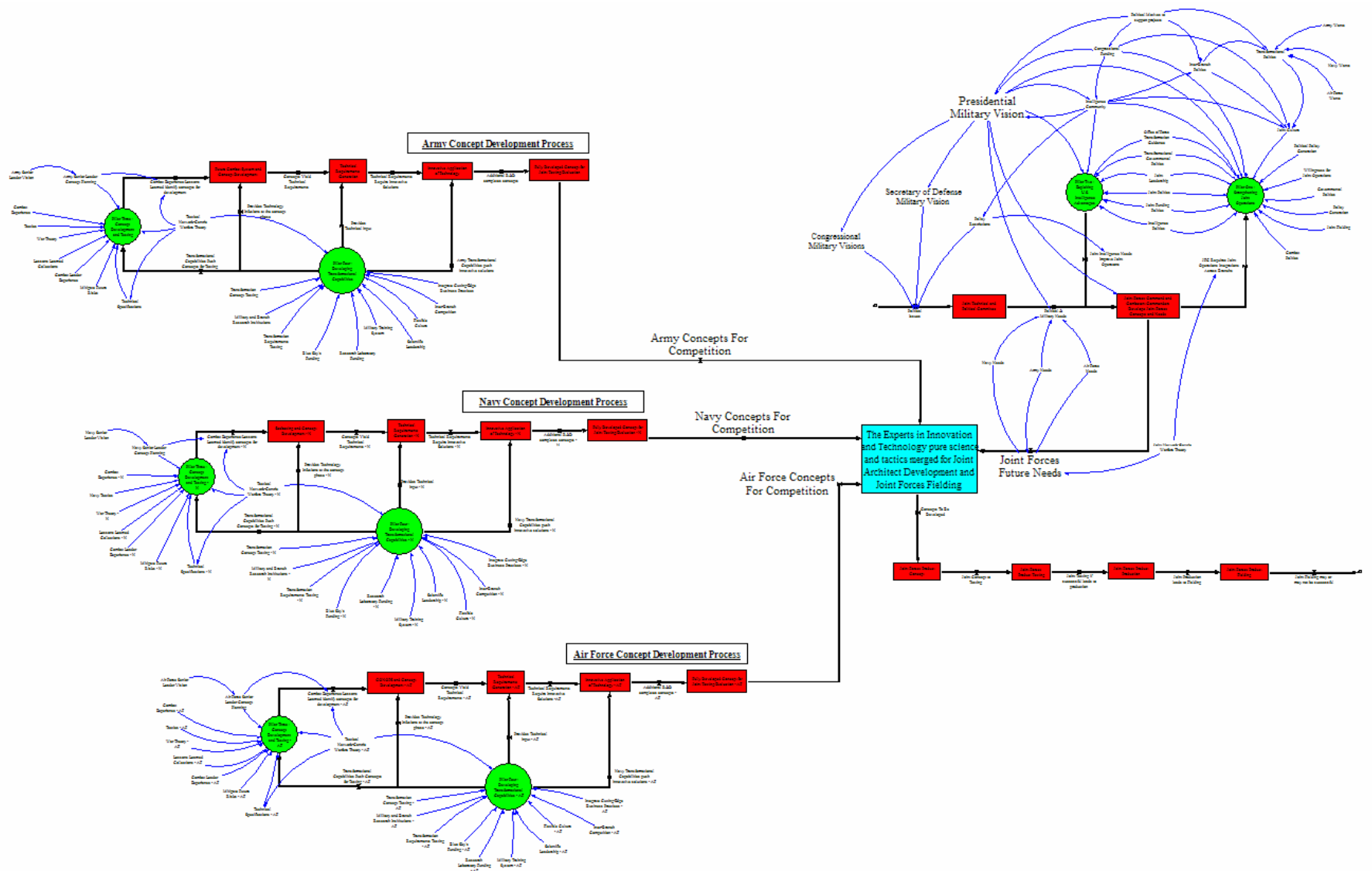
Figure 10-3 Proposed New Model – Large View

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Third, excessive detailed political oversight in acquisitions, concept development, transformation, and operational activities are blurring the lines on what the political responsibility to the military system is. This blurring of responsibilities and how detailed the political oversight is getting to be when recommending military decisions is also further inhibiting efficient acquisitions and DoD transformation especially in concept generation/guidance, capability requirements and line-item ordering of military weapons system. Redefining how to integrate those political responsibilities which allows both appropriate political oversight of the military and political guidance on military decisions is an important part of the New Model. Furthermore an organized and strong connection between high-level thinkers and concept development needs to be established with the high technology and acquisition experts to best merge policy and technology in support of common concepts. Controlling this process and better allowing the integration of those political needs/desires in the acquisition system will help ensure both political desires are well understood and military needs are well fulfilled.

Finally, a new organization built on prestige, expertise and <u>rewarded in completely different fashion than any other government organization</u> needs to be established to entice and retain the nation's absolute best and brightest to help architect and purchase the most important systems the US will buy: its national defense. A detailed explanation for this will be presented in Chapter 11. Previously, the system has worked by shear determination and massive spending. Today, there needs to be a balance of effective and efficient purchasing. "The Blue Box", is a possible start for architecting a new military acquisition culture which could be the envy of the business world.

Section 10.2 - New Model Sectional Explanations

As mentioned previously the New Model is comprised of essentially three main sections. The first section is represented in Figure 10-4 which shows the Army Concept Development Process as a representative model for each of the branches it is part of, with the New Model zoomed in for clarity. The Army acquisition system is renamed the Concept Development Process to illustrate the fundamental difference of this architecture. In this system the branch acquisition

systems will have two primary responsibilities; to deliberately test and evaluate concepts for future development, and to provide rapid acquisition capability to the combatant commander.
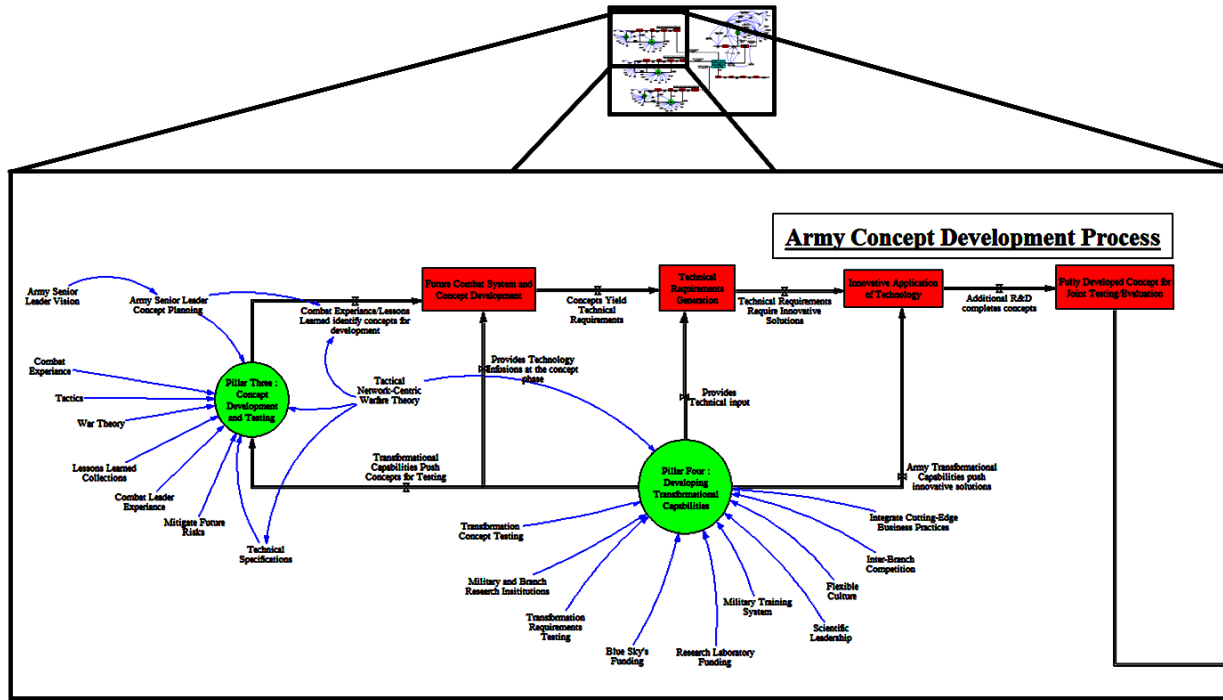
Figure 10-4 New Model Army Concept Development Sectional View

As proposed these branch systems remove the burden of major acquisition operations from each branch—for example, the actual purchase of tanks, planes and ships—thereby allowing the branches to focus on developing better test requirements, theories and concepts prior to the actual acquisition of the product. This defines the first primary responsibility of the Branch Concept Development process. Currently, habitually inadequate requirements cause exponential cost overruns. Since this system facilitates more thorough development of requirements and testing of concepts, it addresses this critical issue in the acquisition and fielding of major systems. Removing major purchasing activities from the branch minimizes political influence on the combatant commander's purchasing activities. This is explained in greater detail in the following two sections.

Nevertheless, the ability to rapidly purchase off-the-shelf combat systems—the second primary responsibility of the Branch Concept Development process—remains critical to sustaining the advantages of the US Military. These off-the-shelf purchases then become the primary interface between the combatant commander and the Defense Industry, as the branches' interface with industry during development of new systems is minimized. For example, should a commander on the ground find a need for bullet proof sunglasses, they must have the capability to purchase those without extensive red tape. This new system more efficiently integrates political influence on rapid purchasing capability of the combatant commanders by allowing larger sums of money to be allocated to combatant commanders, while still following well established purchasing guidelines. This process is already being established in one form with the establishment of the Rapid Fielding Initiative. (Cowan) With the rapid fielding capability currently present and it is a definite competitive advantage and its effects are well known by service members.

Figure 10-4 also shows that research facilities, lessons learned, training commands and other educational organizations all contribute to concept development and testing. One of the keys to military success in the Information Age is the ability to identify, test and field cutting edge capabilities and creative solutions faster than the enemy. By focusing on the two primary responsibilities, this architecture streamlines this process and produces a great emergent property as a result--a controlled interface between the Defense Industry and the military branches.

One of the weaknesses with the current system is a lack of this clear interface between combatant commanders and their Defense Industry partners. In the current model, a weapons sales person can solicit a sale at any point in the military or political system. While the current model allows the Defense Industry the maximum possibility of sales, this model does not facilitate identification of the best Defense Industry Technology to be used by the combatant commander when it is needed. The current model allows politics to influence purchases of what combatant commanders may deem as unnecessary sales based on factors which are other than military. Figure 10-4 illustrates that if each Defense Industry partner has a representative within each research organization and concept development process, they minimize sales force requirements through maximizing exposure to the system which makes purchases, and can integrate necessary

cutting edge industrial weapons technology into future concepts. Having the Defense industry focused in a much smaller number of places, but better integrated, increases efficiencies of sales and technology distribution for both the military and Defense Industry, but more importantly gives the combatant commander access to all the state of the art weapons technology in a single system. The idea is to improve each branch's rapid acquisition system to a higher level of responsiveness and efficiency to support the combatant commanders. This will also work to minimize the time the combatant commanders need to spend soliciting solutions from Defense Industry partners and maximize time refining requirements and needs. This system produces three emergent beneficial properties from this architecture but it will require political regulations requiring, by law, that Defense Industry partners are limited to interface and solicit sales, only, with the designated organizations in each branch. The Defense Industry Partners must have an interface at the Joint Forces Command for Concept development and they must have a close relationship with "The Blue Box", but any other additional contacts with the government will tend to just weaken the efficiency of the acquisition system.

Figure 10-5 illustrates the interactions of the congressional activities, intelligence community, joint forces culture and the branches in the New Model. This is a simplified view of the system, but a more detailed model would obfuscate an understanding of the concepts in the New Model. This new system would require much greater controlled interaction between the branches, joint forces command and congressional activities.
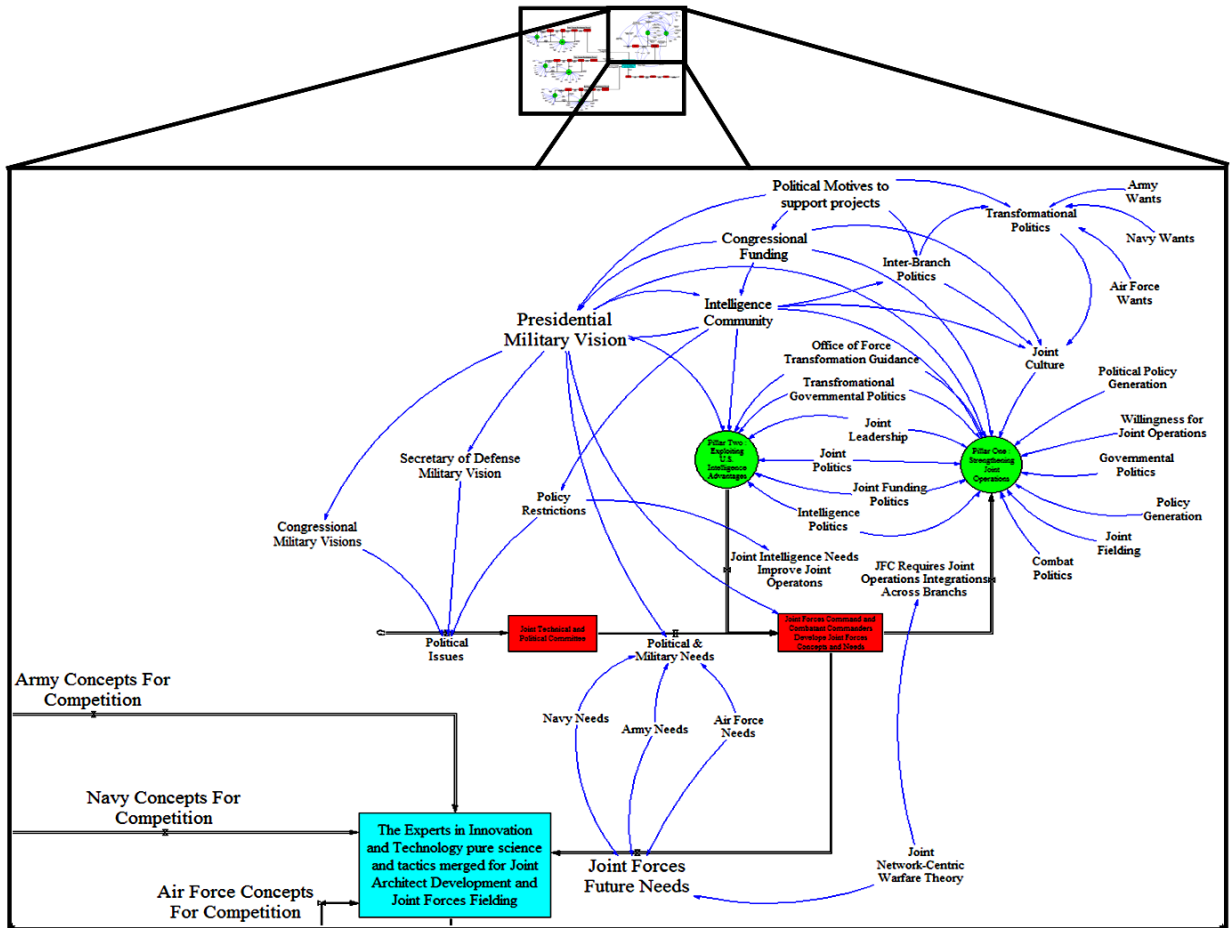
Figure 10-5 New Model Government Sectional View

The New Model maximizes congressional input in the Joint Forces Command and on the branches at a level where early decisions can produce productive decisions. The New Model recommends having political and joint forces concepts and requirements collected and distributed through the Joint Forces Command. The joint forces command would provide the direct interface with congressional requirements and Defense Industry partners. In this architecture The Defense Industry Partners have a minimal operational need to solicit or communicate wants with the congressional leaders but they can do that through other controlled points in the system. Rather, the congressional leaders should place needs and requirements on the Joint Forces commanders and push those concepts down for technical development through the Joint Forces Concept development process, shown by the two red boxes. The concept behind this architecture is to maximize inter-agency cooperation at the highest conceptual levels, and,

once concepts are agreed upon, to push technical decisions down to "The Blue Box" which has the nation's best technical experts available for making those decisions. This New Model contains interagency politics to one section of the acquisition process but allows the actual acquisition process to produce the best DoD-wide technical solution based on agreed upon inter-agency decisions.

The purpose of this model is to focus the political activity, which will inevitably occur, to occur in the most organized and controlled way possible. Unfortunately, inter-agency rivalry and competition will be reinforced as the defense industry and some congressional pressure is placed on the acquisition process without first being filtered by the joint forces agreement process. The ability to ensure the most clear and equitable process for distilling all the needs and requirements of the high-level decision makers in the acquisition process is critical to success.

The output of the Joint Forces part of the system is a unified and clear concept which can be released for technical development and testing. Currently that process is very laborious and still produces products which are not universally embraced by the branches since there may be ill feelings or rivalry between the branches.

This part of the model, shown in Figure 10-5, will only work if a critical organization is created and allowed to develop–"The Blue Box."

Figure 10-5 and Figure 10-6 both show "The Blue Box". "The Blue Box" is the single largest new element in the system. "The Blue Box" represents the fundamental change from a platform-centric industrial age organization to the Information Age. "The Blue Box" will only be briefly introduced here; however the following chapter will discuss how "The Blue Box" will work in great detail. For now we will only discuss what "The Blue Box" will do.

In order to standardize the acquisition and fielding process, "The Blue Box" will be the only agency to develop concepts received from the branches for possible acquisition and fielding. In conjunction with General Accounting Office, "The Blue Box" could assist non-military

government agencies where their acquisition requirements, include large-scale systems and technology nets.
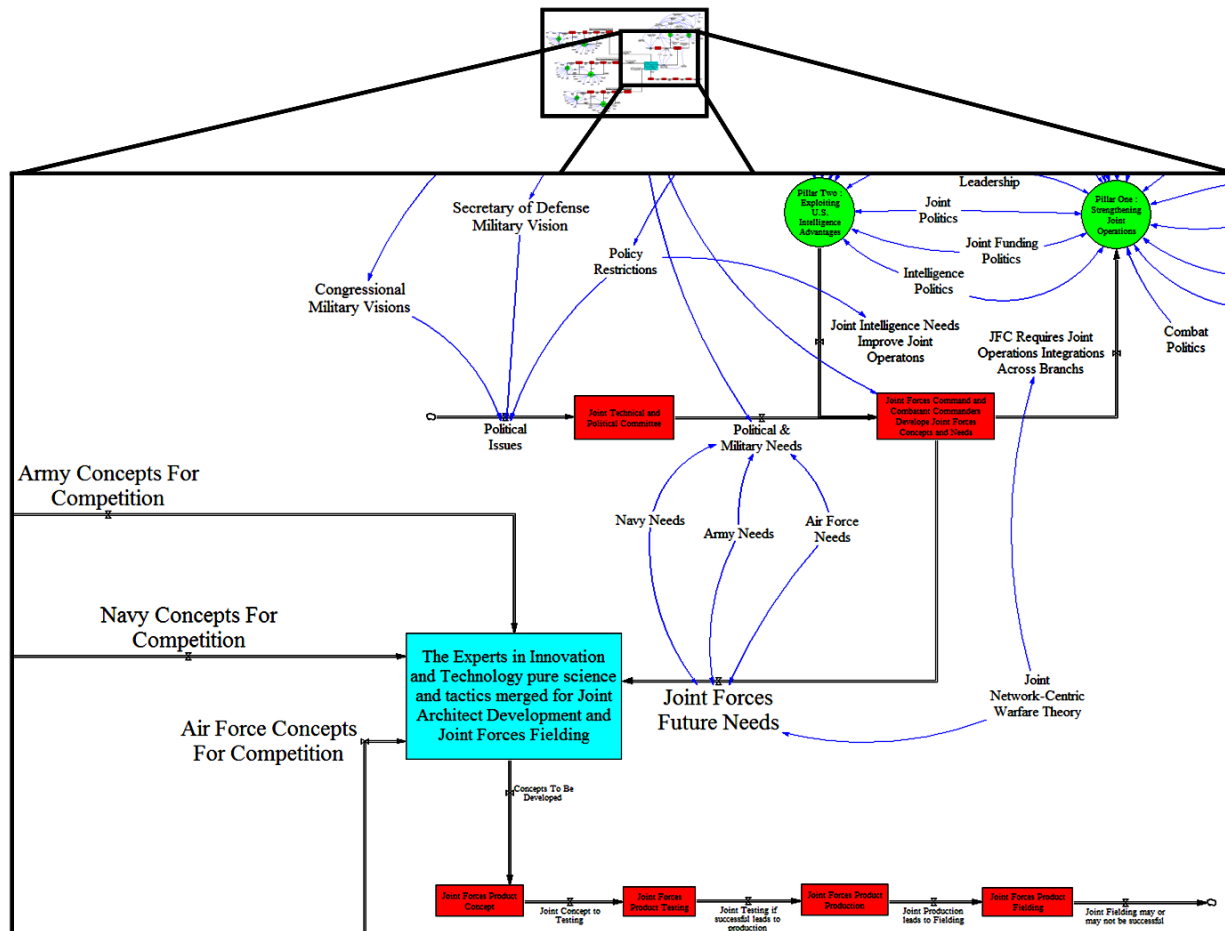
Figure 10-6 New Model Blue Box Sectional View

"The Blue Box" will also provide two-way communication between the branch and Joint Forces Concept Development Processes. This process will allow the branches the ability to compete to produce concepts and will help share inter-branch requirements. Sharing requirements is good since the better the concept addresses other branch requirements the better the overall concept will be. The idea is to foster a controlled competitive environment in the concept development phase of the acquisition system, as opposed to the currently uncontrolled branch competition. For example, each branch will have an opportunity to present a concept to compete for DoD fielding. Once the concepts have been submitted and tested by "The Blue Box" the Joint Forces Command will then select from the data collected to determine the concept to be developed.

When approved by both the Joint Forces Command and congress, as appropriate, then the fully tested and selected concept will move to the actual acquisition and development process managed by "The Blue Box".

Having inter-branch concept competition for joint concepts will allow the branches better opportunities to include their needs in the new concepts and more likely build later confidence and buy-in of the system after it is developed and purchased. All of these issues are illustrated in the system dynamics model which could be built with greater resolution but for our purpose the model clearly illustrates that producing better DoD wide systems inter-branch competition is healthier for the total DoD than to have three competing systems not working together nor on the same problems. By having three concept development systems working on the same problem which they will all eventually use, is more in line with NCW Theory than the current organization.

Finally, "The Blue Box" will provide the insulation between the politics and the branches during the acquisition and fielding of the new systems. How this will occur will be discussed in greater detail in the next chapter. In the new system, "The Blue Box" is the single major acquisition system within the DoD which synchronizes the efforts of three minor branch acquisition systems, whereas the current system has four independent major branch acquisition systems, which is fundamentally against NCW Theory. This is the case since four independent acquisition systems will and do purchase fundamentally different systems with totally different data protocols. The use of a single major fielding organization like "The Blue Box" more closely allows the fielding of universally compatible systems.

Section 10.3– Summary Goals of the New Model

The new model retains several advantages of the current system. It reduces funding waste in the government's acquisitions system and produces better products through controlled competition between branches. It fosters creative innovation by tapping directly into individual branch development systems. Finally, it aligns the acquisition system to meet the strategic and technical needs of our military in the twenty first century.

The potential for such fundamental change as with NCW has not occurred since the industrial revolution, the development of the tank, and the related revolution in deploying military forces. Technology today is causing the same type of paradigm shift in military thinking to emerge as that which has happened in the past. These shifts / revolutions generally follow the same pattern, as history illustrates. First, the need for change is not universally accepted. After the need for change is embraced, there is disagreement over whose system or method to employ. Proponents of each system argue that adoption of an alternate system would be tantamount to throwing the security of the country aside. Inevitably, a champion of a technology or system emerges to recommend a sweeping transformation that sets the stage for future success. Today, this pattern is being repeated as the military moves from the industrial age to the information age. Strategic necessity dictates a new system of analysis to illustrate the benefits of this change to allow transformation to occur more swiftly than it has in the past. Next, I will introduce the largest change to the system in greater detail, "The Blue Box".

Chapter 11 - A New Organization – "The Blue Box[26]"

As we have seen, "The Blue Box" represents an entirely new organization for the government, yet it can be established using existing acquisition organizations to prevent the loss of current product development processes which have proved effective. As mentioned at the end of the last chapter, it is time for this new organization to meet many of the challenges the Information Age is presenting the to acquisition system. Interestingly, the structure of this new organization results from a look at the transformation of the Department of Defense and the application of Network-Centric Warfare Theory. The study of these two operations independently would not recommend the development of an entirely new organization, but when management of the Defense Industry and strategic resilience in defense capabilities of the country are considered together, it becomes increasingly obvious that this kind of drastic change is necessary.

"The Blue Box" represents a conceptual starting point for the development of a new organization which will provide defense acquisition capabilities in line with the new technologies of the age and the new threats the nation is facing. It is already well known that innovation and rapid transformation are the two key factors in continued success of the US and its industries. Businesses have learned this the hard way by massive loses and business failures. The US can not afford to learn lessons in such a hard way.

This concept is presented for consideration to look at the problem from a new perspective, without the limits of reality placed on the concept. "The Blue Box" as described here is not the definitive solution, but a starting point for where the DoD acquisition process should go. The next several sections will describe the basic characteristics of new organization.

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[26] "The Blue Box" name was selected for the thesis since it is a solution neutral concept name. Had another descriptive name been selected, readers would develop a pre-conceived idea on what the organization is supposed to do, and attribute current or similar organizational characteristics to the new proposed organization based on its name. In order to get the reader to consider this new concept with an open mind it is better to have a name not associated with any known organization.

Section 11.1 – Functions of "The Blue Box"

The five primary functions of "The Blue Box" will be introduced here. Each of the functions will be imbedded in separate departments, and the interface between the departments is an important part of the organization and can be considered later based upon other developmental factors. Each of these primary functions is strategically important to the US and should be resourced accordingly.

The first function is to act as the single DoD wide acquisition manager. When final decisions or recommendations are to be made on the actual DoD architecture, these will still be left with the Secretary of Defense to make decisions. The acquisitions projects completed by "The Blue Box" will only be those for all branches with project development lives of longer than five years. This is selected since the military acquisition managers are primarily military and they rotate positions every three years. If a project is not completed within two military leadership rotations the original concept of the project will change scope as new leadership wants to infuse their concepts and ideas on the project. While this activity is based on good intentions from a project management perspective, it is a sub-optimal practice. As the single DoD-wide acquisition management agency, yet to be identified emergent properties will be discovered by having the best and the brightest in the industry co-located. This organization also reduces the number of major acquisition processes from four to one. The reduction in redundant acquisition systems is definitely significant, and the efficiencies resulting from larger acquisitions managed in one organization will help facilitate the learning curve. This emergent property occurs from the consolidation of activities operating at a very slow clockspeed.[27] Since the projects are slower, having more running in one location increases the likelihood of learning between the projects.

The second function is to act as the DoD joint architect. This is an absolutely critical role for future technology development in the Information Age. What allowed the internet to grow and produce the benefits we are hoping to build into our defense infrastructure are standardized interfaces and formats. Having a common interface protocol took the internet from a merely

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[27] The Clockspeed phrase as used here was popularized by Charles H. Fine, and is used here to represent his concepts as applied to the acquisition system.

academic tool to the new cyber-lifestyle we are experiencing now. Even today there are movements to standardize Word documents so more platforms can read the documents. Adobe reader got wide spread acceptance and is becoming the de facto standard for sharing information because it provided a free base software and allows all machines to view the information. This is no different than what the military is trying to do with intelligence information: develop a standard which will allow all branches to view and use timely intelligence in a secure format. This is not a trivial problem. If the underlying architecture is not established, the military will spend billions in development until eventually, like the market, users decide by purchasing a large number of similar systems and forcing a standard architecture, which will neither be optimal, cost effective, nor timely.

Developing the DoD Architecture also requires a minimization of political influences. Since the architecture will be the bones of the future defense system, innovative knowledge workers should be allowed to develop the architecture based on technology architecture and other factors with minimal political influence. While this discussion is using the Internet as an example another example is military logistics. It is also a very complex and technical operation that should be developed with efficiency and effectiveness as the primary goals, not political acceptance. Though reality has dictated that that political influence is inevitable, but the ideal system should have a limited political influence on the architecture of systems. Since the logistics system should work branch-independent, just like the United Parcel Service's, UPS, model process, the logistics system between the branches should be identical to build in resiliency and redundancy of the system. [28] Establishing a single organization with the responsibility of architecting operations and systems that will be used between the branches is the first step in establishing a system which forces inter-branch acceptance.

The third function is to collect the concepts for testing and competition. This is another critical change to the current system. Of course there is concept testing and competition today, but not on a fundamental level as recommended here. As Figure 10-6 illustrates the three branches present their concepts for testing, evaluation and competition at the "The Blue Box." The idea

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[28] Concepts taken from the book, *Resilient Enterprises,* by Yossi Sheffi.

here is to provide a reason why each of the branches should work to incorporate the other branches requirements into its concept design process to help the concept have a better chance of selection by "The Blue Box". This will indirectly re-enforce inter-branch communication. Additionally, the "The Blue Box" can help ensure all the proper requirements are distributed between the branches. This allows the US to better capitalize on its research expenditures since having more and better refined requirements will allow better development of concepts. Each branch is very different and has their own style for concept development, which is excellent since competitive concept development between them will help produce better products, which in the end, will be used by all the branches. It will take leadership support for the Army to accept an Air Force design but experience shows that if the Air Force design and product is better, soldiers would rather have it. This example could easily be shown by the difference in the Air Force Housing process and the Army Housing process. Why not take the best concept and process and allow it to be used DoD wide? Joint concept testing and evaluation is a tremendous competitive advantage the US has, but it needs to further refine the process to allow better use of its capability; "The Blue Box" is one way to do that.

The fourth function is to provide two-way requirements communication between "The Blue Box" and the Joint Forces Command, the branches, and the Defense Industry. One of the major issues our current acquisition system has is the massive web of agencies and organizations across the country. "The Blue Box" introduces a consolidated and organized communication structure to help speed the discussions, technical requirements and issues that are part of military development process. Repeatedly, the major reason for project cost and time overruns is the lack of government provided requirements. There is enough publicly available information on this subject that it does not need to be presented here, but it is sufficient to say that clear requirements communication is a critical part of developing effective products and efficiently managing their development. Due to these issues it can be said that this primary function of "The Blue Box" is unquestionably needed.

The fifth primary function of "The Blue Box" is to take all the other primary functions and package them for other governmental agency use and be the new national acquisitions expert in

conjunction with the Government Accountability Office (GAO). "The Blue Box" will provide the process and tools expertise to help manage the acquisition process and teach those to other governmental agencies while the GAO can ensure the proper independent oversight is still maintained. While this is the least discussed function of "The Blue Box," it allows the government to take this experience and leverage the benefits for the rest of the governmental agencies. The cost savings could be tremendous.

Section 11.2 – Operations of "The Blue Box"

"The Blue Box" will not operate like any other government agency in existence today. "The Blue Box" will require completely new regulations for the people who will work in it especially since there is so much at stake in the acquisition of the future defense systems and ultimately the security of the United States. They should be hired by merit and released by merit, not by time in office. Pay should reflect comparable positions in private and commercial industry. This is essential to help establish "The Blue Box" as the pinnacle of a professional career. The hierarchy of the acquisition system will establish the branch concept development process boxes as a high level position and people in those positions must be carefully selected since they will be developing concepts to be considered for national fielding. The next higher level of prestige should be the Joint Forces area. Those employees will be integrating very complex strategic, political and conceptual joint concepts and feeding those high level requirements to "The Blue Box" for technical development. The employees in the "The Blue Box" are the *best of the best* in their technical fields and they understand all the issues the Joint Forces command is pushing down. They must be able to understand all the issues going into the acquisition of such major systems. "The Blue Box" must have the respect, prestige and pay that reflects the responsibilities it has. If "The Blue Box" is developed correctly, and rewarded accordingly, then aspiring young engineers and military personal will strive to make working at "The Blue Box" a personal and professional life goal.

"The Blue Box" will provide equal representation from the branches, and be comprised of 50% military and 50% civilian employees. The DoD talks of innovations and "Knowledge Workers,"

but has failed to fully support the truly great knowledge workers in a way that will really focus their effort as the concept of "The Blue Box" suggests. The amazing thing about the DoD today is the number of truly brilliant people in its ranks who are often relegated to positions where their great capabilities are not fully realized. The government should develop this system to better reward those individuals and provide them with both a reason to continue to serve the nation and be rewarded for their efforts accordingly. The mix of military and civilian backgrounds in "The Blue Box" is also important to ensure that military necessity and realistic understanding of the operating environments of these military systems is considered, and to balance academic dreaming in the acquisition system.

One final operating consideration is the inclusion of Defense Industry Partners permanently in "The Blue Box." This is important because they represent all the vast capabilities of their companies, and the better they understand the military requirement the better they can all compete to meet those needs. By providing a continuous interface with the military acquisition system, this also reduces the need for the companies to lobby and spend so much on sales forces. By law, it would be recommended that Defense Industry partners not be allowed to communicate with political figures on sales issues in an attempt to better focus defense industry partners on integrating with the branch concept development process. This is an idealistic concept but it definitely should be a considered a starting point for development of "The Blue Box" concept.

"The Blue Box" would initially consist of six departments which embody the above primary functions and represent an initial concept development design. They are presented below for consideration but no further discussion is necessary.

- Project Management Department
- Concept Collection, Competition and Testing Department
- Requirements Management and Communication Department
- Innovation in Technology, Tactics and Procedures Department
- Product Architecture and Integration Department
- Acquisition Department

Each of the departments will be heavily integrated with the others which suggests a single integrated facility for this organization. As mentioned in the previous paragraph, the organization and distribution of the civilian employees, military members and the Defense Industry Partners could be developed at a later time in greater detail but for a conceptual development having these topics provides enough resolution of the organization for discussion purposes.

Section 11.3 – Objectives of "The Blue Box"

There are many objectives of "The Blue Box" and most likely as the concept is refined and discussed, further additional objectives are going to be realized. The primary objectives as envisioned have been mentioned in many other locations in the thesis, but for a quick summary a list is provided below.

- Improve the efficiency of the realization of large joint acquisition projects
- Better provide a process which supports the development of DoD products which embody NCW Theory and the Transition to the Information Age
- Minimize political influence on technical decisions with package decision authority still given to the Secretary of Defense
- Provide a process which maximizes the consideration of strategic requirements on the acquisition system
- Better manage the Defense Industry:
    - To ensure continued survival of current Defense Industry Partners
    - To build resilience in national defense capability strategies
- Integrate and facilitate inter-branch communication, cooperation and competition
- Give the branches reasons to better support their transformational capabilities through competition
- Develop a process which maximizes the integration of technology, experts, innovation, and requirements to produce the best system architecture to support military operations in the Information Age

These objectives are based on current needs and on the current models that are available. An important concern that many critics of change espouse is that changing a system brings about emergent properties which could be worse than the current system. This is possible, but a thoughtful use of system dynamics models and a careful study of new acquisition system architectures prior to implementation mitigates those risks. For the purposes of discussion, and for developing a new system for acquisitions and transformation, any starting point is better than none at all. The problem with large scale change, especially on this level, is there is rarely a comprehensive enough initial concept which can spin off discussions and the development of new better conceptual models. If nothing else, the objective of "The Blue Box" concept is to be a starting point for better future discussions on how to transform the DoD for the Information Age.

Chapter 12 - Summary Conclusions and Recommendations

This document covers very large topics such as concepts of Network-Centric Warfare, military transformation, Department of Defense Transformation Plans and a review of the military acquisition system. It also proposes a new purchasing system for the most expensive military in the world. These are huge subjects and it is acknowledged that all relevant points of discussion on such topics cannot be addressed in one paper. But the major considerations are summarized and reviewed for basic underlying issues. The use of system dynamics to view the complex acquisition system and manage the information such that it is cognitively possible is a significant step towards a better understanding of that complex system.

This thesis reviewed the background concepts and ideas of the both the military past and proposed future military changes. It reviewed the acquisition system and the needs of the combatant commanders. It reviewed the needs of the government and the needs of the Defense Industry, and of course, the needs of the military personnel fighting our nation's battles. These considerations are not simple and each of the above topics represents what some people study for their whole life. This thesis combines all of those systems to be better understood for future change, and argues for taking a systems perspective.

Numerous changes to the acquisition system are proposed for the future to ensure the security of the nation. At the same time the recommendations work to improve the speed and efficiency of the acquisition system while producing better final systems. The recommendations are broad and they represent fundamental changes to the system, including: (1) legislative changes for purchasing authority for the military, (2) the creation of "The Blue Box", (3) new personnel regulations for the staff working in the "The Blue Box", (4) changes to the acquisition system on a massive scale, and (5) regulations controlling the interface of the Defense Industry with the government and military. In addition to those major changes, many other changes will be required of the acquisition system to represent "The New Model" as proposed. But those

changes are not too different from many changes that have already been suggested by other organizations.

John J. Hamre and the CSIS have presented a report to the Senate Armed Services Committee addressing many of the same issues raised here. Their recommendations are based on different studies and completed entirely independently of this thesis. But the surprising overlap of recommendations between their report and this thesis suggests the ability to visualize the entire system is important. It makes it clearer for individuals to understand the system and see what needs to be changed for the future. Below are the parallel issues or recommendations raised between the two papers to illustrate this point.

Mr. Hamre's Comments in the Paper	Brown Thesis position on the point
The acquisition system is antiquated	Agrees – Proved with models
The change from large industrial base to much small #'s	Agrees
Lack of technical expert in DoD acquisition occurred by loss of the Director Defense Research and Engineering	Agrees – but recommends a new organization
Clarity of acquisition process is missing	Agrees – proved with models
"the DoD as a whole does not have a systematic accountability of actions that links requirements with budget acquisition."	Agrees – addressed by "The Blue Box" in great detail
"advocate giving representation on the JROC to the Combatant commanders"	Agrees – shows the connection in the dynamics model
"Fusion of supply and demand occurs only at the office of the Secretary of Defense".	Agrees – approval of package acquisitions as recommended by "The Blue Box"
"Return the Service Chiefs to the Acquisition Chain of Command."	Agrees – but indirectly through the Joint Forces Command
"Service chiefs need to be held accountable for the whole supply function and need the authority to carry it out."	Disagrees- supply functions should be left to supply and logistics experts. Service chiefs should only support demand.
"We cannot fight and win wars without our private sector partners."	Agree- supported by "The Blue Box" concept and other concepts
"The defense industry is an increasingly smaller part of the economy, and fragile."	Agree – discussed in several chapters
"I am not sure that we have solid framework for these alternative management approaches."	Disagree – several solutions are presented in the thesis

The CSIS presented the problems and recommendations in a different way but it is with the same goal that all the previous recommendations in the thesis were also made; to help the government. This thesis was created—not to criticize, but to critically review and recommend changes for the betterment of the organization. As proposed in "Freakonomics" by Steve Levitt and Stephen

Dubner, asking a question in a different way and reviewing the information in a different context can bring startling new insights. System Dynamics may be an effective method for considering complex government issues.

Section 12.1 – Conclusions

The thesis has recommended many changes to the acquisition system and the DoD transformation process. The use of system dynamics models represents a fundamental change to the perspective and process of analyzing the system. Numerous reports use the tried and true method which includes the use of past history analysis with current conditional analysis, and then recommend solutions based on theoretical conclusions. The systems dynamics method offer an effective way to analyze and view the DoD system and the quagmire of processes and procedures it is comprised of. The new perspective this thesis presents hopefully will allow a fresh look at the system, and perhaps provide new motivation for current experts to explore building these types of models further.

The scope of this project and the complexity of the system is far beyond the capability of one person in a single masters thesis, but the freedom to explore and suggest hypothetical changes shows the promise such a system allows. The detail in the models and system could be refined further, but the level of resolution taken was appropriate for the purpose of this thesis and its conclusions.

Section 12.2 - Recommendations

During the course of this analysis many recommendations for further study were mentioned. Below is a list of areas where greater research could lead to better insights on the system and refine further recommendations.

- Develop more detailed systems dynamics models of each military branch to identify system factor effects which most positively help the branch acquisition system.

- Expand the models of the acquisition systems to include the Defense Industry integration and its effects on the development acquisition process. How big an effect does the Defense Industry have on the individual branch acquisition system?

- Collect real data to convert the visual models to fully functioning mathematical models to show/develop potential cost data for projects.

- Build military culture effects tables to model the effects of different military and unit cultures on the transformation process.

- Study the new models to find and evaluate the cost of all the redundant acquisition processes and support organization in the military to place a total cost savings on having one major acquisition system verses four.

- Look at overlapping missions between the services to identify how combining more service schools would build better Joint Operations Culture through training and increased redundancy in both capability and training.

- Study the cost savings of having joint training and redundant capabilities of service members to quantify how the expense of fielding technologically advanced soldiers increases capabilities verses having larger numbers of lesser trained service members.

- Build system dynamics models of the fielding, support and logistical effects on the system to be gained by having more common hardware. Real data could be quickly acquired to build a fully functional and working model for this system. The resulting data will be invaluable for future decision making.

- Most importantly, a continued congressional study of this proposal and "The Blue Box" could provide the beginnings of the next true transformation of the acquisition system for the betterment of both the military and reducing the cost of military development.

The Blue Box is such a fundamentally new organization, and embodies what should be the vast majority of the DoD acquisition and development process, it is going to require a very large facility and location to exist. It is important to remember all the branches and the defense industry will all have offices together in "The Blue Box". "The Blue Box" will also serve as the focal point for new concepts and technical requirements collection and generation. These are very substantial operations and each branch and operation will have their own different

requirements and operations. Also the organization will encompass the interests of the entire U.S. DoD. It is recommended that a new facility, enabling consolidation be constructed outside the D.C. "Beltway" to allow proximity to the operational elements of the DoD, the Pentagon and Congress but nominally geographically separated to allow independent operation as previously described. While some argue it is premature to recommend a "Pentagon II" for transformation and development in reality the complex technical nature of modern war is going to eventually demand some form of development consolidation prior to and part of developing a Network-Centric Military.

Finally the most important recommendation is to continue the study of the transformation process using cutting edge management and engineering systems technologies. This thesis represents one new way of integrating those two sciences to study a common problem. Further research on this subject using systems dynamics would continue to produce new insights and understanding of the DoD acquisition and transformation process. I would hope that this thesis will be embraced and considered a starting point for further analysis and study. The application of system dynamics on military systems is new and allows the user the capability to better track and understand all the interactions occurring in the system. More importantly, this process will allow new patterns and insights to be revealed and evaluated. I am confident that continued study of this methodology-based process, and with the freedom to think, "outside the box", would produce excellent recommendations for the future. And, most importantly, this will help keep our nation best prepared for the challenges the future has in store.

WORKS CITED

Alberts, David S., Garstka, John J., and Stein, Frederick P., Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd Edition (Revised), Washington D.C., CCRP, 1999.

Booz Allen Hamilton, Measuring the Effects of Network-Centric Warfare, Volume I. McLean, VA 1999.

Burke, Martin. Information Superiority Is Insufficient to Win In Network Centric Warfare, Joint Systems Branch, Defense Science and Technology Organization, 2001, http://www.DoDccrp.org/events/2000/5th_ICCRTS/cd/papers/Track4/024.pdf

Butler, Amy. Pentagon Transformation Analysis Outlines Capability Gaps, Defense Daily, 19 November, 2004.

Congressional Research Service, Network Centric Warfare: Background and Oversight Issues for Congress, GPO, Washington D.C., June 2004.

Cebrowski, Vice Admiral (Ret.) Arthur K., Director, Office of Force Transformation, interview with Frank Swofford, Defense AT&L, March-April 2003.

---. Network-centric Warfare: An Emerging Military Response to the Information Age, Presented at the 1999 Command and Control Research and Technology Symposium.

---, Transformation's Trajectory, "Transformation Trends – 3 March 05", GPO, 2005.

Cowan, David, Rapid Fielding Initiative Overview to Precision Strike Association, presented by Chief of Operations, Rapid Fielding Initiative., 21 April 2004. http://www.dtic.mil/ndia/2004precision/cowan.pdf

Davis, Paul. Effect-Based Operations: A Grand Challenge for the Analytical Community. RAND, 2002, http://www.rand.org/pubs/monograph_reports/MR1477/.

Fayette, Daniel F., Effects Based Operations "Application of new concepts, tactics, and software tools support the Air Force vision for effects-based operations". AFRL's Information Directorate, Information Technology Division, Dynamic Command and Control Branch, Rome NY. http://www.afrlhorizons.com/Briefs/June01/IF00015.html

Franks, Tommy. Gen, Ret., American Soldier. HarperCollins, New York, 2004.

Garstka, John J., "Network-Centric Warfare Offers Warfighting Advantage," Signal, May 2003.

General Accounting Office (GAO), United States, Defense Industry Consolidation: Competitive Effects of Mergers and Acquisitions, Testimony, 03/04/98, GAO/T-NSIAD-98-112. 1998.

Grossman, Elaine M., Army, Air Force Brass to Begin Talks, InsideDefense.com NewsStand, Military.com, 06 January 2006.

Harlan Ullman, James Wade, Jr. Et al., Shock and Awe; Achieving Rapid Dominance, Washington, DC, National Defense University Press, 1996.

Hasslinger, USN CAPT (Ret.) Karl, Patrick Gorman, Mark Jacobsohn, mark Levy, Juli MacDonald, Amanda O'Neil, Cliff Webster, CAPT Jan von Toil, USN ed, Michael Fieneberg ed, and Mark Herman ed. Measuring the Effects of network Centric Warfare: Volume II: Exploring Belief Metrics in Warfare. Information Assurance Technology Analysis Center, Fall Church, VA, January 2002.

Hippel, Eric von, Democratizing Innovation, MIT Press, Cambridge, 2005.

Joint Forces Command, Joint Operational Environment-Into the Future – Draft 11 Jan 2005. Washington D.C., GPO. 2005.

Kean, Thomas H., Lee H. Hamilton, Richard Ben-Venise, Fred F. Fielding, Jamie S. Gorelick, Slade Gorton, Bob Kerry, John F. Lehman, Timothy J. Roemer, and James R. Thompson. Final Report on 9/11 Commission Recommendations December 5, 2005. http://www.9-11pdp.org/press/2005-12-05_report.pdf

Levitt, Steven D., and Stephen J. Dubner, Freakonomics: A Rogue Economist Explores The Hidden Side of Everything. Harper Collins Books, New York, 2005.

Network-Centric Warfare, Creating a Decisive Warfighting Advantage, Washington D.C., GPO, 2003

Miller, George A., The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information, Harvard University, first published in *Psychological Review*, *63*, 81-97. 1956

Moray, Neville. "A Taxonomy and Theory of Mental Models." Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting, 1996., page 164-169.

Murdock, Clark A., Michele A. Flournoy and et al, Beyond Goldwater-Nicholos: U.S. Governement and Defense Reform for a New Strategic Era – Phase 2 Report, CSIS, Washington D.C. 2005.

Office of Force Transformation, Office of Force Transformation Home Page. (OFT) August 2005 – January 2006, http://www.oft.osd.mil/

---. Elements of Defense Transformation, Washington D.C. GPO, 2005. http://www.oft.osd.mil/

---, Military Transformation – A Strategic Approach, Washington D.C., GPO 2005.

---, The Implementation of Network-Centric Warfare, Washington D.C., Office of Force
        Transformation, GPO, 2005

Rumsfeld, Donald, H., Transformation Planning Guidance, April 2003, Department of Defense.

---. 2001 Quadrennial Defense Review Report, Department of Defense, GPO, 2001

Simchi-Levi David, Philip Kaminsky and Edith Simchi-Leve, Designing and Managing the
        Supply Chain: Concepts, Strategies and Case Studies, Second Edition. McGraw-Hill
        Irwin, New York, 2003.

Ulrich, Karl T., and Steven E. Eppinger, Product Design and Development, Third Edition,
        McGraw Hill, Irwin, New York, 2004.

U.S. Air Force, The U.S. Air Force Transformation Flight Plan, HQ USAF/XPXC, GPO, 2004

U.S. Army, 2004 Army Transformation Roadmap, Office of the Deputy Chief of Staff, U.S.
        Army Operations, Army Transformation Office. 2004. www.army.mil.

U.S. Navy, Naval Transformation Roadmap 2003, Office of the Secretary of the Navy, GOP,
        2003.

WORKS CONSULTED

Adkins, Dr. Mark, and Dr. John Kruse, <u>Network Centric Warfare in the U.S. Navy's Fifth Fleet – Network-Supported Operational Level Command and Control in Operation Enduring Freedom</u>, Presentation to the Department of Defense, February 2004.

Alberts, David S. & Hayes, Richard E. <u>Power to the Edge: Command…Control… in the Information Age.</u> Washington, DC: CCRP Publication Series. 2003.

---, John Garstka, Richard E. Hayes, and David T. Signori. <u>Understanding Information Age Warfare</u>. Washington, DC: CCRP Publication Series. 2002.

---, John J. Garstka, and Fredrick P. Stein. <u>Network Centric Warfare: Developing and Leveraging Information Superiority</u>. 2nd Edition (Revised). Washington, DC: CCRP Publication Series. 2002.

---. <u>Information Age Transformation: Getting to a 21st Century Military.</u> Washington, D.C.: CCRP Publication Series. 2002.

Agron, COL Gary. <u>Defense Transformation and Network Centric Warfare – "The Path Not Taken…yet"</u>. Briefing to Department of Defense, Office of Force Transformation, 2005.

Baum, Dan, <u>Battle Lessons – What the generals don't know</u>. The New Yorker, January 12, 2005.

Brownlee, The Honorable R.L., and Gen. Peter J. Schoomaker, presentation to the United States Senate Committee on Appropriations <u>FY05 Army Budget</u>., 2nd Session, 108th Congress, Washington D.C. 2004.

Carter, Ashton B. and White, John P., ed. <u>Keeping the Edge: Managing Defense for the Future</u>. BCSIA, Cambridge MA, 2001.

Cebrowski, Retired Vice Adm. Arther K., <u>The Power of Information Comes form the Ability to Share</u>. "The Defender" Volume 2, No 3 page 2. 2005.

---, and John J. Garstka, <u>Network-Centric Warfare: its Origin and Future</u>, "Proceedings" January 1998.

Collens, Josiah R. Jr., and Bob Krause, <u>Theatre Battle Management Core System Systems Engineering Case Study</u>. Center for Systems Engineering at the Air Force Institute of Technology, Wright-Patterson AFB OH, 2004.

Crile, George. <u>Charlie Wilson's War</u>, Grove Press, New York, 2003.

Department of Defense, <u>Global Strike Joint Integrating Concept –Version 1.0</u>, Washington D.C. GPO, 2005.

---. Network Centric Warfare Report to Congress. July 2001.

---, <u>Net-Centric Environment – Joint Functional Concept – Version 1.0</u>, Washington D.C. GPO, 7 April 2005.

Defense Science Board Study, <u>Unmanned Aerial Vehicles and Uninhabited Combat Aerial Vehicles</u>, Department of Defense, Washington D.C. GPO, February 2004.

Fine, Charles H., <u>Clock Speed – Winning Industry Control in the Age of Temporary Advantage</u>, Perseus Books, Reading MA, 1998.

Friedman, Thomas L., <u>The World is Flat – A Brief History of the Twenty-First Century</u>. Farr, Straus and Giroux, New York, 2005.

Garstka, John J. and Fred P. Stein, <u>Fighting the Networked Force</u>, Presentation to Network Centric Warfare, Washington D.C. GPO, 2004.

---, and David Alberts, <u>Network Centric Operations Conceptual Framework – Version 2.0</u>, Evidence Based Research, Vienna, VA, 2004.

---, <u>Network Centric Operations Short Course</u>. April 5-7, 2004.

Gonzales, Daniel, John Hollywood, Gina Kingston, and David Signor, <u>Network-Centric Operations Case Study – Air-to-Air Combat With and Without Link 16</u>. Rand, Washington D.C. 2005.

Hamre, John J., <u>Problems with and Improvements to Defense Procurement Policy</u>, Testimony before the subcommittee on AirLand Committee on Armed Services Unites States Senate, CSIS Report, 15 Nov 2005.

Handel, Michael I., <u>Masters of War – Classical Strategic Thought, Third, Revised and Expanded Edition.</u> 1992, Frank Cass Publishers, Portland, 2001.

Horn, Kenneth, Carolyn Wong, Bruce Held, Elliot Axelband, Paul Steinberg, and Sydne Newberry. <u>Smart Management of R&D in the 21st Centrury – Strengthening the Army's Science and Technology Capabilities</u>. Rand Arroyo Center, 2000. http://www.rand.org/ard/

Joint Chiefs of Staff, <u>Joint Concept Development and Revision Plan – July 2004</u>. Washington D.C., GPO 2004.
---, <u>Capstone Concept for Joint Operations Version 2.0</u>, Washington D.C. GPO, August 2005.

---, Joint Capability Areas – Post OA-05 Refinement Effort, Comment Resolution Conference, Briefing to Joint Staff J7/J8 26-28 April, 2005.

---, JOpsC Family of Joint Concepts – Executive Summaries, Operational Progress Review, Joint Experimentation, Transformation and Concepts Division, GPO, 23 August 2005.

Joint Forces Command, Joint Operational Concepts – Nov 2003. Washington D.C. GPO, 2003.

---, Joint Command and Control Functional Concept – Feb 2004. Washington D.C. GPO, 2004.

Leeds, Carol McMichaels, Al handle, Michelle Lemke, Tom Fernan, and John Dailey. Joint Forces Command, Rapid Assessment Process (RAP) Report #04-01 "The Knowledge Worker", Washington D.C. October 2003.

Leveson, Nancy, Mirna Daouk, Nicolas Dulac, and Karen Marais, A Systems Theoretic Approach to Safety Engineering, , Aeronautics and Astronautics Dept. Massachusetts Institute of Technology, October 30, 2003.

Maier, Mark W. and Eberhardt Rechtin. The Art of Systems Architecting, Second Edition. CRC Press, Boca Raton, 2002.

Matsumura, John, Randall Steeb, John Gordon IV, and Paul Steinberg. Preparing of Future Warfare with Advanced Technologies – Prioritizing the Next Generation of Capabilities. Rand Aroyyo Center, 2002.

Meyer, Marc H., and Alvin P. Lehnerd. The Power of Product Platforms – Building Value and Cost Leadership. The Free Press, New York, 1997.

Moffat, James. Complexity Theory and Network Centric Warfare, Command and Control Research Program, Washington D.C. September 2003.

Mount, Ian. David H. Freedman and Matthew Maier. The New Military-Industrial Complex. Business 2.0, March 2003 Issue.

Office of Force Transformation, A Network-Centric Operations Case Study: US/UK Coalition Combat operations during Operation Iraqi Freedom. Washington D.C. 2 March 2005.

Potts, David. The Big Issue: Command and Combat in the Information Age. Command and Control Research Program, Washington D.C. February 2003.

Phucas, Keith. "The New Military: Proposing Change". Times Herald Staff, Norristown (PA) 28 Nov 2003.

Rausand, Marvind and Arnljot Hoyland. System Reliability Theory – Models, Statistical methods, and Applications, Second Edition, John Wiley & Sons, Inc. New Jersey, 2004.

Roque, Ashley. Congress Revives missile Killed by DoD, InsideDefense.com Newstand 29 Dec 2005. via Military.com.
http://www.military.com/features/0,15240,84076,00.html?ESRC=eb.nl

Senge, Peter M., The Fifth Discipline – The Art & Practice of The Learning Organization, Currency Doubleday, New York, 1990.

Setter, Oren and Asher Tishler, The Role of Integrative Technologies as a "Force Exponent" on Military Capability – Preliminary Draft. Faculty of Management, Tel Aviv University, 2004.

Sheffi, Yossi. The Resilient Enterprise – Overcoming Vulnerability for Competitive Advantage. The MIT Press, Cambridge MA, 2005.

Smith, Edward A., Effects Based Operations. Applying Network Centric Warfare in Pease, Crisis and War. Command and Control Research Program, Washington D.C., November 2002.

Sterman, John D., Business Dynamics – Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston, 2000.

Taylor, Glenn, Dr. Scott Wood and Keith Knuden, Enabling Battlefield Visualization: An Agent –Based information Management Approach. Presented at the 10th International Command and Control Research and Technology Symposium; Soar Technology Inc, Ann Arbor MI. 2005.

U.S. Code Section 10, § 167a. Unified combatant command for joint warfighting experimentation: acquisition authority, Title 10, Subtitle A, Part I, Chapter 6.
http://www4.law.cornell.edu/uscode/html/uscode10/

Utterback, James M., Mastering the Dynamics of Innovation, 1994, Harvard Business School Press, Boston, 1996.

Warne, Leoni, Derek Bopping, Irena Ali, Dennis Hart, and Celina Pascoe, The Challenge of the Seamless Force: The Role of Informal Networks in Battlespace. Presented at the 10th International Command and Control Research and Technology Symposium. 2005.

Wilson Clay, Network Centric Warfare: Background and Oversight Issues for Congress, Congressional Research Service, Report to Congress, Washington D.C. GPO, June 2004.

Williams, Cindy, Filling the Ranks: Transforming the US Military System, BCSIA Studies in International Security, April 2004.

Wong, Carolyn. Organizational Management of Army Research, Documented Briefing, Rand Arroyo Center, Arlington VA, 2003.

Wynne, Michael W., Overview of the Department of Defense Acquisition Programs, Reform and Workforce. Testimony of Michael W. Wynne Under Secretary of Defense(Acting) Acquisition, Technology and Logistics) Before the U.S. Senate Committee on Armed Services Readiness and Management Subcommittee, 13 May. 2004.