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APPLICABILITY OF THE LAW OF REQUISITE VARIETY IN MAJOR MILITARY SYSTEM ACQUISITION

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This research explores the value of variety in major military systems by applying concepts from the Law of Requisite Variety and uses the MRAP as an example of a materiel solution throughout. Increasing system variety conflicts with current acquisition practices, which prefer commonality. This research finds that warfighter capabilities increase with variety, but variety is contra to achieving commonality and cost savings. To achieve a balance between commonality and variety, the authors suggest organizational and system hardware alternatives.

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APPLICABILITY OF THE LAW OF REQUISITE VARIETY IN MAJOR MILITARY SYSTEM ACQUISITION

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ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

AOA	analysis of alternatives
AOC	Army Operating Concept
CBA	capabilities based assessment
CDD	capabilities decision document
CJCS	Chairman of the Joint Chiefs of Staff
COTS	commercial-off-the-shelf
CRS	Congressional Research Service
DAS	defense acquisition system
DOD	Department of Defense
DODI	Department of Defense Instruction
DOTMLPF-P	doctrine, organization, training, materiel, leadership, personnel, facilities, and policy
DSS	defense support system
EFP	explosively formed penetrator
FAA	functional area analysis
FNA	functional needs analysis
FOC	full operational capability
FRP	full rate production
FSA	functional solutions analysis
HMMWV	high mobility multipurpose wheeled vehicle
ICD	initial capabilities document
IED	improvised explosive device
IOC	initial operating capability
JCB	joint capabilities board
JCIDS	joint capabilities integration and development system
JLTV	Joint Light Tactical Vehicle
JROC	Joint Requirements Oversight Council
KPP	key performance parameter
LORV	Law of Requisite Variety
LRIP	low rate initial production

LTV	Light Tactical Vehicle
MATV	MRAP All-terrain Vehicle
MDA	milestone decision authority
MEF	Marine Expeditionary Force
MRAP	Mine Resistant Ambush Protected [vehicle]
NSA	non-state actor
NSC	National Security Council
OT&E	operational test and evaluation
PPBE	planning, programming, budgeting, and execution
RFP	request for proposal
RPG	rocket-propelled grenade
USMC	United States Marine Corps
UUNS	urgent universal needs statement

EXECUTIVE SUMMARY

In 2005, the United States devoted significant military capability to securing and reconstructing Iraq and helping the people of Iraq establish a government. The major military impediment to accomplishing this goal was the insurgency in Iraq which sought to disrupt a legitimate government that the Iraqi people collectively controlled. To defeat the insurgency, the United States would focus military efforts on counterinsurgency strategy, a complex form of warfare against an adaptive enemy.

Counterinsurgency is a difficult form of warfare in any set of circumstances, and counterinsurgency operations always begin at a disadvantage relative to insurgencies. The U.S. military, however, entered the counterinsurgency portion of Operation Iraqi Freedom without modern counterinsurgency doctrine and against an enemy that was very successful using improvised explosive devices (IEDs) against U.S. forces, with particular success against the high mobility multipurpose wheeled vehicle (HMMWV).

With a goal to increase U.S. soldier and marine survivability against IED attacks, Secretary of Defense Robert M. Gates took personal responsibility to procure and field the mine resistant ambush protected vehicle (MRAP) (Gates, 2014, pp. 122–123). Procuring the MRAP was a costly endeavor, but increased survivability against IED attacks. Due to its survivability improvements, tactical commanders were expected to replace HMMWVs with MRAPs. As a result of the fielding mandate, the MRAP became a battlefield constraint that restricted the options commanders had to engage an enemy. Additionally, and because of its size, security, and physical characteristics, the MRAP decreased the personal interaction of U.S. forces with their areas of responsibility and increased the potential for damage to civilian property. The reduced contact with the local population and increased potential to damage local infrastructure reduced overall effectiveness in counterinsurgency, despite increased survivability on the battlefield.

The goal of this research is to conduct ex post analysis on the MRAP procurement timeline, and its relationship to national strategy, as well as strategic goals for U.S. military strategy in Iraq. Specifically, this research answers the question: What is the

relevance of the Law of Requisite Variety (LORV) in a procurement and fielding strategy? The answer to the question is that LORV causes the military to increase the value variety in waging warfare against complex enemies. This increased variety extends to the procurement process.

LORV is a universal law first articulated by W. Ross Ashby that describes complex systems and provides generalized instruction to control them. By categorizing insurgencies as complex systems, the U.S. military can focus strategy, and can generate forces and supporting materiel procurement initiatives to create an adaptive force that can overwhelm an insurgency by creating greater variety than the insurgency is able to create. This challenge is considerable, as insurgencies often control several dimensions of warfare, creating tactical advantages that increase over long periods of time, which are common in counterinsurgency operations.

LORV asserts that the way to control complex systems that have variety is with more variety (Ashby, 1956, p. 207). In military application, this sentiment directly refers to tools available to tactical commanders. It also extends to the military procurement system, charged with generating these tools for tactical commanders. In the current acquisition system, organizations within the Department of Defense (DOD) such as the Joint Requirements Oversight Council, seek opportunities to make service-specific acquisition programs into joint programs. Joint programs certainly have their place in the DOD, but there is no organizational function that opposes the tendency for joint acquisition programs and promotes service-specific acquisition programs. Service-specific acquisition programs increase the amount of systems across the DOD, and leave individual services in control of the balance of economic advantages through common systems versus tactical variety from service-specific acquisition programs. The first recommendation is to assign a variety advocate function within the DOD that can balance organizational tendency to consolidate service-specific programs into joint programs.

To increase the effectiveness of the procurement process that can respond to enemies that adapt quickly, the U.S. must develop alternate procurement methods that can procure adequate solutions quickly. If the military fails to adapt the current procurement system, it risks obsolescence of a system by the time it is fielded, or worse,

may find itself unable to achieve strategic goals because of lack of materiel delivered in an adequate amount of time. The system acquisition process must produce variety while controlling costs, focusing on lifecycle requirements of the system, and anticipating adaptive enemies and changing battlefields. To achieve this end, this research makes a second recommendation of focusing on subsystems and commonality, using in place applications like the modular open systems architecture methodology (MOSA). Through increased use of MOSA, program managers will anticipate a variety of enemies, and a variety of operations that span all types of conflicts that the military may face. The second recommendation, therefore, is to enforce emerging policy to increase use of MOSA in the acquisition strategy, and review MOSA goals at acquisition milestone reviews.

These two recommendations are certainly not exhaustive, but address organizational tendencies to produce conventional military solutions when the military must also anticipate future unconventional threats. The result is compliance with the current acquisition process, while improving the ability to produce variety that tactical commanders can use against adaptive enemies. Failure to anticipate unconventional threats will make enemy unconventional approaches such as insurgency more effective against conventional-minded forces such as the traditional U.S. military.

References

Ashby, W. R. (1956). *An introduction to cybernetics.* London, England: Chapman & Hall.

Gates, R. M. (2014). *Duty: Memoirs of a secretary at war.* New York, NY: Alfred A. Knopf.

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Finally, former Secretary of Defense Robert M. Gates enhanced this research by meeting with us early in our information-gathering phase. His candid answers to questions about U.S. military strategy in Iraq clarified his intent for the Mine Resistant Ambush Protected vehicle and its fit into national defense strategy. Dr. Gates' leadership as Secretary of Defense and continued service exemplify what public service should be, and set a benchmark that we will follow.

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I. INTRODUCTION

A. SUMMARY OF CIRCUMSTANCES IN IRAQ FOLLOWING MAJOR COMBAT ACTIONS

On May 1, 2003, President George W. Bush stood on the USS *Abraham Lincoln* and formally announced the conclusion of major military operations and the transition to "securing and reconstructing" Iraq (Murphy, 2003). The speech is often misrepresented by the banner in the background, attached to the aircraft carrier, which read, "Mission Accomplished" (Rifkin, 2015; see Figure 1).[1] Although the President would receive widespread criticism over this declaration (more so for its mischaracterization), there seemed to be good reason at the time for optimism: President Bush's announcement marked the completion of the first strategic objective in Iraq—the overthrow of Saddam Hussein and his Sunni-led Ba'ath government (Dale, 2008, p. CRS-10). Two and a half years after the USS *Abraham Lincoln* announcement, the White House published *National Strategy for Victory in Iraq*, thereby communicating that the overall mission had certainly not been accomplished, nor was it near completion (National Security Council, 2005).

[1] The speech pictured in Figure 1, on May 1, 2003, is the subject of media mischaracterization and is unofficially referred to as the "Mission Accomplished" speech. The content of the speech did not reference that any mission was complete, but that the United States was entering a new strategic campaign. The speech is accurately characterized by the following quote from the speech from President Bush: "Major combat operations in Iraq have ended. In the Battle of Iraq, the United States and our allies have prevailed. And now our coalition is engaged in securing and reconstructing that country" (Murphy, 2003).

President George W. Bush delivering a speech aboard the USS *Abraham Lincoln* on May 1, 2003. The banner in the background became a source of mischaracterization about U.S. strategy in Iraq.

Figure 1. President Bush aboard the USS *Abraham Lincoln*.
Source: Rifkin (2015).

This strategy document concluded with the following eight pillars of U.S. strategy for Iraq:

1. Defeat the terrorists and neutralize the insurgency
2. Transition Iraq to security self-reliance
3. Help Iraqis forge a national compact for democratic government
4. Help Iraq build government capacity and provide essential services
5. Help Iraq strengthen its economy
6. Help Iraq strengthen the rule of law and promote civil rights
7. Increase international support for Iraq

8. Strengthen public understanding of coalition efforts and public isolation of the insurgents (National Security Council, 2005, pp. 28–35)[2]

These eight pillars indicate that Iraq had been militarily defeated and that future U.S. military efforts in Iraq would focus on rebuilding Iraq and empowering a legitimate government. By publishing these pillars, the National Security Council (NSC) publicly and unmistakably acknowledged that the United States was fighting against an insurgency.[3]

By publishing the *National Strategy for Victory in Iraq*, the United States acknowledged an insurgency enemy that would require U.S. counterinsurgency operations. However, the U.S. Army and U.S. Marine Corps (USMC) did not have contemporary field manuals on how to prepare for and execute counterinsurgency warfare.[4] The U.S. Army and Marine Corps would not publish their joint field manual, FM 3-24 *Counterinsurgency*, for another 13 months. *Counterinsurgency* acknowledged a doctrinal gap that existed in the Army for the previous 20 years and in the Marine Corps for the previous 25 years (Headquarters, Department of the Army, 2006,

[2] The term *strategy* has countless definitions, and definitions vary based on context, such as business strategy in a market or military strategy against an enemy. This research does not rely on a single definition, but a synthesis of definitions that Andrew Marshall, former Director of the Department of Defense Office of Net Assessment and Dr. Mie-Sophia Augier are co-writing. The work is still unpublished, but suggests understanding strategy as "the dynamic process of identifying, creating, and exploiting asymmetric advantages. Strategic thinking is about looking for possible current and future asymmetric advantages that can be used to achieve or improve our competitive advantages in the long term competitive situation. … We must understand how the organizational characteristics of ourselves as well as our competitors both contributes to facilitating as well as creating obstacles to strategy; and we must understand how cognitive, psychological, and cultural factors influences the decision makers and among the organizations" (Augier & Marshall, 2017).

[3] Political leadership avoided using the term *insurgency* and variations of the term. This is apparent in a press conference that occurred on November 29, 2005, with the Chairman of the Joint Chiefs of Staff, General Peter Pace, who may have first used the term publicly to describe warfighting in Iraq. Secretary of Defense Donald Rumsfeld, also participating in the press conference, quickly returned to the strategic message that the United States and coalition partners were not fighting an insurgency, but instead enemies of the legitimate Iraqi government. This demonstrates the reluctance of senior DOD leaders to use the term *insurgency* (Department of Defense [DOD], 2005).

[4] In its Forward, FM 3-24, *Counterinsurgency* acknowledges a doctrinal gap in conducting counterinsurgency operations. This does not imply that there was no knowledge, but there was not a warfighting focus following the Vietnam Conflict. Following the Vietnam Conflict, U.S. strategists focused on conventional warfighting to respond to Cold War threats. One of the purposes of FM 3-24 *Counterinsurgency* was to re-establish doctrine to provide unified instruction on how to wage counterinsurgency warfare from strategic through tactical levels of warfighting (Headquarters, Department of the Army, 2006).

Foreword). Before the Army and Marine Corps published the manual, tactical and operational commanders adapted the forces and the techniques they used to confront their enemies. However, these methods could not have been executed in a consistent and unified manner governed by established doctrine disseminated from strategic levels (National Security Council, 2005).[5] The irony was that the national strategy had clear objectives, but the Army and Marine Corps lacked the institutional knowledge and means to accomplish the strategic objectives effectively.

Counterinsurgency was more than an aspect of the fight; it would become the focus of military operations in Iraq. This shift in focus began with the transfer of command of Multinational Forces–Iraq from General George W. Casey, Jr., to General David Petraeus on February 12, 2007 (Gates, 2017). Prior to this transfer, General Casey focused on transitioning military authority and power from coalition forces to the Iraqi people, a major step in legitimizing the government of Iraq. As the insurgency grew, and was recognized by U.S. leaders and their coalition partners, total conclusion of non-Iraqi military involvement became a goal that moved further and further away. These events required the shift in U.S. strategy from conventional warfare to counterinsurgency. The new *Counterinsurgency* publication would take a prominent role in the military strategy in Iraq, and therefore become a key contributor to U.S. national strategy and strategic resourcing decisions.

B. RELEVANT HISTORY OF IMPROVISED EXPLOSIVE DEVICE USE IN IRAQ

The Iraq War, initiated on March 20, 2003, involved an enemy that had transitioned from a conventional military force to an irregular force using guerilla tactics by 2005. These unconventional tactics included widespread use of improvised explosive devices (IEDs) targeting military vehicles. The enemy use of IEDs as a primary method of attack had become effective enough that the Marine Corps submitted an urgent universal needs statement (UUNS) on February 17, 2005, requesting an armored vehicle,

[5] Prior to publication of FM 3-24 in December 2006, counterinsurgency professional articles were circulated at the operational and tactical levels (Patraeus, 2006; Kilcullen, 2006). The important distinction is that although these articles foreshadowed doctrine and informed tactical and operational warfighting, they did not establish clear intent from strategic leaders.

calling for, by name, the Mine Resistant Ambush Protected Vehicle (MRAP) as a solution to the IED problem.

The Marine Corps' submission of the UUNS was the result of poor materiel planning prior to 2005 from the joint acquisition community. The Department of Defense (DOD) Inspector General notes in a 2008 review of the USMC response to the UUNS that, prior to enemy insurgency activities, the DOD knew the following about potential enemy IED use and mitigation methods for combat environments:

1. IEDs were the primary threat to wheeled tactical vehicles.
2. High mobility multipurpose wheeled vehicles (HMMWVs) were particularly vulnerable to IEDs because of the flat bottom of the vehicle as well as the vehicle's low ground clearance.
3. V-hull technology had demonstrated 70% effectiveness in reducing casualties.[6]
4. Vehicles that incorporated this technology were available (DOD Inspector General, 2008, p. 3).

After reading the DOD Inspector General's report and understanding what military leaders knew about potential threats and their effects, it is unclear why the Army and Marine Corps did not have an MRAP or vehicle with similar mitigating technology already fielded. Neither service had dedicated sufficient resources and emphasis to prepare for this particular threat.[7] For the Marine Corps, it was partly a matter of resource allocation—a managerial decision on allocation of scarce resources. If Marine Corps leadership had known the IEDs would be so widespread and effective, leaders certainly would have prepared an adequate mitigation method. Another reason the Army and Marine Corps did not have an MRAP fielded was that military leaders, not just Marine Corps leadership, thought that they could address the threat with up-armored

[6] *V-hull* technology refers to the shape of the underside of a vehicle that is in a "V" shape, and is designed to deflect the blast from an IED outward, reducing the effects of the explosion to the occupants. This research further describes the technology in Chapter III, Section B, entitled, Why the Mine Resistant Ambush Protected Vehicle?

[7] One exception to the inadequate resourcing was the DOD's creation of the Joint IED Defeat Organization (JIEDDO), with a goal to defeat IEDs before they detonated and to target the IED manufacturing network. JIEDDO did not engage in vehicle procurement (Lamb, Schmidt, & Fitzsimmons, 2009, p. 79).

modifications to the HMMWV (Headquarters, Department of the Army, 2006). Increasing the armor was a partial solution, but it became less effective as enemy forces increased the use of under-vehicle IEDs, for which there was no effective modification for the HMMWV (DOD Inspector General, 2008).

This scenario demonstrates that the insurgency in Iraq was adaptive, and shows at least two evolutions of insurgency adaptation to U.S. tactics. The first was the use of the IED. The second occurred after U.S. forces began to counter IED effectiveness with the up-armored HMMWV. The enemy then focused the attacks to address the inadequate armor on the underside of the HMMWV.[8]

The 2005 UUNS was the catalyst for the major materiel solution that became known as the MRAP. This vehicle was attractive to senior leaders because it was commercially available prior to the Marine Corps requesting it, drastically reducing development time for the system. The other major reason to purchase the MRAP was its ability to reduce casualties from IEDs, which was of national importance and critical to sustaining an effective fight against an insurgency (Gates, 2014, pp. 119–125). Chapters II and III expand on the DOD's procurement of the MRAP and its contribution to counterinsurgency operations.

C. AN ENEMY FORESEEN

By 2005, the insurgency in Iraq was effectively leveling the playing field. Although the insurgent force and the U.S. military were certainly not equal when compared conventionally, the insurgency had become a formidable opponent at the tactical through strategic levels. An observer or historian could reasonably ask: How did the system of systems that generates, equips, and projects a conventionally superior military force allow an inferior foe to develop military parity?

[8] Chapter II further elaborates on insurgency ability to adapt rapidly in combat, especially against a conventional military force such as the U.S. military. Chapter III shows that the acquisition system is not well designed to develop and procure major weapon systems for use against an insurgency. The rapid adaptability of insurgencies exposes a weakness in the acquisition system that must provide materiel solutions to warfighters.

Donald Rumsfeld, secretary of defense from 2001 to 2006, foreshadowed this scenario on September 10, 2001, in his speech that is now known as "Adversary." Rumsfeld (2001) noted,

> The topic today is an adversary that poses a threat, a serious threat, to the security of the United States of America. … It is the Pentagon bureaucracy. Not the people but the processes. Not the civilians, but the systems. Not the men and women in uniform, but the uniformity of thought and action that we too often impose on them.[9]

Rumsfeld (2001) described systems, processes, and interactions with the industrial base on which the DOD relies (Rumsfeld, 2001). Rumsfeld's speech focused members of the DOD and its stakeholders on the system (with strong references to the acquisition system) that were unresponsive to changing environments. Rumsfeld likely envisioned the goal as a military, with a supporting acquisition system, that better anticipated and prepared for enemy contact. The speech outlined what he felt would be his legacy as secretary of defense—reducing red tape across all aspects of the DOD, including its acquisition system. Unfortunately, Rumsfeld's successor, Robert Gates, would inherit much of the same stifling bureaucratic system in 2006 (Gates, 2014). Rumsfeld was unable to adequately address these problems because of procedural inertia as well as events that began the following morning.

Less than 24 hours after this speech, a different enemy confronted Rumsfeld: Al Qaeda. This enemy that engaged the United States in active, kinetic warfare left the DOD reliant on the systems in place: the self-identified, self-created adversary. The admittedly poor system would be used to fight an agile, adaptive, and flexible opponent.[10] This opponent would prove to be formidable through its own methods and its ability to take advantage of the rigid structure of the U.S. DOD, its component organizations, and their acquisition processes.

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[9] Secretary of Defense Donald Rumsfeld gave this speech on September 10, 2001. It is available for view at https://www.c-span.org/video/?c4497613/rumsfeld-dept-def.

[10] The World Trade Center attack that occurred on September 11, 2001, set into motion a military response to Al Qaeda in Afghanistan. The over-arching Global War on Terror would expand to operations in Iraq in the following years, formally beginning on March 20, 2003.

D. RELEVANCE OF THE RESEARCH

This research focuses on how the MRAP fit into U.S. strategy against an insurgency in Iraq. We use the Law of Requisite Variety (LORV) as a tool that looks at enemies as adaptive complex systems and that can help leaders prepare for such enemies by encouraging system variety to increase battlefield options for tactical commanders against known, unknown, or potential threats.[11] Variety is not a goal in the current acquisition process, which is apparent in policies that encourage joint procurement, seeking common materiel solutions to diverse problems. When senior leaders understand the value of variety and advocate for variety in materiel solutions, they anticipate diverse and adaptive enemies. Realizing this enemy adaptability, and adapting proactive materiel resourcing to respond to an array of enemies, places U.S. military forces in a position to provide multiple military dilemmas to the enemy, which is an overarching goal of the Army operating concept (Headquarters, Department of the Army, 2014, p. iv).

To assess the fit of the MRAP into the counterinsurgency campaign in Iraq, this research explores the intersection of three areas of study: counterinsurgency strategy in Iraq, MRAP procurement and fielding, and the Law of Requisite Variety. There is an abundance of written research as well as general institutionalized knowledge on these subjects in the military, especially concerning the MRAP and counterinsurgency. However, there is little to no research that demonstrates how LORV affects military acquisition programs, and how this law can help inform leaders, policymakers, and national strategists to prepare for future conflicts, increasing the relevance of military forces in an uncertain world, and creating potential for value that outweighs the costs of implementation.[12]

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[11] This research is concerned with procurement. There are other solutions available that can contribute to a complete solution and are not restricted to material solutions. An established methodology to find a holistic solution involves examination of doctrine, organization, training, materiel, leadership, personnel, facilities, and policy. This subject is further addressed in Chapter III.

[12] The sentiment that the U.S. military does not value variety in major weapon systems can be confusing. Variety is undeniable throughout the acquisition system, and even apparent in the structure of the Department of Defense as it is composed of different services that have distinctive competencies within them. In Chapters IV and V, this research discusses the acquisition community that values commonality and seeks opportunities to increase joint-service acquisition opportunities. The idea of commonality is contrary to variety, but Chapter V contains some recommendations on how to have benefits of commonality while providing commanders with variety.

This research is practical and applicable to current and future military operations in all U.S. military services individually or collectively in joint operations. *Counterinsurgency* anticipated in 2006 that future opponents would continue to pursue competitive advantages through asymmetric approaches to combat (Headquarters, Department of the Army, 2006, p. 1-2). This prediction has proven to be true thus far, and there is good reason to believe the trend will continue. An effective and comprehensive strategy is imperative to address current insurgency threats, as well as to prepare for future threats. Such a strategy will certainly encompass people and training; tactics, techniques, and procedures; international and interagency cooperation; as well as a shift in the way Americans and their legislative and executive representatives view modern warfare. The strategy must also address strategic materiel resource planning, and ensure that procurement procedures can effectively field a militarily adequate mix of combat systems that can confront, counter, and reduce the effects of enemy attacks. This research addresses and informs materiel strategy to prepare for and execute a counterinsurgency strategy.

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II. COUNTERINSURGENCY WARFARE

The purpose of this chapter is to introduce materiel considerations for waging counterinsurgency warfare. This chapter aligns with the overarching research objective by describing the conditions of the insurgency and challenges of the United States implementing a strategic counterinsurgency campaign in Iraq. In Chapter III, we examine requirement generation and technical aspects of procurement that, in this scenario, led to the United States purchasing and fielding the MRAP.

Many researcher organizations such as the Congressional Research Service, Naval Postgraduate School, and National Defense University have examined and are critical of MRAP affordability and maintainability. This body of research focuses on how the MRAP fits into a counterinsurgency campaign. To address this, military leaders must first be able to recognize an insurgency. This chapter describes the challenges in identifying an insurgency, implementing a counterinsurgency strategy, and supporting the strategy with material solutions.

One significant disadvantage that plagued U.S. ground commanders in 2005 was the lack of modern counterinsurgency doctrine. The Army and Marine Corps filled this doctrinal void in 2006 by publishing *Counterinsurgency*. Since its 2006 publication and distribution, the Army and USMC have published two subsequent revisions of *Counterinsurgency*. Because the research examines a strategic acquisition decision to fill a capability gap that existed as early as 2004, only the 2006 publication of *Counterinsurgency* is considered unless otherwise noted.[13]

This research assumes that strategic leaders were generally aware of counterinsurgency warfare and how to recognize, create, and implement a strategy. The reason for this assumption is that strategic leaders recognized the doctrinal void, which was a catalyst for creating *Counterinsurgency* in the first place. Publishing the doctrine was a way to communicate doctrine, and therefore intent, on how to create and

[13] By using the 2006 edition of *Counterinsurgency*, this research avoids applying 2009 knowledge and doctrine, for example, to a 2005 decision. This allows the research and findings avoid a bias based on ex-post knowledge.

implement a counterinsurgency strategy from the highest levels of military leadership to the warfighters charged with its daily execution. In other words, writing and publishing *Counterinsurgency* represents senior leader knowledge about the subject and its importance. The process of publishing and distributing this knowledge represents the importance placed on its widespread communication.

A. WHAT IS AN INSURGENCY?

Insurgency is a form of warfare that is as old as warfare itself (Headquarters, Department of the Army, 2006, p. 1-1). *Insurgency* is a long conflict, against a government, normally fought by unequal enemies, without restriction on the types and extent of force used, to achieve political objectives. JP 1-02, *Military and Associated Terms*, defined *counterinsurgency* at the time (2005) as "an organized movement aimed at the overthrow of a constituted government through the use of subversion and armed conflict" (DOD, 2005, p. 264).[14] Countless other definitions of insurgency exist, practically one for each counterinsurgency-focused publication. These definitions have recurring themes and common characteristics, which can provide a general but stable view of insurgency strategy.

1. A Long Conflict

Protracted warfare is one of the potential approaches for an insurgency. The goal is to wear down the political organization that is the subject of the insurgency. An effective counterinsurgency strategy requires vast amounts of resources for its execution (Headquarters, Department of the Army, 2006). In the protracted approach, the insurgency seeks to break the will of the counterinsurgency strategy either through slow attrition of resources or the breaking of the national willpower to fight at all.

[14] One point of interest about U.S. joint doctrine is that the definition has not changed significantly since the 2006 publication of *Counterinsurgency***.** The current version of JP 1-02 (the version current as of this research in 2017) defines *insurgency* as "the organized use of subversion and violence to seize, nullify, or challenge political control of a region. Insurgency can also refer to the group itself" (DOD, 2016, p. 113). The definition shift, more importantly the insignificance of it, demonstrates that the nature of insurgency does not change. The way U.S. forces categorize it has changed, and will likely continue to evolve as U.S. military forces refine their understanding of insurgency.

Counterinsurgency describes the protracted approach using Mao Zedong's strategy. Mao Zedong was the communist founder of the People's Republic of China who developed an insurgency approach that consists of three phases. In phase one, "Strategic Defensive," the future counterinsurgency force does not yet recognize the existence of the insurgency, and the established government has the majority of forces and power. In this period, the insurgency recruits its force, establishes networks, and obtains funding but avoids major conflict.

In phase two, "Strategic Stalemate," an insurgency force is a military equal to the force it is fighting from a standpoint of effectiveness. The insurgency force employs guerilla tactics and may utilize information to further its political objectives. Phase three, "Strategic Counteroffensive," is characterized by a tipping point in the forces, with the insurgency becoming militarily stronger than the conventional occupying force. Phase three marks the end of Mao Zedong's protracted war strategy. Insurgencies culminate when the insurgency resembles a government. At this point, insurgency warfighting methods have shifted from unconventional to conventional (Headquarters, Department of the Army, 2006).

2. Against a Government

Broad insurgency objectives normally fall into two closely related categories: (1) overthrowing the existing government and reallocating power or (2) breaking away from state control and becoming an independent entity. In either case, the result is internal war against a government. Although no two insurgencies are the same, all insurgencies seek to force political change, and military action is not the end result but rather a means to achieving the political change (Headquarters, Department of the Army, 2006). Mao Zedong's insurgency model also demonstrates political change as the insurgency's strategic end state. When an insurgency is strategically successful, the result is the insurgency creating a new government. When an insurgency fails, the existing government remains in an unchanged state. These two possible extremes are unlikely, and some compromise between the two is a more likely scenario.

3. Normally Fought by Unequal Enemies

In conventional warfare, the technologically superior force with the most resources is the likely victor. This is not the case in an insurgency; a weaker force against a stronger one characterizes insurgency warfare. To compete, the weaker insurgency force must find a way to level the playing field. *Counterinsurgency* points out various aspects of insurgencies versus counterinsurgencies that highlight this principle, including the following:

- Counterinsurgencies require considerable resources (Headquarters, Department of the Army, 2006, p. 1-11).
- Insurgencies start with the strategic initiative, often long before a countering force realizes that an insurgency is occurring (Headquarters, Department of the Army, 2006, p. 1-2).
- Insurgencies succeed when there is chaos and disorder anywhere. To be successful, counterinsurgencies must ensure order everywhere (Headquarters, Department of the Army, 2006, p. 1-2).
- Expectations of the local populace are difficult for the counterinsurgency force to meet, a climate that favors the insurgency (Headquarters, Department of the Army, 2006, p. 1-3).
- Insurgencies have greater control of information, which is more pronounced as dissymmetry increases (Headquarters, Department of the Army, 2006, p. 1-3).

These characteristics demonstrate why insurgencies are a type of asymmetric warfare. The two sides are unequal in many ways that are observable—from how the force organizes at a strategic level to how it conducts individual attacks at the lowest tactical levels. The insurgency will employ different strategies in an attempt to ultimately overmatch the opposing force, creating an opportunity to achieve the political objective (Headquarters, Department of the Army, 2006, p. 1-3).

In describing this aspect of inequality among adversaries, it is important to clarify the “normally” qualifier. Any conflict can include aspects of insurgency without the overall conflict qualifying as an insurgency. Mao Zedong’s three phases of an insurgency are illustrative. Prior to phase one, there is no conflict. In a state of no conflict, there are no parties and therefore no inequality. Phase one, however, is defined by inequality that

exists through completion of phase two. Phase three is a process that concludes when the insurgency force is militarily superior to its counterpart and becomes conventional. Though Mao Zedong's principles create an easy to understand military theory, the transition between these phases is not as obvious in actual warfare.

One last distinction concerning inequality among the opposing forces is that it is not accidental. Insurgencies are more successful when they are able to keep conventional forces off-balance. Insurgencies seek opportunities to increase uncertainty on the battlefield, obscure activity as an enemy, or even disguise their motives. A former senior Central Intelligence Agency officer noted in his memoir concerning terrorists,

> What do they all have in common? They are in border areas. Because of physical and political geography, the enemy finds refuge in these locations. [Al Qaeda], Hezbollah, and their affiliates understand international boundaries, and use them to their advantage. We [the United States] still look at the world as a collection of nation-states, but the enemy is not organized that way, except to take advantage of our own bureaucratic restrictions. (Crumpton, 2012, pp. 311–312)

A conventional force would overwhelm an insurgency if the insurgency chose to engage in conventional warfare. Insurgencies find success when they are able to choose a battlefield, time of day, enemy force, method of attack, and duration of the engagement. Conventional forces should understand that laws of armed conflict apply to insurgencies, but insurgencies are unlikely to follow or enforce these laws. In an insurgency, the militarily superior conventional force remains vulnerable and reactive if it is unable to anticipate enemy action, adapt, and apply new methods.

4. Without Restriction

Insurgencies fighting without restriction is a difficult topic, and could be considered a mischaracterization of this type of warfare. Though the Geneva Conventions are internationally accepted standards of conflict, their focus is on conflict between two states. Because insurgency is defined as internal to a single state, the standards are not specifically applicable (Headquarters, Department of the Army, 2006, p. D-3). To address this, the Geneva Conventions ratified Common Article 3 in response to the increasing occurrence of internal conflict such as insurgencies. This type of internal conflict is

always complex, but it becomes much more complicated when a third-party nation-state actor becomes involved in an internal conflict. Common Article 3 of the Geneva Conventions of 1949 purposely describes itself as applicable to all parties to a conflict (deliberately not restricted to state actors), and establishes standards for conduct during warfare. Through Common Article 3, the Geneva Conventions adopted standards of conduct that are enforceable during internal conflicts, including insurgencies (International Committee of the Red Cross, 1952). This common article and its commentary create clear standards of conduct for all combatants in internal conflicts.

The problem is not a matter of establishing the law; the problem is the practical implementation of laws such as the Geneva Conventions. Who will enforce these standards of conduct during armed conflicts? In internal conflict, when do combatants fall under jurisdiction of their country or the country they are in and not the Geneva Conventions? When are combatants afforded the protections of Common Article 3? What if someone is not a combatant but provides support for an internal war, such as an insurgency? What if a combatant is from another country? These questions are delicate, and require careful legal analysis to unravel. The intent of Common Article 3 is to reduce confusion and establish legal authority that extends to all types of warfare. This endeavor, however, may generate the opposite effect, creating more confusion and more opportunities for an insurgency to take advantage of bureaucratic processes.

This confusion creates the opportunity for combatants to change the rules they subscribe to in order to take advantage of them when it is beneficial to their situation, and they have a legitimate argument that the rules are not applicable in situations when ignoring the common article is most beneficial. As a non-state, there is no invitation for the combatant parties to participate in drafting, developing, ratifying, or interpreting these laws. The only choice a non-state actor has is to follow the accepted standard or not. Though the consequences are severe, it is unlikely that an insurgency has the interest or resources to enforce conduct that adheres to these laws.

Conventional forces and state actors may find an insurgency’s lack of regard for international standards intolerable, and find it unfair that the international community enforces laws on one side and not the other. This is precisely the disparity that the

insurgency seeks. This is one way an enemy gains competitive advantage and eventual overmatch against a superior conventional force. The apparent inequity creates both tactical advantage and gradual attenuation of the opponent and the opposing nation's will to continue to wage war. When there is no longer national will, there are no longer resources allocated, and forces withdraw from the conflict. As *Counterinsurgency* notes, this sequence of events marks indisputable entry into Zedong's phase three of protracted warfare, strategic counteroffensive: victory for an insurgency (Headquarters, Department of the Army, 2006).

5. To Achieve Political Objectives

Achieving a political change is the strategic end state of an insurgency, and represents a key disadvantage for the insurgency (Headquarters, Department of the Army, 2006). To achieve its strategic objective, the insurgency must assimilate into a government or create its own. This disadvantage also explains why protracted warfare is often a characteristic of an insurgency. Both sides begin with opposing views of what should be, and they are prepared to battle those who possess different beliefs. Unfortunately, only with time, resource expenditure, and loss will each side find compromise by diminishing the other's will and experiencing a decreasing willingness to continue to fight in their own formations. The end result is compromise.

Waging warfare is an attempt to control how much the government will change. An insurgency wants significant government change. The opposing, counterinsurgency force seeks to legitimize the current government. In any outcome, the end state of an insurgency is a legitimized government, and three mutually supporting definitions of insurgency demonstrate that an insurgency often will end with some change in government:

- "Political power is the central issue in insurgencies and counterinsurgencies; each side aims to get the people to accept its governance or authority as legitimate" (Headquarters, Department of the Army, 2006, p. 1-1).
- "Victory is achieved when the populace consents to the government's legitimacy and stops actively and passively supporting the insurgency" (Headquarters, Department of the Army, 2006, p. 1-3).

- "Each insurgency is unique, although there are often similarities among them. In all cases, insurgents aim to force political change; any military action is secondary and subordinate, a means to an end" (Headquarters, Department of the Army, 2006, p. 1-5).

B. WHAT IS A COUNTERINSURGENCY?

Once an incumbent government realizes that an insurgency exists, the natural military response is counterinsurgency operations against the insurgent force. Like insurgency, counterinsurgency operations are complex. Variations in root causes, resources, and actors can create an unlimited amount of variations, and a counterinsurgency must have at least as many options and variations to confront the insurgency.

There are many ways to define or describe counterinsurgency. This research blends counterinsurgency definitions and defining characteristics to form a condensed description: *counterinsurgency operations legitimize the incumbent government through unified and committed response against an insurgency, using the full spectrum of military power*.[15] Where insurgency seeks to delegitimize a government, counterinsurgency seeks to legitimize it. This is much more difficult to execute, and short-term advantages favor insurgency forces.

1. Legitimizing the Incumbent Government

The strategic end state of the insurgency is to delegitimize an existing government. The counterinsurgency force, therefore, must resist this effort and help the government in place demonstrate its commitment and legitimacy to its constituents. Legitimacy means that the government rules primarily through consent, and citizens are empowered to periodically assess and rebalance leadership to ensure consensus. Even legitimate governments use coercion in different aspects of governing, so the rule is not absolute. Consent is the primary source of legitimacy, and legitimacy is more easily established when the government provides essential services and economic opportunity

[15] There are many authoritative definitions of counterinsurgency. This description synthesizes definitions based on the characteristics of insurgencies, their guiding ideologies, strategic objectives, and methods used to achieve their ends. This definition also represents the level of understanding of insurgencies in 2006 (Headquarters, Department of the Army, 2006).

and participates in public audits and rebalances of power by enabling and using the political process (Headquarters, Department of the Army, 2006, p. 1-21).

2. Through Unified and Committed Response

The counterinsurgency exists only because an insurgency preceded it. Insurgency is directed at a portion or all of the government and seeks to achieve political change. The counterinsurgency force must demonstrate unity of effort to demonstrate the legitimacy of the government.

This is another aspect that proves to be challenging in practical application. If another country assists or leads in a counterinsurgency effort, as the United States did in Iraq beginning in 2005, the challenge becomes more complex.[16] No two countries' ideologies are aligned completely, nor are customs the same. Enforcing laws can be problematic and pronounced when the third-party force must adhere to laws that do not align with its social norms or support aspects of governing that it views as illegitimate. Nevertheless, counterinsurgency success depends on presenting a unified front against the insurgency, understanding that in addition to a unified front, the counterinsurgency must also demonstrate that it is willing to outlast the enemy, nullifying or at least mitigating a protracted-war approach to insurgency victory.

3. Against an Insurgency

Establishing and maintaining a unified front among coalition partners is a challenge, and this bureaucracy and inertia are one of the many disadvantages the counterinsurgency force endures throughout its campaign. Insurgency forces, on the other hand, are characterized as adaptive, committed forces comfortable in their operating environment. Insurgents understand how information flows, how it is received, and how to maximize the impact of information operations in their environments. Insurgencies are

[16] The United States realized an insurgency existed in 2005 (Dale, 2008; Hassan, 2005; National Security Council, 2005). This public acknowledgement in strategic documents paved the way for strategy and leadership change. When General Petraeus took command of multinational forces in Iraq in 2007, the U.S. strategy shifted from transitioning military operations to Iraqis, to conducting strategic counterinsurgency (Gates, 2017; Wood, 2007).

at least equal to the counterinsurgency force in their familiarity with their operating environments.

Combatants in an insurgency can be difficult for the counterinsurgency force to identify. “Few insurgencies fit neatly into any rigid classification. In fact, counterinsurgent commanders may face a confusing and shifting coalition of many kinds of opponents, some of whom may be at odds with one another” (Headquarters, Department of the Army, 2006, p. 1-5). Tactical and operational leaders must be able to assess qualitative aspects of their operating environments to determine future actions against an enemy. Successful counterinsurgency operations require leaders to place greater value in human intelligence and less value on some of the high-technology intelligence collection assets. Counterinsurgency warfare requires a different way of thinking, and requires warfighters to create personal relationships with local populations.

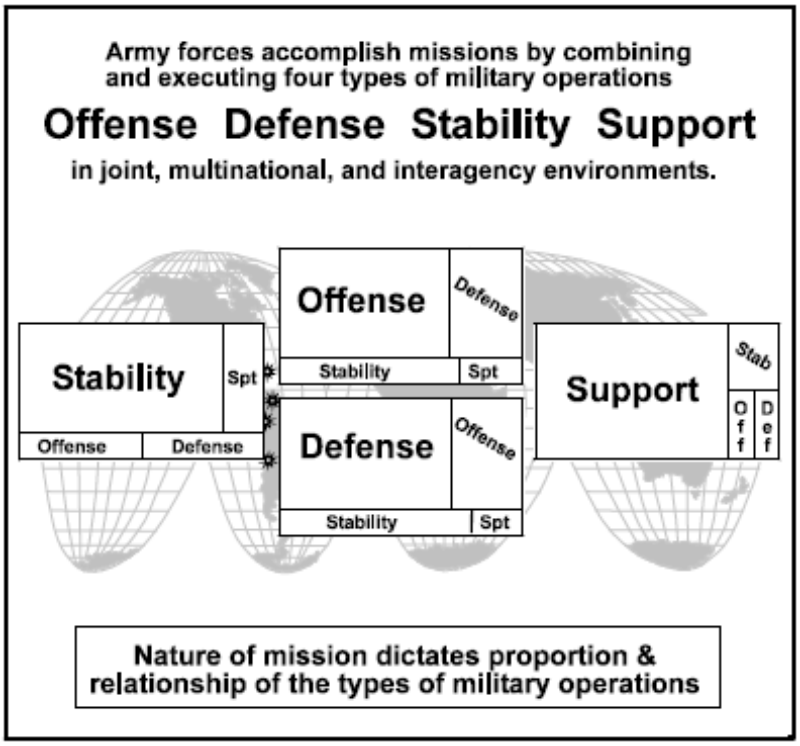
Examining the specific causes and extent of insurgency that the counterinsurgency force faces requires equally adaptive, culturally aware leaders at all levels, trained in a variety of disciplines (Hannah, Jennings, & Nobel, 2010). Effective counterinsurgency execution also requires effective intelligence gathering that can support tactical, operational and strategic decision making. As important as it is to fight the insurgency, it is equally important to respect the culture and other environmental factors, realizing that the center of gravity for the operation is likely neither the insurgency nor the counterinsurgency, but the neutral majority that is militarily unengaged (Zeytoonian et al., 2006).

4. Using the Full Spectrum of Military Power

Full-spectrum warfare was described as “full spectrum operations are the range of operations Army forces conduct in war and military operations other than war” (Headquarters, Department of the Army, 2001, p. 1-4) and that are characterized by the combined use of offensive, defensive, stability, and support operations (Headquarters, Department of the Army, 2001, p. 1-15; see Figure 2).[17] All types of operations

[17] At the time of publication in 2017, the DOD did not recognize “full-spectrum operations” as a doctrinal term.

contained each of the four elements, and the blend and weight placed on offensive, defensive, stability, and support operations characterized the type of operation.



The range of military operations includes stability, offense, defense, and support missions. Each of these missions has portions of other missions included.[18]

Figure 2. Full-Spectrum Operations. Source: Headquarters, Department of the Army (2006, p. 16).

[18] Figure 2 is an illustration demonstrating that no military operations are independent of one other, but rather a combination of the four missions. *Counterinsurgency* self-described counterinsurgency operations as combinations of offensive, defensive, and stability operations and omitted support operations. It is unclear why *Counterinsurgency* terminology did not mirror *Operations* by including support operations, but may demonstrate the emerging state of institutional warfighting knowledge about counterinsurgency. This further demonstrates that insurgencies begin with strategic initiative; counterinsurgency operations begin in a reactive state to an insurgency (Headquarters, Department of the Army, 2006).

C. MATERIEL CONSIDERATIONS FOR COUNTERINSURGENCY

When *Counterinsurgency* was published in 2006, military leaders had realized and were confronting an insurgency. Military leaders were also contemplating a materiel solution of the MRAP due to the increased and devastating use of IEDs against U.S. forces. *Counterinsurgency* provided some specific guidance on military logistics, and readers can infer some guidance in characteristics of military systems. There is not, however, a specific list of attributes to value in a weapon system that will be used for counterinsurgency operations.

What readers of *Counterinsurgency* and other counterinsurgency-related texts could unquestionably conclude is that intelligence gathering was important, and humanizing oneself with the local populace was important as well (Headquarters, Department of the Army, 2006; Zeytoonian et al., 2006). Excelling in either of these tasks likely made that warfighter better at the other.

To accomplish these objectives, *Counterinsurgency* makes clear that commanders may have to increase the risk they incur to gather the necessary intelligence to carry out operations against the enemy (Headquarters, Department of the Army, 2006, p. 1-27). Furthermore, personal relationships help establish legitimacy of the counterinsurgency force. One can reasonably conclude that if doing these things helps a counterinsurgency mission, not doing them will predictably have the opposite effect, causing the counterinsurgency to lose touch with the local population and therefore, fail to capitalize on an opportunity to thwart the insurgency's effort to delegitimize the government.

Counterinsurgency also recognizes an institutional tendency to revert to what one is familiar with, at both individual and organizational levels. In 2005, familiarity was firmly in the realm of conventional warfare; military strategists had taken a 30-year break from addressing counterinsurgency warfare through modern doctrine (Headquarters, Department of the Army, 2001). Ironically, a pair of authors who would publish a best-selling book on organizational management came to the same conclusion, and in the same year. Their discovery was that "when attacked, centralized organizations become more

centralized" (Brafman & Beckstrom, 2006, p. 139). They also described military and non-military examples of inappropriate, conventional responses to an adaptive and unconventional enemy. Their book was certainly not intended to be military related but it demonstrates the human and organizational tendencies to revert to the familiar rather than confront the unfamiliar. *Counterinsurgency* describes counterinsurgency warfare as a learning competition against an adaptive enemy, with victory likely going to the force that can learn the fastest (Headquarters, Department of the Army, 2006).[19]

The necessity to learn applies in all warfighting functions, including force generation and battlefield logistics. Force generation and combat logistics are related because, at the forward-most point of any combat operation, warfighters have requirements. These requirements are typically satisfied by solutions like bullets, food, mail, medical supplies, or any other thing that supports warfighter needs. Military logisticians are responsible for forecasting the demand for items and providing solutions to adequately supply warfighters in the battlefield. When the military does not have a materiel solution available in the supply system, it must find one.

Generally speaking, when the military supply system does not have an item and must procure it, commercial-off-the-shelf (COTS) items are a good choice to support counterinsurgency operations (Headquarters, Department of the Army, 2006). An advantage in choosing COTS items is that they are already developed, tested, and manufactured. This level of maturity reduces acquisition lead-time, increasing the variety of tools available to a commander. Furthermore, procurement professionals can easily determine that their price is fair and reasonable because the non-military market has already determined this through commercial sales (Contracting by Negotiation, 2005). In many cases, COTS items can reduce or bypass developmental testing and move more quickly into and through operational testing, which is also subject to possible reduction according to the commercial nature of the item (Defense Acquisition University, 2005). These characteristics and others make COTS items preferable for those procuring the

[19] *Inertia and Strategy* expands on why organizations are reluctant to change, and prefer familiarity. Several factors influence the inertia, but Augier, Dew, and Aten (2015) describe the change process within organizations that occur in three sequential phases: (1) active resistance, (2) attention allocation and resistance, and (3) adoption processes.

item, and are appealing to the warfighter because COTS purchases can drastically reduce the time between identifying and satisfying the need. COTS purchases are extremely useful for expendable items, less so for durable items.

Major systems are durable items and part of the combat logistical challenge, but they introduce their own complexities because they are not expendable items. Logisticians must maintain and repair major systems in order for the system to remain useful past its initial fielding and use. These activities generate their own set of logistical requirements to create availability of the system for the warfighter. Logisticians must also provide spare parts for repairs and operational readiness floats (extra systems) for when an entire system is not operational for an extended period. Maintainers need instruction on the system, technical manuals, system-unique diagnostic equipment, and an entire infrastructure of materiel and people to support the system. These requirements increase when the system is used in combat (Headquarters, Department of the Army, 2006).

D. SUMMARY

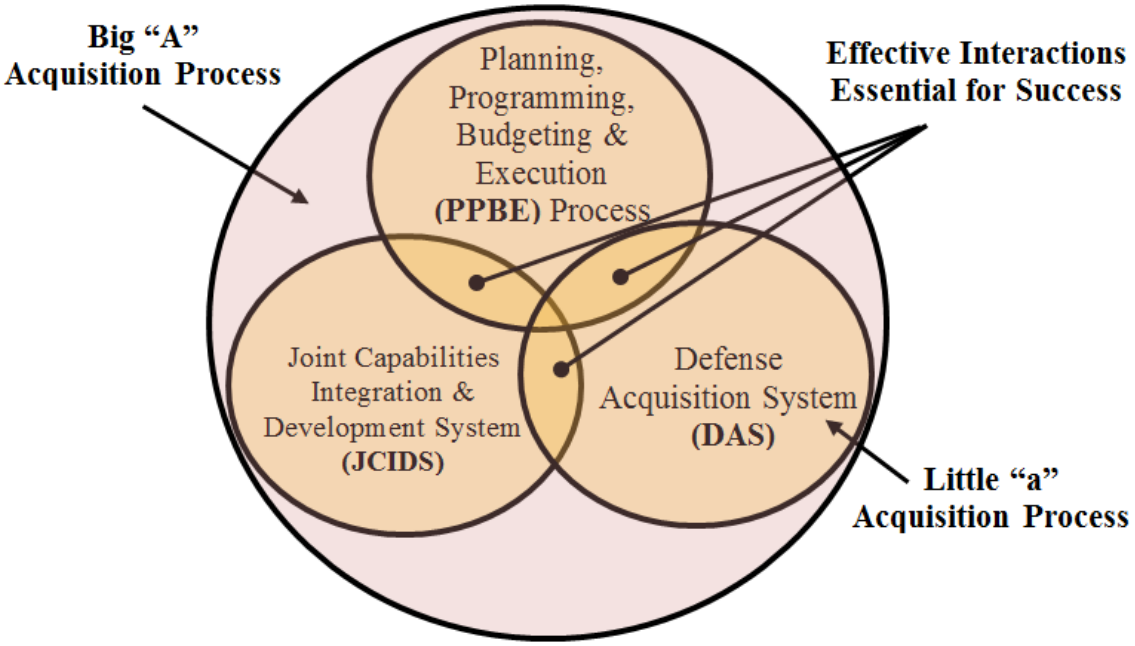
This chapter addressed insurgency action against a government and the counterinsurgency response, which will be relevant in future chapters as we discuss the insufficiently responsive acquisition system which must support U.S. military forces in all mission types. The U.S. military should expect to encounter insurgencies and must engage in irregular warfare in the future. Insurgencies will begin a military campaign with a strategic initiative over the counterinsurgency force. Once the counterinsurgency force acknowledges the insurgency and chooses to confront it militarily, the counterinsurgency force will need materiel solutions. Like the counterinsurgency force itself, materiel solutions must have adequate variety to create flexibility and options for the counterinsurgency commander. COTS are part of this solution because of the decreased procurement timeline. However, one major COTS shortfall is that COTS systems are typically not supportable from a maintenance standpoint. This creates the need for additional items to act as floats. This may not be a significant consideration for expendable or non-expendable items, but can be very costly to procure additional entire systems and maintenance floats.

III. DOD'S ACQUISITION FRAMEWORK VS. THE MRAP

The Congressional Report Service, the Inspector General, academia, and think tanks have conducted extensive research concerning the DOD's acquisition framework, and separately, the procurement of the MRAP. The majority of the research regarding the acquisition system has focused on acquisition reform. Many of the MRAP studies have focused on its successes as an accelerated acquisition program, and in some cases why rushing the MRAP to the field led to an unsustainable program. This chapter not only reviews aspects of the acquisition framework and the MRAPs procurement, but also considers whether the MRAP was the right vehicle to fight a counterinsurgency—a field of study with little to no data.

This chapter also reviews the DOD's Defense Support System (DSS), which is vital to understand that every item the DOD purchases fulfills a warfighter requirement. The DSS is the three-component DOD framework that fulfills warfighter requirements. They are the Joint Capabilities Integration and Development System (JCIDS); Defense Acquisition System (DAS); and the Planning, Programming, Budgeting, and Execution (PPBE) systems. In order to fulfill the warfighter's requirement, the three components and their processes interact with each other within the system characterized as the big "A."[20] Throughout the big "A" process, the JCIDS process identifies the required capability, the PPBE process establishes the funding for the capability's acquisition, and the DAS is the actual procurement process. The three components are interrelated and essential for the successful fulfillment of warfighter requirements. Figure 3 illustrates the interaction between the DSS components.

[20] The big "A" is the overall acquisition process that includes all three components of the Decision Support System. The little "a" refers only to the DAS.



This illustration is a simple representation of the interactions between the DSS components as part of the more comprehensive big "A" acquisition process.

Figure 3. DOD Decision Support System. Adapted from Defense Acquisition University (2017).

This chapter focuses on the DOD's acquisition process to procure the Mine Resistant Ambush Protected vehicle. First, it guides the reader through the DOD's traditional acquisition process for generating, procuring, and fielding requirements to the joint warfighter. It also examines why the acquisition leadership resisted the MRAP, Secretary Gates' emphasis on the accelerated acquisition process for the MRAP's procurement, and in hindsight, why the MRAP was not the best investment in capabilities to conduct counterinsurgency operations in Iraq and beyond.

A. HOW DOES THE DOD GENERATE REQUIREMENTS?

In order to understand why the MRAP's acquisition strategy was a source of friction within the DOD prior to 2007, it is essential to understand the basic characteristics of the DOD's acquisition process. [21] The DOD characterizes the purchase

[21] Pentagon bureaucrats were more focused on protecting funded programs of record regardless of their relevance to the ongoing war in Iraq and the deadly IED threat (Gates, 2014, p. 117).

of goods and services in two ways: *procurement* and *product development* via research, development, test and evaluation. The DOD defines procurement as the purchase of any good or service. The DOD refers to the goods and services that warfighters need as requirements. Solutions to these DOD requirements may fall into one or any combination of doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy (DOTMLPF-P) domains. This research focuses on the procurement of a materiel solution—the MRAP. In contrast, defense acquisition is a comprehensive term that includes the design, engineering, manufacturing, testing, fielding, sustainment, and disposal of systems purchased by the DOD from a contractor (Schwartz, 2010, p. 1). This section of the chapter includes a discussion of the three components of DSS in further detail as they relate to the procurement of the MRAP.

1. The Joint Capabilities Integration and Development System

The Joint Capabilities Integration and Development System (JCIDS), is the DOD's process for identifying and prioritizing requirements in support of military operations. Prior to Operation Iraqi Freedom, the DSS and JCIDS processes relied primarily on strategic documents like the National Military Strategy and Joint Operational Concepts to manage programs from concept to capability. The JCIDS analysis process, known as a Capabilities Based Assessment, describes the warfighters' requirement in terms of a capability, *not* a particular solution. The MRAP is a great example of the services (USMC and Army) requesting a specific solution to counter the IED threat in Iraq, departing from the process of defining the capability prior to identifying the solution or solutions. In February 2005, USMC field commanders specifically requested the MRAP, which is a potential solution and not a desired capability.

a. Capabilities Based Assessment

The capabilities based assessment (CBA) is the analysis portion of JCIDS and initiates the formal process of identifying a required capability and associated gaps, which are then formulated into warfighter requirements (Halverson, 2013, p. 137). The

U.S. Army's Training and Doctrine Command's CBA guide describes the CBA as a three-step process that includes, in this order:

1. Functional Area Analysis (FAA)
2. Functional Needs Analysis (FNA)
3. Functional Solutions Analysis (FSA)

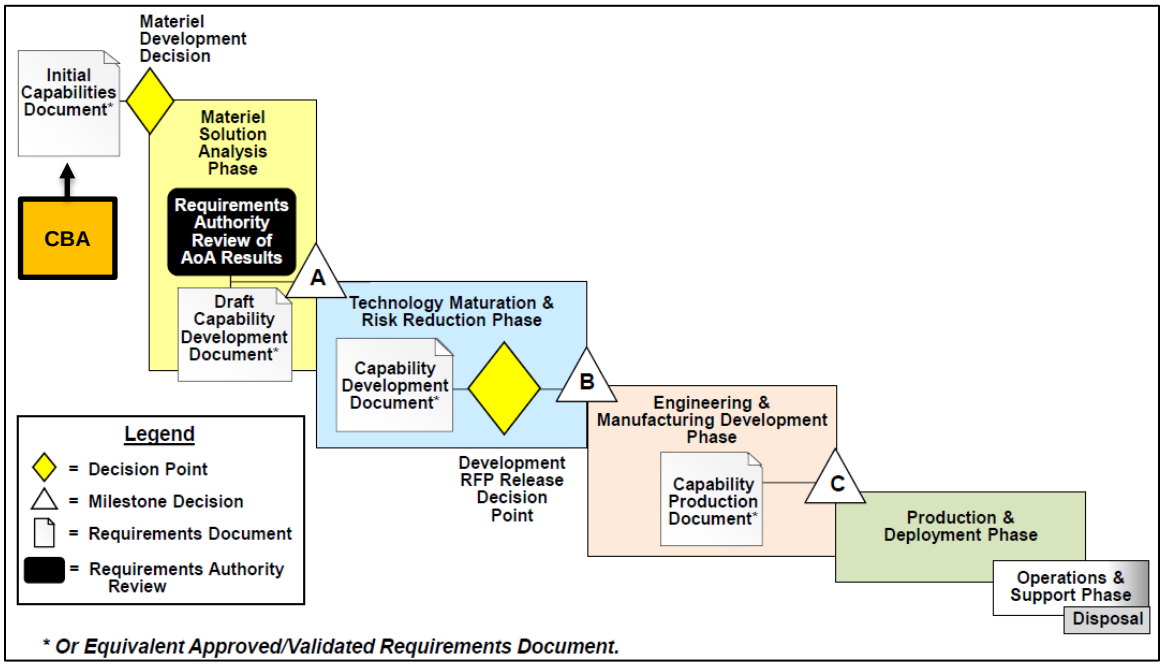
First, the FAA uses national strategies, joint concepts, and other specified operational missions to develop a prioritized list of capabilities that must be accomplished to achieve the desired military objectives in a specific timeframe. The capabilities in the FAA are defined and analyzed in terms of tasks, conditions, and standards. Second, a FNA assesses current and future capabilities to meet the desired military objectives of the operational context identified in the FAA, and determines whether the military can achieve the desired effect, or if a capability gap exists. Lastly, the FSA assesses the potential DOTMLPF-P approaches for achieving the required capability, materiel or non-materiel, in order to eliminate or reduce the capability gaps identified during the FNA (TRADOC, 2010, pp. B1- D1).

If the completion of the three-step CBA process identifies a significant capability gap, an initial capabilities document (ICD) is generated to initiate the development of a capability solution. The ICD serves as a decision document that helps the DOD determine whether a non-materiel solution, materiel solution, or a combination of both is appropriate (Chairman of the Joint Chiefs of Staff, 2015, p. A-5). Lastly, ICDs generated for major defense programs require validation by the Joint Requirements Oversight Council (JROC).[22]

Warfighter needs and JROC validated requirements drive the acquisition of all military defense programs. As described in DODI 5000.02, the chairman of the joint chiefs of staff (CJCS) will assess and validate joint military requirements for major

[22] The JROC is chaired by the Chairman of the Joint Chiefs of Staff. The JROC has the responsibility for decisions to make service-specific acquisition programs into joint acquisition programs. Their decision is based on information and recommendations of the Joint Capabilities Board, functional capabilities boards, and other interested organizations, which can vary. In this research, we generalize these collective responsibilities as those of the JROC because of their ultimate decision authority in joint acquisition matters (Goldfein, 2015).

defense programs, and programs of interest to the JROC and the joint capabilities board (JCB). In cases where the JROC validation authority is delegated to a military service, the service will use suitable variations of the JCIDS process to validate its requirements (DOD, 2017, p. 5). Figure 4 illustrates how the CBA outputs inform the JCIDS process.



The CBA box has been added to Figure 4 to illustrate where the CBA informs the materiel acquisition process and where the requirements documents are used throughout the different phases of the defense acquisition system.

Figure 4. Relationship between the Capability Requirements and Acquisition System. Adapted from DOD (2017, p. 6).

From a basic understanding of the JCIDS process and the JROC'S responsibility, one can assert that it tends to be a utilitarian-centric model.[23] The DOD implements this utilitarian-centric model by requiring JCB to look for *joint program* opportunities. This model is an effective way to optimize benefits for the majority of warfighters and utilize economies of scale. However, a consequence of the model often leaves the warfighter (customer) with unsatisfied mission specific requirements.

[23] A utilitarian-centric model is compelled to make decisions that will benefit the needs of the greatest number of entities.

b. The "Jointness" Challenge

Since the implementation of the Goldwater–Nichols Act, the DOD has placed greater emphasis on joint acquisition opportunities which adds to the overall complexity of a program and often results in cost overruns, schedule delays, and sub-optimal performance.[24] Angelis and co-authors note that the complexity of joint programs arises from the increased number of stakeholders, competing requirements, budget arrangements, and complicated program structures. The negative results stem from the fact that the DOD identifies joint programs at the DOD level, but the program management function is delegated to a service to act as the lead, as was the USMC in MRAP procurement (Angelis et al., 2009). The F-35 fighter airplane is an instance of the DOD's utilitarian approach to major defense acquisitions. The program set out to procure a common, affordable, next generation aircraft for the Air Force and Navy. In 1994, the USMC's Harrier replacement program was added to the Air Force/Navy program in order to avoid the higher costs of procuring multiple tactical aircraft to meet the services' similar but not identical operational needs. As of April 2017, the F-35 program is the most expensive DOD program, it is not yet fully fielded, and the Air Force's F-35A variant is not as stealthy nor as capable of air-to-air combat as the F-22 Raptor, which is already in service.

2. Defense Acquisition System

The DAS is the actual process for procuring or acquiring a warfighter requirement. DODD 5000.01 defines the DAS's primary objective:

> To acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price. The DAS exists to manage the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces. The investment strategy of the Department of

[24]The Goldwater–Nichols Department of Defense Act of 1986 is legislation that set out to improve the DOD's ability to conduct effective joint operations and update the acquisition system to adequately meet the requirements of the joint warfighter. It caused a paradigm shift in the DOD acquisition process. The DOD moved from a service-centric requirements generation process to an approach that generated requirements for a joint perspective.

> Defense shall be postured to support not only today's force, but also the next force, and future forces beyond that. (DOD, 2007, p. 3)

The DODI 5000.02 describes the DOD's four basic models for defense acquisition program structures. The structure of the program depends on the type of capability being acquired and the urgency of the acquisition. The program structure is influence by one of the four basic models, which are formed according to the features that best describes the capabilities being acquired:

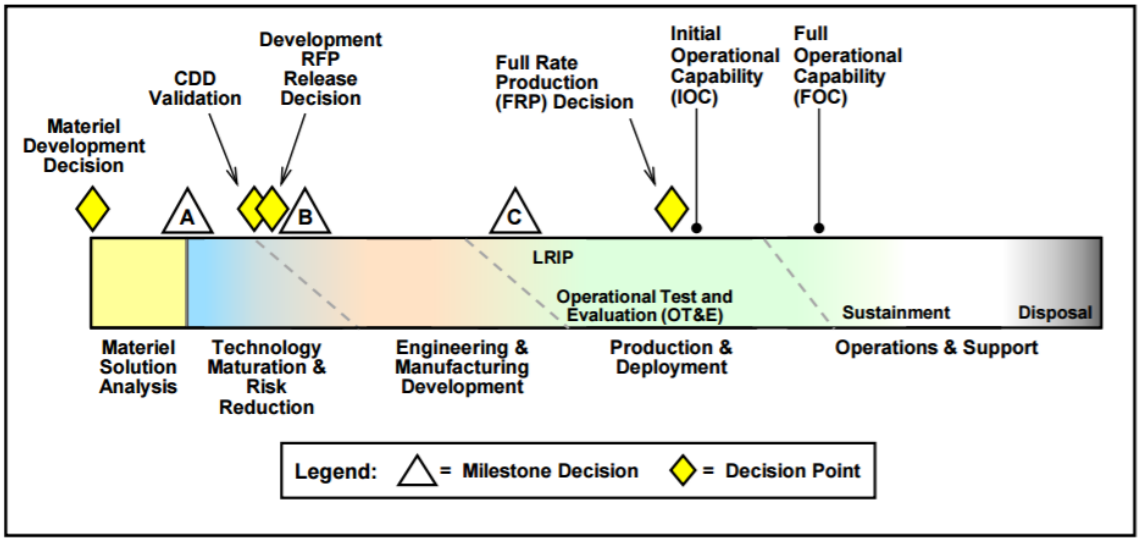
- Model 1: Hardware Intensive
- Model 2: Defense Unique Software Intensive
- Model 3: Incrementally Deployed Software Intensive
- Model 4: Accelerated Acquisition (DOD, 2017, pp. 12-15)

The DOD and its program managers use these models as a foundation and starting point when developing their acquisition strategies for the specific capabilities being procured. Regardless of the model chosen, the capability being acquired is required to move through the following phases; materiel solution analysis, technology maturation and risk reduction, engineering and manufacturing development, production and deployment, and operations and support (DOD, 2017, pp. 9-11). Generally, the phases occur in sequence, but of accelerated programs, like the MRAP, some of the phases occurred in parallel in order to expedite to capability of the operations and support phase. The milestone decision authority (MDA) approves the programs passage from one phase to the next during specified Milestone Reviews (A, B, and C), which are investment decisions at key knowledge points.[25]

Considering these models, it is easy to see why the DOD acquisition enterprise was fixed on Model 1 for the procurement of the MRAP; it was a "materiel" hardware solution. A major problem in the acquisition system is the length of time it takes to navigate through all of the acquisition phases. This procurement process and the acquisition leadership's lockstep compliance was the biggest obstacle to fielding the

[25] Knowledge points assist the MDA in determining if appropriate resources match customer requirements, design stability of the system in development, and maturity of the process involved in producing the system (GAO, 2004, p. 3-4).

MRAP. In hindsight, the 2011 U.S. withdrawal from Iraq would have occurred prior to MRAP fielding if the Army had followed the traditional phases in Model 1. Figure 5 illustrates the phases of a traditional hardware intensive program (DOD, 2017, pp. 9–15). The Joint Light Tactical Vehicle (JLTV) serves as a great example for how long it takes a traditional wheeled vehicle program to move through Model 1–10 years for the JLTV. The JROC validated the JLTV requirement in November 2006, the JLTV program entered the technology maturation and risk reduction phase in October 2008, and the first low rate initial production JLTV was delivered in September 2016 (Feickert, 2017, p. 7).



This figure illustrates the multiple phases the MRAP vehicle would have had to navigate from the Materiel Development Decision to Initial Operational Capability, which may have taken about five years for a platform like the MRAP.

Figure 5. Program Structure Model 1 Hardware Intensive Program. Source: DOD (2017, p. 11).

3. Planning, Programming, Budgeting, and Execution (PPBE)

PPBE is DOD's acronym for the phases in the process used to allocate resources and develop the proposed defense budget for all acquisition programs. A detailed analysis of the PPBE process is beyond the scope of this research. Nonetheless, it is important to understand the goals of each phase, the overarching purpose of the process, and the length of time associated with the activities to gain an understanding of why the MRAP

was met with such resistance when it was initially identified as a possible solution to the emerging IED threat in Iraq.

The PPBE process typically follows the order: planning, programming, budgeting, execution. However, there is overlap among the four phases and different budget years. The following are the basic goals of PPBE's individual phases, described by Candreva:

- ***Planning:*** to identify gaps or overmatches between strategy and capabilities and produce objectives for programming to address them.
- ***Programming:*** to allocate resources among programs across a mid-range time horizon that best achieves the planning objectives.
- **B*udgeting:*** to justify the programming decisions in a format that serves the process of legitimation (enactment).
- **E*xecution:*** to implement the policy direction and to create the desired capabilities. (Candreva, 2016, p. 15)

The overarching purpose of the PPBE process is to assign defense dollars to specific programs that aim to meet strategic objectives. As specified in the DOD Directive 7045.14 governing the PPBE, the purposes of the process are to:

1. Support the objective to provide the DOD with the *most effective mix* of forces, equipment, manpower, and support attainable within fiscal constraints.
2. Facilitate the *alignment of resources* to prioritized capabilities based on an overarching strategy and requires balancing necessary warfighting capabilities with risk, affordability, and effectiveness.
3. Provide mechanisms for making and *implementing fiscally sound decisions* in support of the national security strategy and national defense strategy.
4. Facilitate execution reviews of past decisions and actions. The reviews shall *assess actual execution performance based on goals and strategic objectives*. Recommendations from these reviews shall be linked to decisions on future resource allocations. (DOD, 2013, p. 2)

With a basic understanding of the PPBE process, one can see why the MRAP was met with such resistance by Pentagon bureaucrats. The MRAP, when viewed through the PPBE lens, did not provide the force with the most effective mix, it was not aligned with any resources, and it did not support strategic goals or objectives based on national

defense strategy. The Pentagon bureaucrats viewed the MRAP as an expensive solution to a very specific temporary problem that would not have a place in the most effective force mix beyond the Iraq war. The MRAP program was becoming a victim of the defense acquisition system until Secretary Gates made the MRAP program the DOD's top priority and secured the funding from Congress.

B. WHY THE MINE RESISTANT AMBUSH PROTECTED VEHICLE?

1. The Unforeseen: Why Was the DOD Slow to Procure the MRAP?

> The hidebound and unresponsive bureaucratic structure that the Defense Department uses to acquire equipment performs poorly in peacetime. As I saw, it did so horribly in wartime. (Gates, 2014, p. 126)

During times of relative peace, the DOD acquisition enterprise relies primarily on joint concepts and other strategic documents to drive requirements generation and the JCIDS process. The concepts are written with a focus on presumed future warfare and supported by government funding cycles. At times, the requirements generation process will diverge from the joint concepts in order to respond to current and emerging threats not anticipated for in the concepts but required by Combatant Commanders in order to respond to a capability gap.

The capability gaps identified by Combatant Commanders are described in urgent need statements that are sent to the service or department level as joint urgent operational needs statement (JUONS) for validation and approval. Even though service secretaries and military leaders are responsible for organizing and procuring equipment for their services, many if not all urgent needs are viewed as "unfunded" requirements since the services do not have appropriated dollars to procure the capability. In his memoir *Duty*, Secretary Robert Gates, when discussing requirements and funding, wrote,

> The military departments develop their budgets on a five-year basis, and most procurements programs take many years—if not decades—from decision to delivery. As a result, budgets and programs are locked in for years at a time, and all the bureaucratic wiles of each military department are dedicated to keeping those programs intact and funded. They are joined in those efforts by the companies that build the equipment, the Washington lobbyists that those companies hire, and the members of Congress in whose states or districts those factories are located. Any

> threats to those long-term programs are not welcomed. Even if we are at war. (Gates, 2014, p. 117)

The acquisition of the MRAP was not supported by senior leaders because it was not a materiel solution to a capability gap identified in future concepts, which are normally validated and funded several years prior to development. It was identified by a war-time necessity and was therefore had not been part of a long-term wheeled vehicle strategy.

a. One-Time Use Item Not Funded in the Budget

The MRAP vehicle was considered the only solution readily available to the protect against the growing IED threat, however, none of the military services wanted shoulder the burden of financing the program. The DOD acquisition leadership was reluctant to procure the MRAP because they believed the MRAP was an expensive one-time use item that did not fit in the military's long-term wheeled vehicle strategy. The DOD's slow moving pace caused Secretary Gates to guide the MRAP's procurement outside the traditional JUONS process to expedite its delivery (Gates, 2017). He considered it his personal responsibility to inject "urgency and ruthlessness" in the procurement of the MRAP (Gates, 2014, p. 116). It was his response to the number one casualty producing threat in Iraq and Afghanistan—the IED (Feickert, 2008).

b. MRAP's Weaknesses

The MRAP's increased survivability had several unintended consequences that warfighters on the ground had to confront on a daily basis. Its size and height often damaged local power lines, internet lines, personal property, and infrastructure. Additionally, U.S. commanders lost valuable maneuverability in urban and mountainous terrain, which negatively impacted their ability to engage the population they were trying to assist. The MRAP's unintended tactical consequences ran counter to the U.S. counterinsurgency strategy in Iraq, which expected U.S. forces to be more accessible to the local population and restore essential services.

David Kilcullen, counterinsurgency expert, published *Twenty-Eight Articles; Fundamentals of Company-Level Counterinsurgency* in March 2006. The U.S. Army and

USMC used his publication and expertise update *Counterinsurgency*. His *Twenty-Eight Articles* provided commanders on the ground with a condensed, easy to read playbook for success in counterinsurgency operations prior to *Counterinsurgency*. The near simultaneous fielding of the MRAP in Iraq complicated the execution of the counterinsurgency imperatives.

(1) Damage to Public and Private Property

The MRAP's size and height made it prone to striking low hanging internet wires and power lines, which could result in serious injury to MRAP vehicle gunners, who were usually exposed at the top of the vehicle. The MRAP's size over the HMMWV, pictured in Figure 6, made it more difficult to navigate through narrow streets, increasing the likelihood for accidents with civilian vehicles and angering the population U.S. troops were trying to help. This is not helpful when conducting COIN operations, since the support of the local population is critical. U.S. leaders viewed the MRAP's protection qualities as benefits that outweighed the damage caused to public and private property. Although these concerns were voiced to senior commanders in the field, Secretary Gates characterized it as "the cost of doing business, rather than a big problem" (Gates, 2017).

Figure 6. Size Comparison between a U.S. HMMWV (right) and Two MRAPs (center and left). Source: Shachtman (2008).

Secretary Gates stated that to mitigate the dangers presented by the MRAP's antennas, troops in the field came up with "a lot of ad-hoc solutions," such as PVC pipes to safely guide wires over the vehicle (see Figure 7; Gates, 2017).[26] The other method mitigating the antennae issue was to tie a rope to the antenna and have the gunner pull it down when moving under low hanging wires. The problem that that creates is now the gunner's hands are on a rope pulling down an antenna instead of on this primary weapon prepared to engage hostile threats.

Figure 7. Last MRAP to Depart Iraq for the United States Depicted with PVC Pipe Wire Guides. Source: AMC Staff Report (2012).

(2) Loss of Maneuverability and Speed

The fielding of the MRAP exposed a major weakness in the vehicle's ability to maneuver effectively with speed in urban environments. Kilcullen (2006) advises soldiers to "travel light" because the enemy will likely carry only the necessities like a rifle, RPG, and water bottle. In order to prevail against a "light" enemy you must make a concerted

[26] Polyvinyl chloride (PVC) is a raw material used in many applications, such as plumbing pipes, windows, signs, and furniture.

effort to become “light” and enforce a culture of speed and mobility; if you do not, the insurgents will consistently have a competitive advantage to out-maneuver the larger force.

(3) Loss of Situational Awareness

Kilcullen also advises soldiers to “be there” with an emphasis on movement on foot, sleeping in local villages, and patrolling at night. All of these methods are certainly more dangerous than patrolling in an armored vehicle during the day, but they establish and help maintain valuable relationships that increase the commander’s situational understanding. Doing these activities improved the local population’s perception of U.S. troops—they saw them as real people. These activities also seek to improve trust between the locals and the U.S. troops, which in turn increases the likelihood of locals providing U.S. troops information on insurgent activity. Kilcullen (2006) states that you do not want to appear as “aliens who descend from an armored box. Driving around in an armored convoy—day-tripping like a tourist in hell—degrades situational awareness, makes you a target and is ultimately more dangerous” (Kilcullen, 2006, p. 4).

(4) Top-Heavy and Predisposed to Rollover Risk

The MRAP’s weight, height, and high center of gravity made it extremely susceptible to rolling over. A 2008 CRS report indicated that more than 50% of the MRAP accidents since 2007 involved rollovers, and nearly 75% of the rollovers occurred in rural areas where roads and road shoulders do not meet U.S. standards (Feickert, 2008, p. 5). Rollovers were caused by crews swerving the avoid potholes and debris in the road, hitting an object, and soft terrain that would give way under the MRAP’s weight (Marine Corps Center for Lesson Learned, 2008). To mitigate the rollover risk and provide warfighters with an off-road MRAP style vehicle for Afghanistan, Secretary Gates approved the M-ATV (MRAP All-Terrain Vehicle; Gates, 2017).

2. Why Did the DOD Finally Procure the MRAP?

The DOD, with Secretary Gates as the catalyst, finally procured the MRAP to decrease the number of U.S. casualties caused by the IED. The USMC initially identified the MRAP as a potential solution for the emerging IED threat in Iraq in November 2004.

The USMC's Marine Expeditionary Force 1 (MEF) submitted an UUNS requesting MRAP vehicles in March 2005. That request, and many that followed, went unanswered until May 2007 when Secretary Gates designated the MRAP as the highest priority acquisition program in the DOD. The program was designated as a "DX"[27] program, establishing it as the number one priority for contractors to resource during production. The MRAP became an ACAT 1D program of record in September 2007. By 2009, it was supposed to replace most HMMWVs in Iraq (Feickert, 2008). The MRAP undoubtedly saved lives, and by some accounts has been credited with saving as many as 40,000 lives in Iraq and Afghanistan since its fielding and deployment. The actual number of lives saved is questionable and 40,000 seems inflated. A 2012 study conducted by economics professors Chris Rohlfs and Ryan Sullivan determined that the methodology used to account for lives saved assumed that the MRAP saved the lives of its occupants regardless of the type of enemy attack, which is not realistic. Rohlf and Sullivan's (2012) theory of inflation is even more credible considering the final number of combat fatalities in Iraq was 3,481 as of April 2017.[28] This number is significant, but does not support the theory that the MRAP saved 40,000 lives.

a. MRAP as an Accelerated Acquisition Program

COTS items and a tailored acquisition approach are the key to MRAP's success as an accelerated acquisition program. The DOD was able to rapidly procure the MRAP because it was commercially available from several domestic and international companies who were already producing several variants of the vehicle (Feickert, 2008). The DOD also tailored the acquisition approach by establishing minimal operational requirements and focusing on crew protection and speed of delivery to the warfighter.

[27] "DX" is not an acronym. The DOD uses two ratings, "DX" and "DO", to establish resource allocation priorities of industrial resources that support national defense programs. Programs rated "DX" are regarded as the highest priority to national defense and are approved by the Secretary of Defense or the Deputy Secretary of Defense. The Department of Commerce implements the DOD's priorities through the Defense Priorities and Allocation System which ensures that the industrial base has the required resources available to meet DOD's requirements during times of national crisis (U.S. Department of Commerce, 2017).

[28] This summary of combat deaths in Iraq reflects combat related deaths as of April 26, 2017, by the Congressional Research Service. This number does not include non-combat related deaths (Congressional Research Service, 2017).

The speed was achieved by awarding indefinite delivery, indefinite quantity contracts to nine companies, using a phased test plan, and developing a sustainment plan that relied on both military and contractor support personnel (GAO, 2008).

The DOD used model 4 (accelerated acquisition) of the basic program structures to acquire the MRAP vehicle because of the military's urgent operational requirement and the fact that it was a commercially available system. The model is the DOD's preferred program structure when materiel solutions to capability gaps are available and schedule outweighs performance and cost risks. In terms of cost and performance, accelerated acquisition programs are a higher risk than traditional hardware and software acquisition programs, however accelerated programs are necessary when the military has to rapidly adapt to enemy capabilities (DOD, 2017, p. 15). Model 4 accelerates programs through the acquisition phases by shortening phases of the process or running phases concurrently. When using this model, the DOD accepts the potential risks associated to cost and performance requirements in order to deployed mission critical capabilities to the battlefield as rapidly and as feasibly possible. The DOD generally uses this model to acquire and field urgent needs in under two years. (DOD, 2017, p. 15). As described in DODI 5000.02, Figure 8 is an example of an accelerated acquisition program structure.

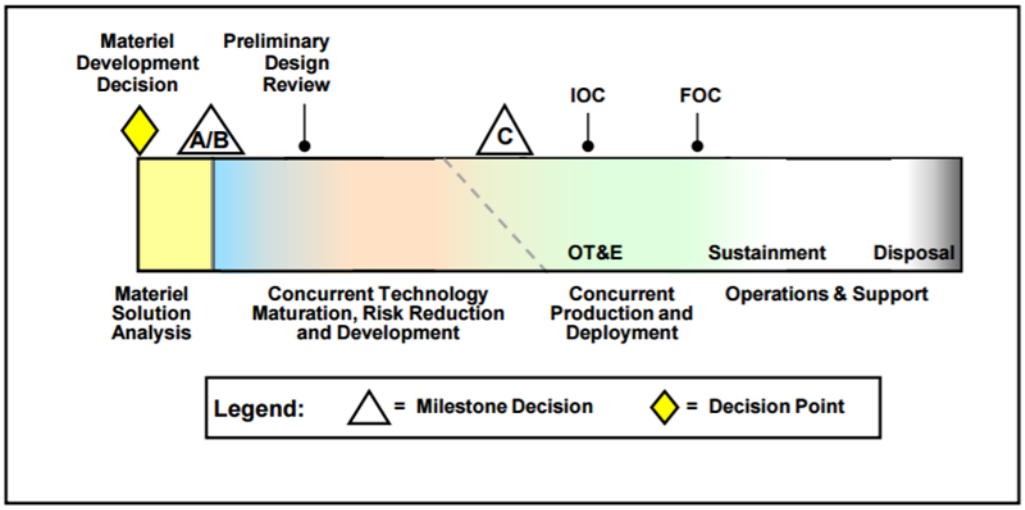


Figure 8. Program Structure Model 4 Accelerated Acquisition Program. Source: DOD (2017, p. 15).

b. MRAP's Strengths in a Contested Environment

In 2008, the DOD highlighted the success of the MRAP by announcing its casualty rate of 6%, calling it "the most survivable vehicle we have in our arsenal by a magnitude." For comparison, the HMMWV's casualty rate was 22% during the same time (Feickert, 2008).

However, the introduction of the MRAP to Iraq caused the enemy to evolve and change their tactics. When the United States added armor and electronic jammers to HMMWVs, the enemy produced larger IEDs and changed the types of triggers. Similarly, as U.S. units upgraded from HMMWVs to MRAPs, the enemy increased the size of their IEDs and introduced the explosively formed penetrator (EFP), which was their deadliest IED capable of penetrating MRAP crew compartments (GAO, 2008). The MRAP as a single-solution to the IED threat made it easier for the enemy to adapt its tactics. The MRAP's biggest strength became one of its biggest weaknesses. Its size made it slow and tough to maneuver through urban areas. There are analysts who believe the MRAP was not practical for counterinsurgency operations (Lamb et al., 2009).

c. MRAP (V-Shaped Hull) Versus HMMWV (Flat-Bottom)

Brig. Gen. John Allen, deputy commander of coalition forces in Anbar province during Operation Iraqi Freedom in 2007, explained that V-shaped hulls of the MRAP vehicle help deflect blast force of the IED that are buried in the roadways patrolled by the Marines under his command. Additionally, the MRAP's crew compartment was higher off the ground where the concentration of blast force is the greatest. In contrast, HMMWVs have a lower crew compartment and not adequately protected from underbelly threats such as IEDs (Brook, 2007). Units reinforced the sides of the HMMWV with armored kits, but the underbelly of the vehicle was still no match for the buried IED, which would strike from the bottom often causing death or serious injury.

C. SECRETARY OF DEFENSE INVOLVEMENT

Secretary Gates personally ushered the MRAP program through the Pentagon's buearcracy in order to get the vehicles to Iraq as fast as possible. He realized that even through the DOD had a process for urgent requirements, the process was slow and often took to years to produce a materiel solution. The DOD's acquisition process sends the most pressing and urgent needs to the military senior leadership in the Pentagon, the JROC. The JROC considers requests and decides if there is joint (multi-service) application, and which military service will be the appropirate program lead (Gates, 2014, p. 117)**.** Secretary Gates realized that if the MRAP vehicles were going to make their way to warfighters, he had to get involved and break the beaucratic interia of the Pentagon's acquistion process.

1. Uniqueness of the Purchase

The DOD's procurement of the MRAP is unique because it highlights the DOD's ability to quickly acquire military capabilities in times of absolute necessity. The MRAP program had stalled in the Pentagon's bureaucratic inertia until 2007 when Secretary Gates made himself the pseudo-MDA and essentially removed cost and schedule as constraints for the MRAP's joint program office.[29] Normal DOD programs require Program Managers to manage cost, performance, and schedule associated with the program's acquisition decision memorandum.[30] Once Secretary Gates made the decision to procure the MRAP, his requirement of the program office was to get as many MRAPs as possible and deliver them to the battlefield as quickly as possible. He recognized that warfighters would encounter operational and sustainment challenges with the MRAP, but he believed it provided "better protection than anything we else had" and fielding the MRAP became his number one priority (Gates, 2014, p. 123). In his memoir,

[29] Secretary Gates was not the MDA for MRAP procurement. His personal involvement guided the MDA on key decisions and the speed of the major system procurement. This level of involvement in the acquisition process is atypical from a Secretary of Defense.

[30] The acquisition decision memorandum documents the decisions made by the MDA during a milestone decision review and lists the tasks that must be completed during an acquisition phase with specific exit criteria. It is the formal justification that allows a program to proceed into the next acquisition phase.

Gates (2014, p. 124) stated, he "would move heaven and earth" to save lives. To "move heaven and earth," he personally lobbied Congress for supplemental war funding to buy MRAPs. In April 2007, Congress approved $3 billion to support the MRAP program in the Fiscal Year 2007 budget, and added another $4 billion to the 2008 budget (Gates, 2014, pp. 122–123). Secretary Gates held bi-weekly meetings with the key stakeholders, members of the joint program office, funding office, and the Under Secretary of Defense for Acquisition, Technology, and Logistics, to track the progress of the MRAP program. He stated that he ended all of his meetings with "hurry up, kids are dying" to convey a sense of urgency (Gates, 2017). Gates' involvement in MRAP cost schedule and performance advanced the MRAP program, but program goals were not tied to goals in an ADM.

2. Speed of MRAP Testing, Fielding, and Deployment

The procurement of the first 700 MRAPs took 27 months to field, even with personal involvement by the Secretary of Defense. Secretary Gates (2017) said that the length of time was inadequate for procuring an urgent system. By the time the MRAP was fielded, experts like retired Army General Barry McCaffrey, a former Combatant Commander of U.S. Southern Command, asserted, "It is the wrong vehicle, too late, to fight a threat we were actually managing." Commanders at the tactical level need varied capabilities in order to adapt to the operational environment and present enemy forces with multiple dilemmas to prevail in the range of military operations (Lamb et al., 2009).

D. SUMMARY

This chapter reviewed the DOD's Defense Support System (DSS) for procuring systems using a traditional acquisition approach and accelerated approach, both of which fall short of meeting the Goldwater–Nichols Act initiatives of equipping the joint warfighter with the required capabilities necessary to win in variety of scenarios. The MRAP program was used to illustrate how even the highest priority program in the DOD was mired in the acquisition process. It took the Secretary of Defense's personal involvement to move the program rapidly through the acquisition system and into the hands of the warfighter.

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IV. THE LAW OF REQUISITE VARIETY

Chapter II described the complications of waging a strategic counterinsurgency campaign and described insurgencies as adaptive and complex. Chapter III focused on the U.S. government's procurement process, its inability to rapidly respond to adaptive threats such as insurgencies, and its adaptations to procure and field the MRAP as a materiel solution for U.S. forces conducting counterinsurgency operations. In order to conduct these operations, the U.S. military managed to expedite MRAP procurement because of Secretary of Defense Gates' leadership. The commercial availability of the MRAP prior to military interest in the vehicle created schedule benefits by modifying which bypasses significant portions of the acquisition model. Although the MRAP improved IED survivability compared to its tactical vehicle predecessor, the HMMWV, it also created tactical disadvantages as well as a battlefield constraint for commanders who were forced to use the MRAP.

This chapter focuses on the Law of Requisite Variety (LORV) and controlling complex systems. LORV is paraphrased by stating that variety and information are essential in controlling complex systems. This is relevant because *Counterinsurgency* describes counterinsurgency operations and insurgencies themselves as "complex." In order to achieve a successful end state in counterinsurgency operations, commanders must be able to control complex systems—insurgencies. There are endless examples of complex systems; insurgencies are complex systems that require control in the form of military action. LORV is a universal methodology that demonstrates that commanders can control complex systems by increasing variety. Variety, however, has an opposing force: regulation. The tension between variety and regulation creates a constant tradeoff for procurement professionals that affects tactical commanders' combat capabilities. Furthermore, this chapter includes a discussion of organizational barriers in the acquisition process that discourage system variety.

A. THE FIELD OF CYBERNETICS

When W. Ross Ashby wrote the Law of Requisite Variety in 1956, it was only a portion of the work he was publishing on cybernetics. W. R. Ashby's *An Introduction to Cybernetics* was, in part, a demonstration of the universal nature of the field of cybernetics (W. R. Ashby, 1956). Universal as it may be, in the 21st century, the term is barely used.

Cyberneticians trace the origins of their field as far back as Pythagoras in the 6th century B.C. Cyberneticians credit Plato with the first use of the word *kybernetike* in his fifth-century *The Republic*, describing "steermanship" or the process of governing an organization. Through many millennia and progressive development in the field, cybernetics' popularity peaked in the 1930s through 1970s as scientists began to realize the interrelated nature of various systems. The field of biology could be credited with the rapid progression of cybernetics at the time, with exponential advances in the knowledge of organisms at the sub-cellular levels and the effects these systems have on their much larger, much more diverse ecosystems in which they live and contribute (American Society for Cybernetics, 2016).

Though a large part of cybernetics can be traced to the field of biology, it would be incorrect to suggest that the application of cybernetic principles can only benefit certain academic fields. This is the realization that W. R. Ashby was seeking in *An Introduction to Cybernetics*, an overview of the field with mathematical modeling examples of its application in ordinary, ubiquitous systems (W. R. Ashby, 1956).

Because of the general nature of the field, and by design, its unlimited application to other fields of study, cybernetics has many different descriptions and definitions. Some definitions from leaders in the field are as follows:

- "Cybernetics is the science of effective organization" —Stafford Beer (Pruckner, 2002).
- "The science of control and communication, in the animal and the machine" and "The art of steermanship" —Norbert Wiener (W. R. Ashby, 1956, p. 1).

Though promulgated by leaders in hard sciences during the last century, the field of cybernetics has also found application in fields such as management and economics, as well as various scientific fields such as physics, medicine, mathematics and modeling. Because of the diversity of the field, it is also applicable, relevant and an economical use of resources to apply cybernetic principles to current and future military strategy and tactics. There are many applications of cybernetics throughout the military, though the application is most likely accidental, applied through an organizational form of natural selection. Through deliberate application of cybernetic principles, military leaders can anticipate and prepare for multiple diverse complex environments, judiciously using scarce resources to achieve national strategic objectives.

B. QUALITATIVE ASPECTS OF THE LAW OF REQUISITE VARIETY

1. Common Applications of Law of Requisite Variety

The universal nature of LORV is apparent in almost everything or system imaginable. The only exception could perhaps be elements themselves in the form of atoms, which simply exist without explanation. Every other thing on earth is some combination of elements and/or processes, and somehow serves a purpose and helps compose a system.

The list of LORV applications is literally infinite. If someone examines an automotive mechanic's toolbox, he would see many tools, each with its own application. A mechanic would never describe his work as controlling a complex system but that is exactly what he is doing. Through a form of natural selection, the mechanic, over time, and perhaps with collaboration with other mechanics or industry best practices, finds an economic mix of tools to do his work. The mechanic does not have all tools, but has enough to control a system such as a broken vehicle.

Someone who is going on a camping trip may have a similar situation in that he anticipates needing tools, but differs from the mechanic in that the camper cannot entirely anticipate the task or conditions. An additional facet of the camper's decision is that the camper is likely unable or unwilling to carry an entire toolbox with tools in order to prepare for an unlikely occasion that would require a specialized tool. The camper may

likely purchase and carry a multi-tool, something that has many uses, but is probably not optimal for any specific task. It is easy to see the tradeoff that the camper is making relative to the mechanic. Whereas the mechanic expects specific problems concerning vehicles, in a specific location, during the workday, the camper expects few or no requirements for tools, and cannot be certain of where or when they will be needed. In this scenario, the camper knows that he will be carrying all of his items, and places a higher value on weight reduction than the mechanic does. The camper still acknowledges the complex system that he may encounter but chooses to increase his variety and flexibility relative to his environment much differently than the mechanic. The mechanic and the camper have both recognized variety in a system they plan to control, but the mechanic finds variety in many specialized tools while the camper finds variety in a single, generalized tool.

LORV is not restricted to tangible objects. LORV explains why dozens of different instruments make up a symphony and why there are different parts for each instrument. Furthermore, it helps explain why instruments play different notes and musicians play notes of different lengths. One could conclude that someone playing the same note on an instrument for the same duration is music, but this musician would have to adapt his performance if he expected to entertain an audience.

LORV explains the economic concept of specialization. In an economy where people can choose their professions, a market of various professionals emerges. These professionals can specialize in medicine, entertainment, manufacturing, writing or any number of occupations. Alternatively, someone can choose to generalize, filling unique niches that may not have adequate demand for a specialized professional. In each scenario, LORV is at work and determines the appropriate variety of professionals to control the complex system.

The example of the mechanic’s and the camper’s tool selection criteria is hypothetical to demonstrate how the need for variety arises and is often handled without conscious thought. Examples of LORV are not restricted to tangible objects, but apply wherever complex systems exist. To control a complex system, variety is required.

a. Military Applications of Law of Requisite Variety

The mechanic example of LORV demonstrated the mechanic's desire to control the broken car. Just as it is applicable in most things, LORV is applicable to military operations and the strategic decisions used to shape them. The U.S. Army operating concept is to "win in a complex world" (Headquarters, Department of the Army, 2014). Though the operating concept is rather simplistic at first glance, the Army must apply LORV to achieve this goal. Furthermore, the operating concept requires its executors to acknowledge that their operating environments will be complex and that leaders should have no expectation of certain victory. Winning in a military sense will require preparation, resourcing, and optimizing the consumption of scarce resources.

One way to progressively apply LORV militarily is to begin by simply stating that a military force wants to occupy a geographical area. The force commander can simply place an untrained person in the area and accomplish his mission. However, an opposing military force complicates the simple model and the commander must train and equip his occupant to address the threat. When the commander realizes that the opposing force is more capable than his by measures of quantity or quality, he must increase the quantity or quality of his force to achieve greater variety than the opposing force. The escalation can continue indefinitely, or until one force finds the cost to occupy the geographic area greater than the benefit received, making further pursuit uneconomical, and yielding victory to the force that achieved the greatest variety. Variety is the key to achieving the military advantage; W.R. Ashby noted, "Only variety can destroy variety" (W. R. Ashby, 1956, p. 207).

2. Incremental Application of Law of Requisite Variety

LORV is applicable when opposing forces have a desire to control a system and have different desired outcomes. Status quo or stagnation could be a desired outcome. In the auto mechanic example, the car prefers to remain as is, the mechanic must repair the car, thereby asserting himself on the broken vehicle, starting a process to control the complex system.

In any application of LORV, there is a process. W. R. Ashby described it in 1956, and his simple diagram and explanation of variables create opportunity to apply the law to virtually any system, including military applications. The next sections introduce LORV, its variables, and the process of opposing forces trying to influence the outcome of the system and its environment. LORV recognizes opposition among systems, and additional variables represent the forces that represent the opposition.

a. Variables D, T, and E—the Disturbing Force, Transformation, and Outcome

Variables D, T, and E are easily understood when grouped together, and provide context in military application. Variable D is a disturbing force. The disturbing force is the initiator of desired outcome E by process of a transformation, T. In other words, LORV begins when variable D performs process T to achieve outcome E (W. R. Ashby, 1956). This activity is explained graphically in Figure 9.

Disturbance (the enemy force, variable D), uses a process (variable T) to achieve a desired outcome or result (variable E).

Figure 9. Law of Requisite Variety Variables D, T, and E. Adapted from W. R. Ashby (1956, p. 213).

In a military application, LORV will identify the disturbance as an enemy (variable D). The enemy desires to achieve an outcome (variable E) through a process (variable T). If these were the only variables, the process would be as simple as the example of an untrained person occupying a piece of terrain. When there is no contest, no opposition, there is no need to introduce additional variables. Because military environments, or any other environment, is not this simple, W. R. Ashby introduced other variables to demonstrate a complex environment.

b. Variables C and R—The Controller and the Regulator

Just as variables D, T, and E are easily understood when grouped together, the same behavior applies to variables C and R, the controller and regulator of a complex system. One key difference with variables C and R, compared to variables D, T, and E, is that the controller and regulator represent a contesting force of some sort, and the limitations that are on the contesting force.

(1) The Controller

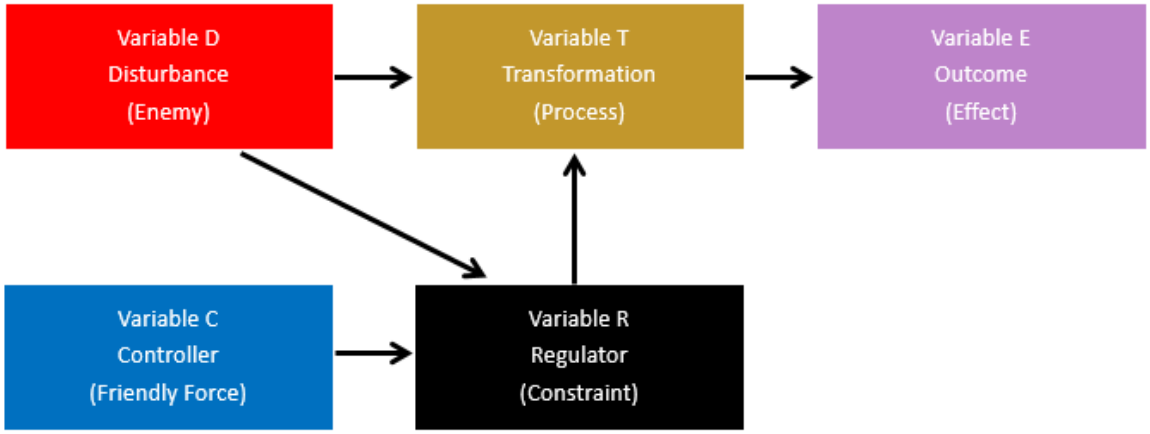
The controller is the person, organization, idea, or other complex system that opposes the disturbance, has a different desired outcome and is willing to participate in the transformation process in order to achieve its desired outcome. In a military application of LORV, the controller would be a friendly force. In the LORV context, the military force represents resources such as a trained force and equipment, a plan to effect the transformation process such as an operation order or commander's intent, and a driving force that compels the friendly force to do anything at all.

(2) The Regulator

The regulator in a system is the factor that limits the controller's ability to have an effect on a system at all, and is the focus for this research. Simply defined, a regulator is any barrier, rule, terrain, idea, decision, capability, or technological limit that restrains a controller from doing whatever it desires. An obvious regulator is an inability for man to travel at the speed of light. There are, perhaps, many uses for this capability like inter-stellar travel, but it is simply not possible in the current state of technology. Regulations are another type of regulator in a system, and certainly it is not mere coincidence that the two concepts share the same root word. A regulation seeks to limit, create boundaries, or somehow standardize an activity or process. In military application, the Law of War and Geneva Conventions are regulators because they restrict behavior to limit the effects of warfare (International Committee of the Red Cross, 2014).

Figure 10 introduces variables C and R to demonstrate the contested nature of this hypothetical scenario. Recall that if there is no contest or disagreement about the outcome at variable E, the disturbance could simply apply his process and arrive at his intended

outcome. For LORV to be applicable, there must be some force that opposes the disturbance. These opposing forces could be as obvious as an opposing military force or simply the broken vehicle that would remain in its inoperable state indefinitely if not transformed by the mechanic.



The controller (variable C), desires to affect the disturbance (variable T) process to achieve a different outcome (variable E). The controller is limited by the regulator (variable R).

Figure 10. The Law of Requisite Variety with All Variables. Source: W. R. Ashby (1956, p. 213).

3. The Importance of Variety in LORV

The previous section introduced the five variables that compose the LORV model and their interaction. The regulator deserves additional explanation and definition, because of its significance in this research. This research hypothesizes that LORV would be not applicable at all in military application, except for the regulator. Without the regulator, opposing forces would apply all of their military power to the transformation to achieve their desired outcome. To counter the limitations of the regulator, the commander seeks variety.

a. The Regulator Opposes Variety, and Variety Opposes Regulation

To more precisely demonstrate the role of the regulator, and to visualize some of the principles, consider a person driving a convertible north on the iconic California Highway 1 along the coast of the Pacific Ocean, and consider the tangible and intangible

regulators the driver must address. In many sections of the highway, the northbound driver will see the Pacific Ocean to his left and mountains to his right. On the road, the driver sees speed limit signs. The highway also has physical limitations, such as defined lanes going each direction, and the driver can only exit at constructed highway exits. The driver's car has limitations on speed, maneuvering ability, and passenger capacity. Finally, the driver must consider the dynamic actions of other drivers as he continues on the highway. The driver's goal is to sightsee and enjoy his drive.

The driver is probably not focused on how many limitations he is experiencing by driving on the road. He has geographic, physical limitations, as he can neither drive into the ocean, nor into the mountains; he is restricted to the highway. He has regulatory limitations, and will have to endure the possible consequence of a speeding ticket if he exceeds the posted speed limit. The driver has structural limitations concerning the road itself, the number of lanes, and limited exit options. The driver has many different systems at work that limit how he can enjoy his sightseeing trip along the Pacific Coast.

Just as the driver has limitations, he also has options. Assuming that the driver's intent is to enjoy the drive as much as possible, there are several ways to increase his enjoyment level. He can play music, he can choose to have his convertible top up or down, he has a range of options to choose from regarding his speed. The driver can add a companion, stop altogether to look more closely at something that particularly interests him, or the driver can simply end his trip and go home.

This example illustrates the tension between the regulator and its counterpart, variety. Variety is the solution to regulation. For the driver who wants to increase the enjoyment he has on his trip, his opportunities are diminished by the various regulators that keep him on the road, restricted to certain speeds, and within the other limits of his environment. When the driver has variety, he has different options that he can choose, different ways to influence his environment to maximize his experience.

So, too, a military commander in any conflict will experience geographical limitations, equipment limitations, weather restrictions, and personnel limitations to name a few. These limitations are further restricted by the types of weapons he can use, the

types of force he can use, his restrictions on collateral damage, etc. The commander may even choose to self-induce short-term restrictions because he believes his decisions will have greater reward at a later time. A military commander has several forms of variety, several ways to present his enemy with multiple dilemmas, by varying the options he controls, such as the size of attacking force compared to the reserve force, combining different weapon systems to achieve multiple effects on his targets, his avenue of approach to his target, or even the speed of the attack. These examples are only in the realm of kinetic options for military commanders of counterinsurgencies. Commanders have several non-kinetic options such as information operations, using purchasing power to influence the operating environment, improving infrastructure and other seemingly non-military tools that certainly affect the ability to conduct combat operations. The commander increases his ability to be successful when he has a greater variety of options that he can use and force an enemy to contend with. Conversely, each regulator restricts what the commander can do, and reduces his variety.

b. Information

W. R. Ashby describes information and variety as inseparable in a complex system but continues to differentiate their roles in the complex system, always indicating that information decreases uncertainty about a system (W. R. Ashby, 1956, p. 152). Bushy describes variety in military terms: “It is key to understand that information does not reduce or destroy the enemy’s variety. Rather, it reduces the uncertainty of the situation and helps the commander regulate the system” (Bushey, 1997, p. 64).

An example of the value of information could occur by considering the spectrum of intelligence available to a commander. With no information (intelligence), the commander must prepare for every possible enemy course of action, which is impossible. With partial information about the enemy, the commander can prepare for likely enemy courses of action, and reduce attention to unlikely courses of action. In another impossible scenario where a commander has complete information about an enemy and all decisions the enemy will make, the commander requires far fewer resources to achieve his desired outcome on the battlefield. Information can help a commander achieve more,

even when regulation is increased and/or variety is decreased. The value of intelligence is not new to military decision-making. However, increased information about an enemy, environment or any complex system may help reduce resource expenditure to control the system.

c. Quantity

A common military aphorism concludes that quantity has a quality all its own. W. R. Ashby also acknowledges this concept by addressing degrees of freedom in a system, achieved by each component (J. Ashby, 2008, p. 129). One could conclude that an armored tank with a single large round and an infantry soldier with unlimited, small rounds both have quality. The same person could also reasonably conclude that the infantry soldier could achieve the same amount of destruction as the tank with a single round if given enough bullets, against a target such as a non-tactical truck.

This conclusion is correct, but fails to consider economics and strategy. The strategist must seek efficiency to have a feasible military solution. All resources are constrained in some manner, and commanders and their leaders will find themselves incapable of winning a long war, such as a counterinsurgency campaign, by trying to overwhelm an enemy with quantity as the only form of variety.

4. Clarifications for Military Applications of LORV

When W. R. Ashby published *An Introduction to Cybernetics* in 1956, his intent was to demonstrate the universality of LORV. At the time, those with extensive backgrounds in electronics or mathematics generally dominated the field of cybernetics. W. R. Ashby realized that the field should not be constrained to hard sciences, and he realized that there were many other applications (American Society for Cybernetics, 2016). W.R. Ashby aspired to demonstrate applicability of the cybernetics field to non-cyberneticians, specifically physiologists, psychologists and sociologists (J. Ashby, 2008). W.R. Ashby summarized his intent for applying cybernetics concepts to biological sciences in the following quote:

> Though the book covers many topics, these are but means; the end has been throughout to make clear what principles must be followed when one

> attempts to restore normal function to a sick organism that is, as a human patient, of fearful complexity. It is my faith that the new understanding may lead to new and effective treatments, for the need is great. (J. Ashby, 2008)

Because of his background as a scientist and inventor, it is understandable that W. R. Ashby demonstrates LORV application primarily through biological sciences. However, it is also clear that W.R. Ashby understood that LORV application was unlimited, both in the preface of *An Introduction to Cybernetics* as well as examples he uses to explain LORV. For example, before W.R. Ashby even defines LORV, he describes decision models that support game theory. Because his work is ultimately a textbook, W. R. Ashby also includes word problems that the reader can solve and receive answers and have underlying concepts explained. In one of his first examples of a word problem, W. R. Ashby demonstrates to readers that LORV will help a butler develop a model of which spirits he should stock to ensure all guests have a drink they prefer, but with the assumed limitation that the butler cannot stock nor prepare all drinks for all guests. The challenge to the butler is to have enough variety in his bar to satisfy guests, but readers also assume that resources such as time, money, and knowledge are constrained.

In addition to these examples, W.R. Ashby introduced LORV and the concept of regulators to demonstrate that variety is a solution to regulation, and indicated that regulation occurs “in physiology, ecology, economics, and much of the activities in almost every branch of science and life” (W. R. Ashby, 1956). Clearly, W.R. Ashby does not see his law as confined to any subject or limited from any subject. Contrarily, he sees it as universally applicable. Although W. R. Ashby does not use military examples in his publication, military applicability of LORV is clearly acceptable and appropriate for controlling complex systems. However, applying LORV to military examples requires some clarification and interpretation of concepts. For this clarification, we answer the following questions:

- Why does the controller not just attack the disturbance, adding a line from variable C to variable E?

- Why can the disturbing activity apply action to the regulator directly, but the regulator action can only apply to the transformation (variable T)?
- Why isn't there a regulator between the disturbance (variable D) and the transformation (variable T)?

These questions may not have been apparent in initial or subsequent academic work in LORV. Again, it is important to understand the original thoughts surrounding the descriptions and scenarios used to communicate LORV. In biological sciences, a disturbance may be a force that a scientist cannot control, or simply chooses not to control because of some measure of practicality.

Consider rainfall. A person caught in a rainstorm has no control over the rainfall, its intensity, duration, when it begins, or other factors. The rain simply occurs. The person can, however, influence the effects of the rainfall. For example, he can cover the things that he wants to remain dry; he can move inside or walk with an umbrella. The important similarity to recognize is that the rainstorm, though incapable of making a decision, clearly desires to make everything wet. The person, we assume, wants to keep some portion of the environment dry, and therefore has a decision about what countermeasure to apply. In military examples, there are at least two complex systems; two teams that are capable of making decisions at the tactical through strategic levels. When rain is a disturbance, it is not because the rain chooses to fall; it just falls. Contrarily, in military application, the opposing forces actively choose, execute and adapt strategy, applied at the transformation, to influence the outcome.

a. Why Does the Controller Not Just Attack the Disturbance, Adding a Line from Variable C to Variable E?

This is, perhaps, the most obvious military-related question. The answer will demonstrate that while the LORV is at work, an observer will think that he or she is observing a different process. In this case, the observer witnesses one force attacking another and assumes this is representative of a controller attacking a disturbance. This observation is certainly correct but hardly explains the complexity of what is actually happening. In actuality, the process the observer is watching is the same as W. R. Ashby describes (illustrated in Figure 10).

The observer is actually witnessing the controller that is attempting to influence a transformation and a regulator limiting the controller's actions. In a practical application, this is demonstrated in a scenario of an infantry unit which must comply with the rules of engagement in any attack so that the controller can achieve its objective. The critical distinction is that the controller's objective is not to destroy the enemy; it is how the controller affects the transformation process. This point is made clear in *Counterinsurgency*. "In all cases, insurgents aim to force political change; any military action is secondary and subordinate, a means to an end" (Headquarters, Department of the Army, 2006, p. 1-5). The controller and disturbing forces are both focused on the end state, and combat is the transformation method that they use. This scenario demonstrates that an observation and LORV do not have to appear the same for LORV to be active and applicable. In this scenario, the regulator was operating to restrict the controller but was not apparent to an observer.

b. Why Can the Disturbing Activity (Variable D) Apply Action to the Regulator (Variable R) Directly, but the Regulator Can Only Apply to the Transformation (Variable T)?

This question represents another example of LORV at work, when an observer sees something that appears to be a different process. This question, however, demonstrates one of the most critical military applications of LORV, and is essential to implementing a counterinsurgency strategy. Two considerations are essential to answering this question and realizing the significance of the answer:

1. A controller's actions are restricted by the regulator (W. R. Ashby, 1956).
2. Insurgency enemies are adaptive (Headquarters, Department of the Army, 2006, p. 1-26).

The important concept to remember is that a controller does not choose to be regulated. An enemy as a disturbance has some control over the regulator. One example involves the use of information in warfare, which is a critical aspect of insurgency and counterinsurgency operations. An enemy could use a civilian death or damage to a non-combatant's property as propaganda against the controller. To keep favor with the local people, the leader of the controller force may be forced to restrict his rules of engagement

(increasing regulation). He may not have been compelled to change his methods if not for the propaganda.

Another example of an enemy disturbance taking advantage of a controller's regulation is the use of terrain to restrict the controller's movement, creating a safe area for the disturbance (enemy). Warfighting is significantly more complicated in an urban environment. Communication, command and control, identifying enemies, and minimizing unwanted collateral damage are some of the warfighting aspects that increase in difficulty in an urban environment. Any fighting force will only choose to fight on terrain where it feels it has a tactical advantage. Conversely, the opposite force will choose to not fight on terrain where it has a disadvantage. If an enemy can effectively retreat into an urban environment, the enemy may make the pursuing commander uncomfortable with committing forces in an unknown environment and will end the pursuit. In this example, the enemy clearly has indirect control over the pursuing commander's decision, and is another of many examples where an enemy can influence a military outcome (variable E) by focusing on the regulator (variable R).

c. Why is There Not a Regulator between the Disturbance (Variable D) and the Transformation (Variable T)?

The simple answer is that there *is* a regulator between the disturbance and the transformation. However, perspective is an important consideration. In any military scenario, the roles of controller and disturbance are not defined. For example, during World War II, Germany would be considered a disturbance to any of the Allied Forces. Germany, however, would have viewed the Allied Forces as disturbances, and Germany would have wanted to reduce regulators to more effectively fight the Allied Forces.

The controlling force is simply not concerned with the disturbance's regulator. The disturbance arrives at the transformation after being restricted by the regulator. The disturbance and the disturbance after regulation are one in the same as far as the controller is concerned. The controller describes the disturbance as though the controller has already considered regulation.

This research hypothesizes that, in a military example, a controller could be placed between the disturbance and the transformation, without changing the law. The reason not to do so is that it does not add any additional understanding or application to LORV. Once again, the assumption in military examples is that the disturbance is actively making decisions. In scientific and mathematic examples, for which LORV was initially introduced, the disturbance does not make decisions. In sciences, the phenomenon the controller wishes to influence just exists.

C. OPPORTUNITIES FOR VARIETY IN THE CURRENT ACQUISITION SYSTEM

The JCIDS process is a thorough and deliberate process to produce materiel solutions that support warfighters. Though thorough and deliberate, these attributes of the acquisition and JCIDS can make it inadequate to respond to an adaptive and complex enemy, such as an insurgency. As mentioned in Chapter III, joint status of a program increases program complexity, as multiple services must be considered as stakeholders. Additionally, joint designation increases the oversight of a program. These qualities reduce the flexibility of an inflexible system.

The modular open systems approach (MOSA) is an existing solution to increasing the ability to field materiel solutions to warfighters. MOSA is a methodology that anticipates change in the operating environment, and materiel solutions that can adapt accordingly to maximize relevance on a battlefield. MOSA represents industry best practices to increase overall success of programs by preparing systems for incremental upgrades. MOSA has been encouraged in DOD for years, but MOSA received increased importance in the National Defense Authorization Act (NDAA) of 2017, which mandates the use of MOSA for major defense acquisition programs initiated after December 1, 2019. These future programs must include MOSA objectives in their acquisition strategies, and the MDA verifies progress in accordance with the acquisition strategies at milestone reviews (NDAA for Fiscal Year 2017, 2016).

The need for variety is widespread and urgent to address future threats. In a paper titled *The Future Navy*, Chief of Naval Operations Admiral John M. Richardson describes the environment as complex, with competitors (potential enemies) adapting quickly. Admiral Richardson's paper addressed his concern on the readiness and responsiveness of the Navy. Though not directed at acquisition community and processes per se, he called for a "balanced fleet that offers U.S. leaders credible options, in places of strategic importance, and at a relevant speed" (Richardson, 2017, p. 3). He calls for an evolutionary approach to U.S. Navy modernization, in which ships can incorporate new technology as it emerges, upgrading and adapting to achieve the mission.

Without addressing the acquisition process, Admiral Richardson called for more variety, and a modernization system that incorporates MOSA principles into hardware-centric materiel warfighting solutions—that is, navy ships (Richardson, 2017).

D. SUMMARY OF LAW OF REQUISITE VARIETY

LORV has been around for more than 60 years, yet the law is still finding applicability. Military strategists and tacticians will improve decision-making by incorporating LORV into decision cycles. At strategic levels, leaders must look at materiel resourcing to warfighters to ensure that solutions indeed fill capability voids that have an identified threat. At the operational and tactical levels of warfare, leaders must ensure subordinate organizations have created options that increase flexibility, and one way to increase flexibility by decreasing regulation. Warfighters will always have some form of regulation with which they must contend. The challenge to leaders and strategic decision makers is ensuring that the benefits of the regulation are greater than its costs.

In the topic of the MRAP as a tool to combat an insurgency, the DOD added a unique capability, thereby increasing the variability of how U.S. ground forces could address the complex enemy of an insurgency. However, through fielding and leadership, the MRAP was forced upon commanders as the tool that must be used, a battlefield constraint that reduced variety.

Policy makers and strategists can benefit from LORV by resourcing current and future military forces with variety. With variety, senior executives through tactical

warfighters will have the opportunity to present the enemy with multiple dilemmas that will create tactical advantages if needed, but more importantly can present the strategic capability to deter enemy action through overmatch via flexibility.

V. INTERSECTION OF COMPETING PRIORITIES

The previous three chapters independently addressed difficulty waging a counterinsurgency campaign and supporting it with appropriate materiel solutions, and competing stakeholder priorities. Chapter III addressed the military procurement system that favors commonality. Chapter IV discussed the applicability of the Law of Requisite Variety in military operations and planning, or in any system that requires controlling a complex system. These two chapters demonstrate the tension present to field a materiel solution to warfighters conducting counterinsurgency operations which was the focus of Chapter II. The MRAP was well-suited to improve survivability against IEDs, but other features detracted from other necessary counterinsurgency ancillary missions such as intelligence gathering and networking with the local populace. Additionally, leaders mandated the use of the MRAP, which made it a battlefield constraint, a regulator, in Iraq. This chapter explores the interaction, tension, and tradeoffs between these three focus areas of counterinsurgency, procurement, and the Law of Requisite Variety.

After learning the benefits of LORV, one could conclude that a single materiel solution is not viable in combat, because it limits variety. Although this could be true in most circumstances, leaders, strategists, and warfighters must understand that there is not a method to determine the appropriate amount of variety; the decision is ultimately a trade-off. This chapter reasserts the military requirement for variety, addresses the trade space and other criteria to decide the correct balance of commonality versus variety. After exploring this trade space, this chapter recommends two approaches to achieve benefits of variety without abandoning the positive attributes of commonality. This chapter finds that there are opportunities to achieve both of these goals simultaneously, with potential to decrease costs and development time for major systems.

A. WHY IS THE INTERSECTION CRITICAL?

This research looks at the DOD decision to procure the MRAP as a means to improve counterinsurgency warfighting operations. All of the decisions represent sunk costs. Even the doctrine used to dissect the cloud of complexities surrounding the

decisions are, for the most part, obsolete editions. Further aggravating the purpose of this research, a common internal complaint among military service members is that their service is preparing for the last war, indicating that the bounded rationality of leaders, both individually and collectively, uses past experiences to anchor ideas about future conflicts. Secretary Gates mentioned in a 2008 speech the problem he termed "Next-war-itis," the over-eagerness of leaders to prepare for future wars that may not materialize, and therefore create an opportunity to criticize the defense establishment for wasting money (Gates, 2008).

Clearly, neither extreme represents the right balance of preparation between these two options; at least not a balance that is available before a conflict begins. In his closing remarks in *Duty*, Gates empirically addresses the inability of the DOD to predict even mild specifics about future conflicts (Gates, 2014, pp. 589–592). However, a defining characteristic of unconventional warfare is asymmetry of forces. Therefore, insurgencies are predictable scenarios in future combat.

As the United States improves its ability to conduct conventional warfare and win, it increases its overmatch against potential adversaries, increasing the conventional military capabilities competitive advantage. No rational country or non-state actor (NSA) will choose to participate in a conventional war that it expects to lose, so the adversary will look for a strategy in which it can be competitive—unconventional warfare. This research does not suggest that the DOD should neglect its incremental improvements to wage unconventional warfare. Rather, this research suggests that as the United States increases its conventional warfighting ability relative to an opponent, the United States also increases the likelihood of unconventional warfare.

This reality is tied to the acquisition system, and the greater ability to generate a relevant mix of forces in that the DOD must continue improving conventional warfighting capabilities, which aligns with the current JCIDS process and ensures a slow but sure acquisition risk tolerance and corresponding resource expenditure. However, to address the unconventional threat, the DOD must develop a warfighting (and accompanying procurement) strategy that is prepared to adapt to enemy decisions, tactics, and strategy.

The balance represents the two types of organizations, their competition for scarce resources, and the execution of national strategy. James March (1991) describes this balance of competing priorities in concepts of "exploration" and "exploitation." Exploitation represents improving on what we know—conventional warfare—and incremental improvements in existing combat systems using the JCIDS process. Exploration is the method that not only uses imagination, novelty, and creativity, but also increases the vulnerability. This vulnerability is not related to an enemy necessarily, but may have the appearance of failure and open itself to criticism. March (1991) expounds on exploration:

> Compared to returns from exploitation, returns from exploration are systematically less certain, more remote in time, and organizationally more distant from the locus of action and adaption. What is good in the long run is not always good in the short run. What is good for one part of the organization is not always good for another part. … The certainty, speed, proximity, and clarity of the feedback ties exploitation to its consequences more quickly and more precisely than is the case with exploration. (p. 73)

The military must have separate ways of looking at the acquisition process, and separate goals and metrics to judge merits of the individual programs. The current JCIDS process has demonstrated its inability to respond to adaptive threats in an adequately responsive manner. However, applying an acquisition system that is designed to be quickly adaptive and responsive will not produce the incremental upgrades, the exploitation, that maintains *conventional* military superiority and cost-effectiveness.

B. THE SIGNIFICANCE OF VARIETY IN COMBAT

The Army Operating Concept (AOC), subtitled "Win in a Complex World," describes the Army's challenge in a dynamic operating environment to "prevent conflict, shape security environments, and win wars" (Headquarters, Department of the Army, 2014, Foreword). The AOC guidance provides strategic intent on how to generate forces that can achieve national objectives in various environments and against an array of enemies. To achieve this end, the Army must provide commanders and warfighters with a variety of capabilities to prevail against the challenges and threats in uncertain

operational environments and against determined enemies. Although this document is specific to the Army, the concept and charge are applicable to any branch of service, or in joint operations comprised of two or more services.

The operating concept does not provide guidance on how to procure material solutions to achieve requirements, but it does describe the inseparable relationship between materiel solutions and warfighter capabilities, using the JCIDS process (Headquarters, Department of the Army, 2014, p. 1). Furthermore, the operating concept calls for a more responsive acquisition system noting, "The Army must adapt faster than enemies and potential adversaries. Army forces will have to develop materiel solutions much faster than in the past due to the ease and speed of technology transfer and adaptation by enemies" (Headquarters, Department of the Army, 2014, p. 34).

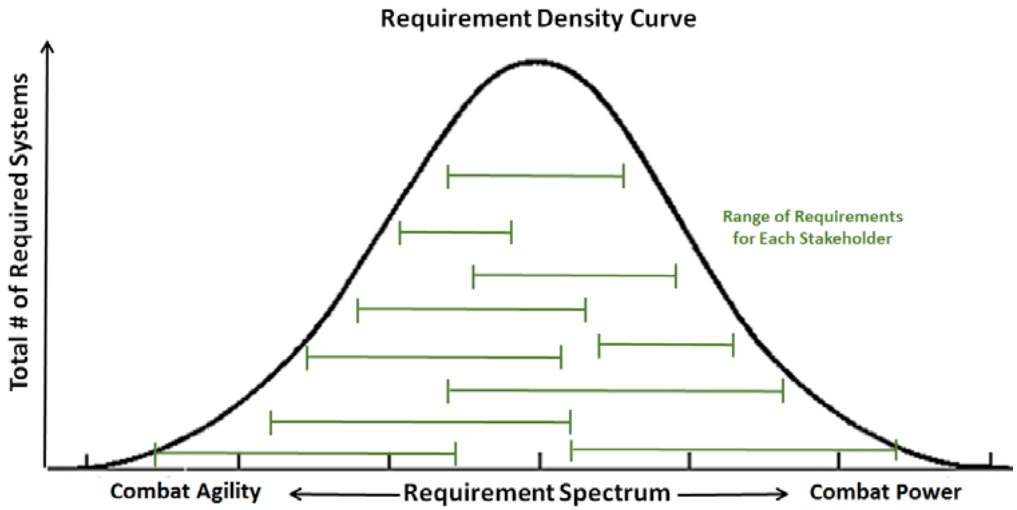
When military leaders incorporate variety proactively, they create opportunities for forces to be adaptive. Sir Michael Howard captured the AOC in observing "No matter how clearly one thinks, it is impossible to anticipate precisely the character of future conflict. The key is not to be so far off the mark that it becomes impossible to adjust once that character is revealed" (Headquarters, Department of the Army, 2014, p. 39). The combination of the AOC and the role of materiel acquisition in the AOC suggest that the Army must develop a broad base of materiel solutions to prepare for future conflicts. Sir Howard acknowledges that this endeavor will not be precise for every threat, or even any threat, but can be close enough that tactical commanders will be able to achieve operational and strategic objectives with the soldiers and the equipment available for the mission. This will require a shift in thinking about how the Army and other military services prepare for warfare, and develop combat systems to aid in this strategic preparation.

C. COSTS AND BENEFITS OF COMMONALITY

In 2015, Jessup and Williams illustrated a scenario in which the light tactical vehicle (LTV) replaces the HMMWV. In the scenario, the authors demonstrate that it is not practical to expect a single wheeled vehicle system to meet all 13 key performance

parameters (KPPs) that are required by 23 stakeholder communities.[31] The authors show (illustrated in Figure 11) an initial goal to achieve all KPPs in a single system, until system developers realize that this goal is unrealistic. The result was the LTV, plus four additional wheeled vehicle systems. This five-system result failed to address a requirement for an ambulance (Jessup & Williams, 2015).

The inescapable tension and impossible goals in combat system acquisition is apparent in the spectrum of desired capabilities that Jessup and Williams describe. On one end of the spectrum, systems have agility attributes such as mobility, transportability, and speed. On the other end of the spectrum, the system achieves combat power capabilities such as lethality and survivability. Any system that is not completely focused on either of these two spectrum extremes represents a compromise between the two. Countless attributes in the MRAP demonstrate its partiality to combat power attributes. These attributes came at the expense of the agility attributes (Jessup & Williams, 2015).



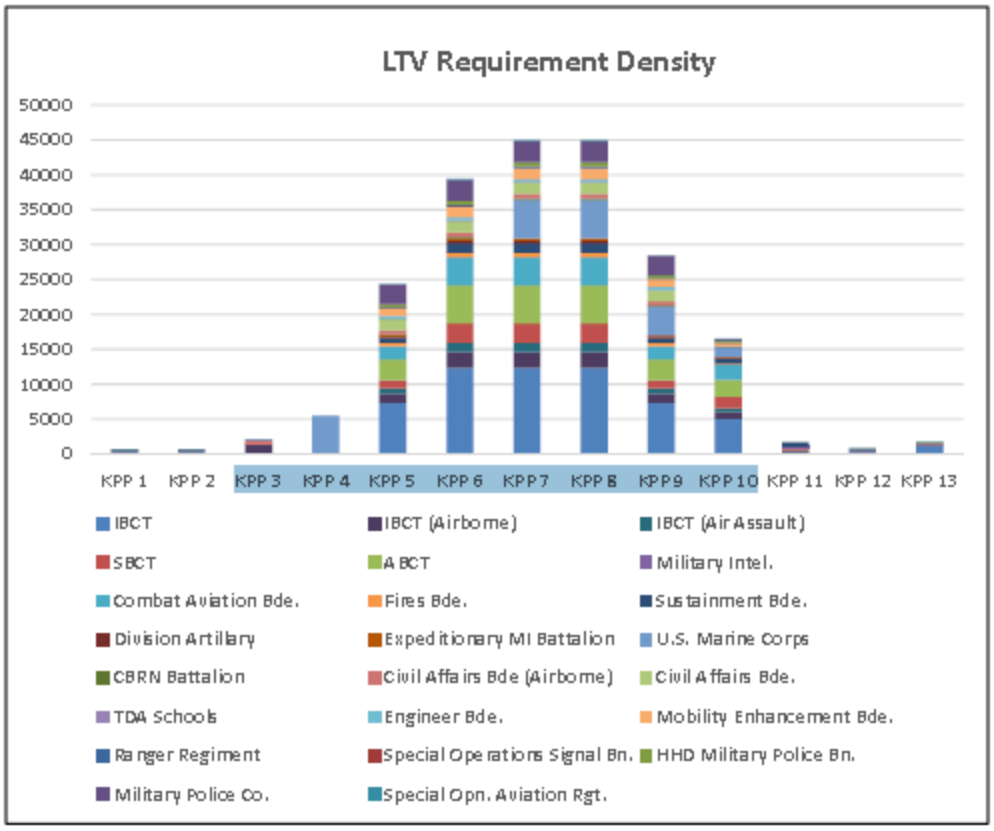
This figure demonstrates the constant tension between combat power and combat agility attributes of a system. The area on the vertical axis between the left and right extremes represents the opportunity for tradeoff.

Figure 11. Requirements Density Curve. Source: Jessup & Williams (2015).

[31] Key performance parameters (KPPs) are essential system attributes. KPPs represent what the system must do to achieve minimally acceptable results. KPPs are different than additional attributes, which are qualities that are desirable, but not essential.

This metaphor is not limited to tradeoffs between agility and combat power, but represents any system attributes that are exclusive of each other. For example, Army aviators constantly trade aircraft weight for other characteristics that are desirable. These tradeoffs can last for a portion of a mission or are integrated into the system as a permanent feature. For example, a helicopter pilot may choose to reduce fuel on board to increase performance, range, or ordinance carried. When priorities are inverted, the pilot can reduce fuel on board, and therefore station time, for increased ordinance. Infantry squads also face similar tradeoffs in small arms ammunition. The decision for infantrymen to carry 5.56mm ammunition represents increased quantity of ammunition, with less lethality per round. These attributes are inverted for 7.62mm ammunition, which is heavier and takes more space, but has increased destructive power than the 5.56mm round.

Although Figure 11 is conceptual, Jessup and Williams (2015) demonstrated actual applicability by mapping LTV KPPs by density (illustrated in Figure 12) with the left side of the horizontal axis representing agility attributes and the right side representing combat power. When commonality is the goal, acquisition decision-makers could reasonably choose to eliminate system KPPs that are specific to niche military communities and their missions. In the scenario represented in Figure 12, a system that represents only KPPs 3–10 is a solution that will achieve the needs of a large portion of the requiring community. Assuming that the LTV is a singular solution, and KPPs 1, 2, 11, 12, and 13 are excluded from the proposed final system attributes. While the final system will certainly satisfy a large number of requiring customers, the solution excludes a highly agile vehicle for use in air assault operations, as well as the ambulance, which is heavy and offers increased protection compared to other vehicles. The cost of commonality is not necessarily a monetary cost, but reflects the stakeholders whose requirements cannot be addressed in a single vehicle. The result is lack of military ability to perform specific missions, such as reconnaissance (KPP 1) or medical evacuation (KPP 13) which are illustrated in Figure 12.



The LTV Requirement Density represents 13 KPPs for a wheeled vehicle, and 23 organizations with requirements. This chart illustrates that by focusing on KPPs 3–10, the program manager can satisfy the majority of the system requirements and users.

Figure 12. LTV Requirement Density. Source: Jessup & Williams (2015).

Why was a single solution for a wheeled vehicle such a focus anyway? One major goal of commonality is to make a system a greater value through economies of scale. The LTV was a desired singular solution, but due to its inability to achieve the goals of the entire community, the materiel solution was expected to require three additional developmental vehicles. Although economies of scale are not likely a goal of the three vehicles that will augment the LTV solution, the fact remains that the final solution is four separate vehicles, and fails to address the requirement for an ambulance. Had the initial concept for a materiel solution allowed for four different vehicles, other communities could benefit from individual specialized characteristics created from solutions in the acquisition trade space. By creating multiple solutions to achieve the

KPPs of the requiring communities through several vehicles, the final array of solutions increases battlefield variety—multiple dilemmas to present to the enemy.

Captain James R. McKenzie also researched joint programs in 1993, and noted the tendency of the JROC to force *service-specific* acquisition programs to become *joint* acquisition programs.[32] He also noted that some acquisition programs that appeared to be successful joint acquisition programs were not joint at all. He used the examples of the F-4 Phantom aircraft, the M1 Abrams tank, or the Sidewinder missile. These programs were service-specific programs. However, once successful, other military services procured the systems from the service that was responsible for the system (McKenzie, 1993). In this acquisition method, the services interact like a free market. One service developed an item based on service necessity, and other services have the option to purchase the system, or develop their own system. If the originally developed system has value, the second service will not choose to develop a similar system. Through evolution of this free-market type of development process, services may increase communication with each other. As each service looks out for its own interests, they also look out for the interests of other services. This behavior is ensured because the individual services want to be more efficient with resources. Sharing combat systems with other services achieves the benefits of economies of scale, but without the additional bureaucratic layers that come with joint programs.

The benefits of commonality include development and manufacturing economies of scale in in large volume purchases. Additionally, logistical non-functional requirements such as reliability, maintainability, transportability increase when common hardware and supporting logistical systems can effectively support several systems with common hardware and expertise. These benefits improve availability, which is an overarching goal of program managers in defense system acquisition.

[32] The National Defense Authorization Act of 1996 codified the JROC as an entity in federal law. McKenzie's research, which was published in 1993, references the JROC several times (NDAA for Fiscal Year 1996, 1996). We hypothesize that the JROC was an informal entity following the Goldwater–Nichols Department of Defense Reorganization Act of 1986, but was codified in 1996 to establish a legal charter, composition, and define functional requirements and responsibilities.

D. COSTS AND BENEFITS OF VARIETY

Commonality has a positive correlation to cost reduction in major systems acquisition. Variety, the opposite of commonality, has an inverse relationship with cost. Variety increases cost, and may not be desirable in system attributes such as fuel type, user interface, or areas where common, non-technical hardware achieves the requirements of the system. In general, the benefits of variety have greatest potential to increase when the number of the type of systems increases. For example, if there were a requirement for a vehicle to transport equipment, passengers, and food, there probably would not be a need for variety, as an ordinary passenger van with removable seats could accomplish all three of these requirements. However, if the requirement were to do these activities several times each week, for several years, an organization may benefit from a variety of vehicles.

Variety also has a cost associated with maintainability, in that systems that are different will require different facilities, repair parts, maintainer training programs, etc. These support requirements are essential to ensuring availability of the system to a warfighter, especially since systems must be prepared to endure battle damage and then have maintenance personnel return the systems to mission capable status. These system support structures are costly when the system is not in combat, and costs will predictably increase with the threats in the operating environment.

When variety is appropriate, however, organizations create greater opportunity to achieve the benefits of specialization. This specialization improves efficiency as organizations become larger. In military-specific examples, variety presents commanders with options, and creates multiple opportunities for dilemmas that are imperatives of the Army Operating Concept (Headquarters, Department of the Army, 2014, p. iii). The appropriate balance is impossible to calculate, and at some point requires the professional judgement of experienced strategic leaders, who understand the demands of military systems, their operators, and maintainers; as well as how to improve affordability and availability without sacrificing system attributes. These decisions become more complicated when considering that leaders must make these important strategic decisions with incomplete information.

E. ORGANIZATIONAL CHALLENGES

The critical organizational challenge that military services must first address is the JROC, an organization that makes the decision to leave a program service-specific or a joint responsibility. In the current acquisition framework, the JROC has unilateral authority to make these decisions, and services are unlikely to challenge the views of these senior service officers. The result is groupthink, where people support bad decisions because of various social fears.[33]

F. THE DEMAND FOR VARIETY IN THE ACQUISITION SYSTEM

The military's current acquisition model is an adequate process for producing many materiel solutions, which include major weapon systems for conventional warfare. The process is methodical and deliberate. It constantly calculates risk, manages program risks, and utilizes contract structures that ensure resource expenditures reflect the priority of the system and risk allocation reflects the maturity of the system and its position in the acquisition lifecycle. However, this system is an inadequate process for procuring materiel solutions that can augment warfighters to address unconventional threats. A new system may not be feasible or even required, but the military must have a procurement process that is able to respond rapidly.

Dr. Mary Maureen Brown (2013) captures the need for increased flexibility in the acquisition process, noting,

> When organizations are confronted with high levels of demand uncertainty, they require the flexibility to make rapid shifts in their service delivery and production cycles—shifts that a hierarchical approach cannot accommodate. … Under asymmetric conditions, the types of solutions that may be required are difficult to predict a priori. (Brown, 2013, p. 123)

Brown notes that the acquisition community must manage the trade space in warfighting requirements and have techniques that can increase flexibility in the acquisition system in order to be responsive. Where uncertainty is low, the current

[33] "Groupthink occurs when a group values harmony and coherance [sic] over accurate analysis and critical evaluation. It causes individual members of the group to unquestioningly follow the word of the leader and it strongly discourages any disagreement with the concensus [sic]" (Psychology Today, n.d.).

hierarchical system is adequate, even appropriate. However, in uncertain environments, the warfighters require (by proxy) an acquisition system that can respond to evolving threats and changing requirements, among other changes to the environment. Warfighters cannot continue to be effective when constrained by an unresponsive acquisition system (Brown, 2013).

G. RECOMMENDATIONS

1. Create a Variety Advocate Function

We recommend assigning functional responsibility to an entity whose job is to consolidate contrarian views to JROC decisions to make service acquisition programs into joint programs. This variety advocate and the associated process would allow those who disagree with JROC decisions to ensure that their concerns for cost, performance, survivability, lethality, or any other concern are communicated to the JROC and documented as part of the program.

Practical application of this system could come in the form of a disinterested person who is familiar with the federal acquisition process. This person could inject his own professional opinions on the matter, and also receive and forward concerns of individuals who are uncomfortable with disagreeing with a rank-heavy organization such as the JROC. The result would be unfiltered communication from stakeholders that might foreshadow program risks before they occur.

Another practical method to implement this solution would be through surveys that can protect confidentiality of its participants. Surveys can have an area where experts can address any concern about the future of the program. The anonymity in the survey ensures that the employee can voice concerns about the system without fear of reprisal if the employee's view does not align with organizational pressures that affect a program. Once input, the collection of concerns can become a consolidated list of concerns about the program. At a minimum, this would give a program manager the opportunity to address system concerns throughout the lifecycle of the program.

2. Increase Focus on Subsystem Commonality

The JROC is not limited in their scope, but focuses on major systems to achieve the benefits of commonality. One major aspect that the JROC omits, for the most part, is the subsystems of the major systems. By focusing on the subsystems, the JROC could create conditions to benefit from commonality, while allowing services to pursue unique solutions that answer service-specific capability requirements.

This recommendation aligns with the 2017 NDAA which mandates the use of MOSA in major defense acquisition programs and changes the perspective of the acquisition system. Instead of focusing on systems that are responsive to set requirements, the DOD will create modular systems with interfaces. The system itself would be designed to maximize modularity, thereby increasing variety through subsystems, whose non-functional requirements such as maintainability are can be individually addressed (2017 NDAA, 2016).

H. CHAPTER SUMMARY

This chapter converged the previous three chapters, exploring unconventional warfare, through the vignette of MRAP procurement for counterinsurgency warfare, and the value of variety in combat systems. If the military maintains its track record, it will remain unable to predict the conduct of future warfare. However, in a more generalized prediction, the military can expect an enemy to use unconventional methods to achieve victory. Furthermore, the likelihood of an enemy to use unconventional warfare methods increases as the U.S. military's conventional warfighting ability improves.

An entity serving as a variety advocate can balance the JROC's propensity for joint systems when service-specific systems are appropriate. Furthermore, increasing focus on joint subsystems creates an opportunity to obtain the benefits of commonality while simultaneously increasing adaptability and maintainability. This approach focuses the acquisition system on many individual and independent programs that can be combined when needed to synergize battlefield effects and increase variety for tactical commanders.

VI. CONCLUSION

The U.S. Army and collective military services must anticipate future irregular warfare scenarios to conduct unified land operations (Headquarters, Department of the Army, 2016a, pp. iv–1) in "chaotic, ambiguous, and complex environments" (Headquarters, Department of the Army, 2016b, p. 1-1). To create the possibility for success in this endeavor, the military must develop variety that is superior compared to an adversary. The military can increase variety by adapting doctrine, organization, training, materiel, leadership, personnel, facilities, policy, or any combination of these domains.

Among potential adversaries, the military must prepare to fight insurgencies, described as adaptive and complex. The military cannot rely on increased conventional ability to engage an unconventional threat. History and doctrine demonstrate that reliance on conventional capabilities to combat unconventional enemies could cause damaging results for a desired strategic end state. To make the problem worse, the very improvement of conventional warfighting ability may create conditions conducive to insurgency formation in the first place. The military needs capabilities to address unconventional threats, and a supporting acquisition system that can produce these capabilities.

In order to fight in any environment and against any enemy, warfighters will require materiel solutions. The current acquisition system is optimized to develop materiel solutions for a conventional force using a deliberate process. This process is inadequate to respond to unconventional and adaptive threats, such as insurgencies. Complete overhaul of the U.S. military's acquisition system is neither realistic nor achievable and will certainly generate its own shortcomings. However, modifying the current acquisition system to recognize the value in variety is a goal that is attainable in the short term, sustainable in the long term, and will adapt quickly to changing battlefield conditions.

A. SUMMARY OF RECOMMENDATIONS

This research makes the following recommendations:

1. Assign variety advocate responsibility for major defense acquisition programs.
2. Increase joint focus on hardware-centric interoperable systems and subsystems using MOSA principles.

By incorporating these recommendations to the acquisition process, the JROC will have an organization to capture contrarian and/or dissenting opinions to joint decisions. These consolidated concerns of stakeholders and subject-matter experts could be used to ensure the actual system will fulfill warfighter needs and give additional early indication if the trade space between cost, schedule, and performance is not balanced appropriately.

Joint focus on subsystems aligns aspects of the federal acquisition process with best practices of private industry. The current systems approach is well suited for developing conventional materiel solutions to address conventional threats, but is not responsive enough to produce timely materiel solutions for threats that can adapt rapidly.

The modular open system approach is a tool and methodology available to program managers, but is encouraged and not mandatory. MOSA applicability will certainly vary among different materiel solutions. Program managers must assess MOSA usefulness over the life of the system and incorporate its principles to maximize the value of the system to warfighters and the greater warfighting challenges.

B. AREAS FOR CONTINUED RESEARCH

To further this research about the applicability of variety in warfighting and system development, we recommend the following research questions:

1. How can non-materiel domains of doctrine, organization, training, leadership, personnel, facilities, and policy be used to maximize variety in the current constraints of the acquisition system?
2. How can the military acquisition system apply MOSA principles to hardware-centric materiel solutions?

3. Will the 2017 NDAA MOSA mandate increase variety, or further delay major defense acquisition programs?

These research questions further this body of research and the research goal of increasing variety on the battlefield. With variety, tactical commanders can adapt rapidly, overwhelm an enemy with multiple dilemmas, and win in a complex world.

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APPENDIX

This appendix contains an interview with former Secretary of Defense Robert Gates (Gates), following his special guest lecture at King Hall at the Naval Postgraduate School.[34]

The interview was conducted at 12:30 p.m. on January 5, 2017, in Hermann Hall at the Naval Postgraduate School by U.S. Army Majors Juan R. Santiago (Juan) and Steven R. Cusack (Steve). Honorable Gates' personal assistant Charles Crimmins (Charles) was also present for the interview.

Transcript:

Steve: OK, so we're recording. I just want to get some admin stuff out of the way. So …

Gates: You need to bring [the recording device] over closer.

Juan: This is Major Juan Santiago with my thesis partner Steve Cusack, and we're meeting with former Secretary of Defense, the Honorable Robert Gates.

Steve: Thank you.

Steve: I just wanted to give you some background on how we stumbled on this. Juan and I go to church together, that's where we met several months ago. But, one of the classes I took last quarter was Strategic Management, taught by Dr. Augier. We read chapter four of your book, *Duty*, as part of the curriculum and one thing that caught my attention was that chapter four was written about the MRAP and how it came to be in Iraq. Juan and I, after church one day, were talking about the MRAP. Both of us have some experience since both of us were in Iraq for several years over the last decade of our lives. Proud to have served but we started talking about the MRAP. I was an aviator, attack pilot, and Juan was on the ground and he has personal experience with several iterations and we acknowledge that it had a lot of capabilities, a lot of survivability especially, and we're thankful for that. But still, as we look back, we are just trying to capture some of the lessons that we can still learn from that purchase, because its, as far as any recent history, it's the only thing of its type in magnitude and

[34] The transcript of this interview is included to add to the publicly available body of knowledge about the MRAP, the urgency of the procurement, and Secretary Gates' involvement with the purchase.

immediate effectiveness. So we just wanted to capture your thoughts. We have a couple of questions, but we're more interested in what you have to say.

Juan: And if I may add, sir, Steve's an aviator, Apache Pilot. I was an Artillery officer. On my last two deployments to Iraq, my battalion in 4th Infantry Division. We were artillerymen, but we were infantrymen. Since then, we both transitioned to the Acquisition Corps. That's why we're here at the Business School. We're looking at the MRAP, as Steve described. Strategically, we understand why it was important. Tactically, obviously we understand that we want to save as many lives as possible. I think that, at the end of the day, one of the questions that we wanted to ask is: were there any leaders, General Patraeus, General Allyn, General Odierno, who may have expressed concerns how it may have been counter, the vehicle itself may have been counter to our counterinsurgency strategy which said we should be more visible to the population. We should engage with them. It seemed like it was a delicate balance, because the MRAP was a great vehicle, but we sometimes inside the vehicle, we lost a little situational awareness tactically.

Gates: Well, my understanding was, the whole purpose of the MRAP was not to take the troops off the battlefield, but to get the troops to the battlefield safely. So, if you're going from a FOB or a COP to a village, I wanted you to get to the village safely. But then you had to get the hell out of the MRAP to do your business in the village. So it was really a bus from point A to point B, not intended to change the nature of the counterinsurgency approach, but simply to provide a safer way of getting there. I mean, it was really very simple for me. Kids were just being blown up in the HMMWV. And no matter [if] we armored the doors, and more and more armor on the sides, you guys put sandbags on the floors and everything else, and it still wasn't working. And the HMMWVs didn't change the nature of the counterinsurgency, they were just dangerous. And so the whole point was, both in Iraq and Afghanistan, was to move the troops to where they needed to be more safely than the HMMWVs. It was just as simple as that; and because that was the intent, I don't recall any of those guys ever expressing any of those concerns.

Steve: One of the things I noticed, just looking at the MRAP is, as we are looking for somewhat of a replacement for the HMMWV at the time, in Iraq, the HMMWV holds four troops plus a turret gunner, so you know 4–5 depending on how it is configured. The MRAP had multiple troop configurations. I'm just curious if anybody, especially at the senior leadership level, especially General Petraeus or General Odierno, if they ever brought up that we're consolidating more troops into a single vehicle. Did anybody ever think that that would become … make it a bigger threat.

Even though it is more difficult to defeat, maybe it is more appealing as a target.

Gates: No, because my understanding was that it was still 7–8 troops. It wasn't like you were putting 20 guys in the back of a truck or something like that. It was still a pretty limited number of people in the back of those things. They never raised concerns.

Steve: Ok

Juan: Ok, sir. Since we're both acquisition corps officers now, let's talk maybe about some of the acquisition reform we touched on in the auditorium. We know, how important, and trust me, sir, I want to thank you personally for the MRAP and I don't want you to think that we think the MRAP was a bad idea. The MRAP, it still took several years before we saw the MRAPs. My first deployment, like you said, I had a soft-skin HMMWV. Anything we could put on the side, and sandbags on the floorboard, and by my third deployment I had the best MRAPs I think our dollar could buy. That process, a JUONS process, we're told is the fastest process, but it's about a two-year cycle for a JUONS. Is that, and I think I know the answer, but is that adequate, or what do you believe is an acceptable timeline?

Gates: No, no. It's not adequate. Everything I did to try and help the troops I did outside the JUONS process. And when Ash Carter was the undersecretary, and with General Jay, who's the J-3, Paxton, Jay Paxton were heading the counter-IED group and going after everything from the all-seeing dirigibles to the sniffers and dogs and everything else. The whole purpose of that, those two guys heading that taskforce, was to bypass all the different procedures. And what made the difference, the problem with the JUONS is not only that it has to go from the field commander to CENTCOM to multiple offices in the Pentagon, and then go to the leadership group co-chaired by the deputy secretary and the Vice Chairman of the Joint Chiefs [of Staff], so like you say, that process alone takes forever. But, then the problem with the JUONS process was that funding of a JUONS was then assigned to a specific service. Now, in the JUONS process, they might consider that the highest priority, but when it goes to the service, that might be number ten. And so, more often than not, it was very difficult to get the service to pony up the funds for something they didn't want, didn't ask for, but were being told to pay for. The virtue of the process that I ran was that I basically said we'll find the money wherever we can find it in the Department of Defense, and I don't give a shit who it comes from, but I'm just going to take it. And so the funding problem was basically stopped, uh, solved on things at a lower level of priority, I mean a lower level of cost than the MRAPs. On the MRAPS, I just had a lot of support on the [Capitol] Hill for the MRAPs, and they

basically voted every dollar I asked for. But it took, only the Secretary could override all that process and all that time consuming through all these different channels. You know, they go out to the field and they find out from Patraues or from a Brigade Commander "What do you need?" "What kinds of stuff are you looking for?" And they come back with that stuff, and you read the story about how I tipped onto the MRAPS. And I kept telling Ashe [Carter] as I was leaving, and he was still undersecretary, I said we have got to figure out a way to have an express lane that replicates what we have been doing, that assigns funding at the departmental level, so that its mandated, and you can go find the money anywhere you can find it, and the secretary or deputy secretary has to be in charge of that. And you know, that problem had not been solved when I retired. But Ashe and I had multiple conversations about how do we institutionalize this, in terms of support, fast support, to the war fighter. How do you get the warfighter stuff in weeks or months, that used to take years?

Juan: And I think, I agree completely as far as the funding piece. It's always … having spent a small amount of time in DC it seems that the money will drive the capabilities that we purchase and a lot of the decisions that we make. I don't want to steal your thunder, Steve, do you have anything?

Steve: I do. I want to go back to the strategic purchase. You had to have a lot of involvement to get this through, but some of the tactical implications, I don't want to put Juan on the spot, but I'm going to anyway. Juan was talking about some of the, in having the MRAP, as part of his fleet, some of the collateral damage that it caused, and I'm curious what the senior leaders such as you or any of the generals on the ground, or even brigade commanders, if they ever thought that it potentially detracted from the mission through the damage that they caused. For example, its maneuverability in an urban environment.

Gates: Yeah I heard about the maneuverability problems. And one of the challenges that they pointed out to me when I visited a unit that had the MRAPs was that was the antennas. Because you'd go through these towns, with all these jerry-rigged electrical wires, and these kids showed me that they'd taken a long piece of PVC pipe and they'd pulled the antenna down as they went through town. So, there were a lot of these ad hoc solutions to that that the troops came up with. And the other thing in terms of jerry-rigging stuff was that the number of battalion commanders who would turn one of these into a mobile command post or another. Then they'd begin turning them into ambulances, I mean, they ended up with a lot of uses. But I never, they never came back to me but they never, and I'll say that I visited a lot of units at COPs and FOBs in Afghanistan and in Iraq, but especially in Afghanistan after we did the MATV and the

troops, the commanders in the field, the brigade commanders, the battalion commanders, and so on, company commanders, were pretty candid with me about a lot of things, but I never had any of them express any concerns about the collateral … they would talk about how difficult they were to maneuver in town, and the narrow roads and stuff like that. But as I say, I mean, the whole purpose was to get them from one place to another, and so my understanding was that most of the commanders, you would get to a village and you would dismount, and you would be out of the MRAPs. So mitigating the fact that you can't make a turn in the middle of one of these villages. But yeah they talked to me about the maneuverability issues just as initially in Afghanistan they talked about the absence of an off-road capability for the Iraq-style MRAPs which is why we did the MATVs. They would mention these things but it was just kind of something they had to deal with and adapt to, rather than it being a tactical obstacle or a big problem.

Juan: Yes sir. And I think, just to elaborate what Steve mentioned was that it, and I agree, prior to my last deployment in '08–'09. We were told that the MRAP was going to be the vehicle that gets us to work; and so that was the mentality. It was like "OK, great, this is going to get us to work safely, we're going to dismount just as we would from a HMMWV." But we ended up in Baghdad, just north of the Green Zone, on Haifa Street, and the roads there were very congested, the alleyways were very narrow, in some cases you couldn't even get a HMMWV, it was all dismounted. Because we received the MRAP, we turned in all of our HMMWVs, just about all of the HMMWVs for the MRAP. We weren't just going to work, but a lot of times we were doing patrols off the MRAP. And in some cases, the MRAP would scrape a local national vehicle, or rip down an antenna wire. So in some cases, we thought that maybe we were … this thing is kind of pissing off the people we were trying to win over. So those were the kind of things that we were wondering if those type of issues ever surfaced to your level.

Gates: No

Juan: Ok. And at the time I was a company commander, and I thought that, it's just the price of doing business, and here's a claims ticket, you can go to the Green Zone and they will buy you a new car or whatever.

Gates: These things, these issues, as I recall, would be mentioned to me from time to time. But sort of in the context of just the price of doing business, rather than a big problem or something like that.

Juan: Ok. Great.

Steve: One thing Juan and I were looking at was that the Army, for example, has the Rapid Capabilities Office … and we came to the conclusion that it's the same procedure. It almost implies that everyone else wants to do it slowly. So they've got this rapid capabilities office, but there's no new authority. At least it's not apparent to me.

Juan: Sir, if I may, I read the article when it first came out, because my last assignment before I came here was in the building [Pentagon], and I saw the article about the Army's Rapid Capabilities Office, I thought that's a great idea, but what are they not going to do to accelerate that acquisition process that's very cumbersome, if you will. What are we not doing in order to get it to them faster? How is that office going to change the way, the DOD policies that we still have to follow? You still have to do live fire testing, you still have to do operational testing; those things take time and money. So for the Army's Rapid Capabilities Office, what are some of the challenges you see that they will have, and who needs to be their champion in order to get whatever capability they are pursuing to the warfighter as soon as they can?

Gates: So I think this office was set up after I left. So this is the first I've heard of it. What I say in *Duty* was that the Pentagon, the Department of Defense, is organized to plan for war and not to wage war, and in any of these offices that are set up to expedite things, they have to be empowered to either accelerate the usual process or skip steps in the process to get something to the warfighter quickly. And as I say, I put this in terms of days, or weeks, or months; not years. And if you can't do one or another of those things, if it can't either dramatically accelerate the ordinary procurement process, or skip steps in that process to shorten it, it is hard for me to see how it can accomplish its objective. And the only way, if I were looking at it today, the only way I'd say it could work would be is if the head of that organization reported directly to the Chief of Staff of the Army who could then put their finger on the people and say make it happen … which is basically replicating at the service level what I was doing at the departmental level.

Juan: On those same lines, sir, how instrumental was the Undersecretary of Defense for Acquisition, Technology, and Logistics in the MRAP procurement? Was he part of the bureaucracy that you were trying to work around, or did they finally fall in line?

Gates: The problem in any decision in the Department of Defense, is that nobody except the secretary can tell anybody else what to do. So the chairman is not in the chain of command, and he has no money. He can't authorize a dime for a procurement program. You've got AT&L [Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics], you've got the comptroller, you may end up having to involve

P&R [Personnel and Readiness], and you've got the services. None of these organizations can tell the other what to do, and so endless amounts of time are spent wrangling getting consensus so that all these people get on board and then forward a recommendation to the secretary. So the way I made it work, was I'd get them all around the table, and the issue would be tabled, and I'd say "You do that." Now the guy who managed it, first of all the program manager was a marine. But AT&L oversaw the testing and a lot of the … in terms of getting the MRAPs, and the contracting and stuff like that, first John Young, and then Ash Carter played a big role in facilitating it, but it was because I empowered them. They couldn't tell any of these other people around the table what to do. So it was only my getting them around the table every two weeks, and everybody knew that I was going to expect a briefing on where are we on the schedule. And I did at every meeting. Hurry up. Kids are dying. Just to try to communicate a sense of urgency to these people. And I would say I want this done tomorrow or today. But only in that way could we keep the thing moving. But AT&L as individuals, I would say, played the critical role, because clearly they had an institutional home. But they were also personally committed and made a big contribution.

Charles: I see we've got a Boy Scout handbook here, so not just the regular books. So you get to have one more [question].

Steve: Can I confirm a couple of assumptions that I've extrapolated from *Duty* and some other stuff. I can't find a single document that explicitly describes the strategy in Iraq. Can we confirm that it was a counterinsurgency when you took over as Secretary of Defense?

Gates: Well the strategy changed with Patraeus. Because the strategy under General Casey essentially had been, and this was all just as I was coming in, strategy with General Casey had been "As we draw down, they stand up." And the view of most senior commanders was our presence was retarding the development of Iraqi security forces. And the more we turned it over to them, the faster they would have to accept responsibility. But they couldn't. And beginning with the bombing of the mosque, the internal security environment completely deteriorated. So by fall, even Casey was saying that we need to stop the drawdowns. And then, at that time, before I got there, you had multiple reviews going on at the NSC, by the Chairman, by Pete Pace, and I think even at the State Department of a different kind of strategy, and whether we should surge. And Patraeus, basically, integrated all of that, the surge with a counterinsurgency strategy that was focused on first of all bringing security to the people. So, my advent to office, his assumption of command, and the surge, all represented a change in strategy.

Steve: Thank you.

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LIST OF REFERENCES

AMC Staff Report. (2012, May 7). *Army materiel command brings "last MRAP" to port.* Retrieved from https://www.army.mil/article/79406/Army_Materiel_Command_brings__last_MRAP__to_port

American Society for Cybernetics. (2016). Foundations: History of cybernetics. Retrieved from http://www.asc-cybernetics.org/foundations/timeline.htm

Angelis, D., Dillard, J., Franck, R., Melese, F., Brown, M. M., & Flowe, R. M. (2009). *Exploring the implications of transaction cost economics on joint systems-of-systems programs* (NPS-GSBPP-09-012). Monterey, CA: Naval Postgraduate School.

Ashby, J. (2008). Biography: W. Ross Ashby (1903–1972). Retrieved from http://www.rossashby.info/biography.html#top

Ashby, W. R. (1956). *An introduction to cybernetics.* London, England: Chapman & Hall.

Augier, M., & Marshall, A. (2017, January). The fog of strategy. Unpublished manuscript.

Augier, M., Dew, N., & Aten, K. (2015, April). Inertia and strategy. Uunpublished manuscript, Graduate School of Business and Public Policy, Naval Postgraduate School, Monterey, CA.

Brafman, O., & Beckstrom, R. A. (2006). *The starfish and the spider: The unstoppable power of leaderless organizations.* New York, NY: Portfolio.

Brown, M. M. (2013, April 1). *Acquisition risks in a world of joint capabilities: A study of interdependency complexity* (Master's thesis). Retrieved from http://hdl.handle.net/10945/34558

Brook, T. V. (2007, June 28). New vehicles protect marines in 300 attacks. *USA Today*. Retrieved from http://usatoday30.usatoday.com/news/world/iraq/2007-04-18-marines-new-vehicles_N.htm

Bushey, D. B. (1997). *A conceptual framework for providing requisite variety in the future operational forces of the United States Army* (Master's thesis). Retrieved from http://calhoun.nps.edu/handle/10945/8140

Candreva, P. J. (2016). Planning, programming, budgeting, execution. In *National Defense Budgeting and Financial Management (DRAFT)* (pp. 13–31). Manuscript submitted for publication.

Chairman of the Joint Chiefs of Staff. (2015, January 23). *Joint capabilities integration and development system (JCIDS)* (CJCSI 3170.011). Washington, DC: Author

Congressional Research Service. (2017, April 26). *American war and military operations casualties: Lists and statistics* (CRS Report no. RL32492). Retrieved from https://fas.org.sgp/crs/natsec/RL32492.pdf

Crumpton, H. A. (2012). *The art of intelligence.* New York, NY: Penguin Press.

Dale, C. (2008). *Operation Iraqi Freedom: Strategies, approaches, results, and issues for Congress* (CRS Report no. RL34387). Washington, DC: Congressional Research Service.

Defense Acquisition University. (2005). Commercial and non-development items. In *Test and evaluation guide* (5th ed.; pp. 23-1–23-6). Fort Belvoir, VA: Defense Acquisition University Press.

Defense Acquisition University. (2017, April 25). *DoD decision support system.* Retrieved from https://acc.dau.mil/CommunityBrowser.aspx?id=643945

Department of Defense (DOD). (2005). *Department of Defense dictionary of military and associated terms.* Washington, DC: Author.

Department of Defense (DOD). (2016). *Department of Defense dictionary of military and associated terms.* Washington, DC: Author.

Department of Defense Inspector General. (2008, December 20). *Marine Corps implementation of the urgent universal needs process for mine resistant ambush protected vehicles* (Report No. D-2009-030). Washington, DC: Author. Retrieved from http://www.dodig.mil/audit/reports/fy09/09-030.pdf

Department of Defense (DOD). (2013). *The planning, programming, budgeting, and execution (PPBE) process* (DOD Directive 7045.14). Washington, DC: Author.

Department of Defense (DOD). (2007). *The defense acquisition system* (DOD Directive 5000.01). Washington, DC: Author.

Department of Defense (DOD). (2017). *Operation of the defense acquisition system* (DOD Instruction 5000.02). Washington, DC: Author.

Feickert, A. (2008). *Mine resistant, ambush protected (MRAP) vehicles: Background and issues for Congress* (CRS Report No. RS22707). Washington, DC: Congressional Research Service.

Feickert, A. (2017). *Joint light tactical vehicle (JLTV): Background and issues for congress.* (CRS Report No. RS22942). Washington, DC: Congressional Research Service.

Gates, R. M. (2008, May 13). *Remarks to the Heritage Foundation (Colorado Springs, CO)* [Speech]. Retrieved from http://archive.defense.gov/Speeches/Speech.aspx?SpeechID=1240

Gates, R. M. (2014). *Duty: Memoirs of a secretary at war.* New York, NY: Alfred A. Knopf.

Gates, R. M. (2017, January 5). Interview by S. R. Cusack, & J. R. Santiago [Digital recording]. MBA thesis research project, Naval Postgraduate School, Acquisition Research Program, Monterey, CA.

Goldfein, D. L. (2015, February 12). *Charter of the Joint Requirements Oversight Council (JROC)* (CJCSI 5123.01G). Retrieved from http://www.jcs.mil/Portals/36/Documents/Library/Instructions/5123_01.pdf?ver=2016-02-05-175042-203

Government Accountability Office (GAO). (2004). *Best practices: Using a knowledge-based approach to improve weapon acquisition* (GAO-04-386SP). Washington, DC: Author.

Government Accountability Office (GAO). (2008). *Rapid acquisition of mine resistant ambush protected vehicles* (GAO-08-884R). Washington, DC: Author.

Hannah, S. T., Jennings, P. L., & Nobel, O. B. (2010). *Tactical military leader requisite complexity: Toward a referent structure.* West Point, NY: United States Military Academy.

Hassan, H. D. (2005). *Iraq: Milestones since the ouster of Saddam Hussein* (CRS Report No. RS22598). Washington, DC: Congressional Research Service.

Headquarters, Department of the Army. (2001). *Operations* (FM 3-0). Washington, DC: Author.

Headquarters, Department of the Army. (2006). *Counterinsurgency* (FM 3-24). Washington, DC: Author.

Headquarters, Department of the Army. (2013). *Concept development, capabilities determination, and capabilities integration*. (TR 71-20). Fort Eustis, VA: Author.

Headquarters, Department of the Army. (2014). *The Army operating concept: Win in a complex world* (TP 525-3-1). Fort Eustis, VA: Author.

Headquarters, Department of the Army. (2016a). *Operations* (ADP 3-0). Washington, DC: Army Publishing Directorate.

Headquarters, Department of the Army. (2016b). *Train to win in a complex world.* Washington, DC: Army Publishing Directorate.

International Committee of the Red Cross. (1952). Commentary of 1952. Retrieved from https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/Comment.xsp?action=openDocument&documentId=1919123E0D121FEFC12563CD0041FC08

International Committee of the Red Cross. (2014, January 1). The Geneva Conventions of 1949 and their additional protocols. Retrieved from https://www.icrc.org/en/document/geneva-conventions-1949-additional-protocols

Jessup, R., & Williams, J. (2015, December). *The cost of commonality: Assessing value in joint programs.* Retrieved from http://calhoun.nps.edu/handle/10945/47969

Kilcullen, D. (2006, March 29). Twenty-eight articles: Fundamentals of company-level counterinsurgency. *Small Wars Journal.* Retrieved from http://smallwarsjournal.com/blog/28-articles-practical-application-101

Lamb, C. J., Schmidt, M. J., & Fitzsimmons, B. G. (2009). MRAPS, irregular warfare, and pentagon reform. *Joint Forces Quarterly*, 76–85.

March, J. G. (1991, February). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71–87.

Marine Corps Center for Lesson Learned. (2008, October 31). Best practices for preventing/mitigating vehicle rollovers. *The Safety Corner*. Retrieved from http://www.transportation.army.mil/adso/pubs/MRAP%20Safety%20Best%20Practices.pdf.

McKenzie, J. R. (1993). *Who is responsible for the joint acquisition mess.* Washington, DC: Industrial College of the Armed Forces.

Murphy, J. (2003, May 1). Text of Bush speech. *CBS News.* Retrieved from http://www.cbsnews.com/news/text-of-bush-speech-01-05-2003/

National Defense Authorization Act for Fiscal Year 1996, §181. (1996, February 10). Retrieved from https://www.congress.gov/bill/104th-congress/senate-bill/1124?q=%7B%22search%22%3A%5B%22national+defense+authorization+act+for+fiscal+year+1996%22%5D%7D&r=1

National Defense Authorization Act for Fiscal Year 2017, §1701. (2016, December 23). Retrieved from https://www.congress.gov/bill/114th-congress/senate-bill/2943

National Security Council. (2005). *National strategy for victory in Iraq.* Washington, DC: Author.

Patraeus, D. H. (2006). Learning counterinsurgency: Observations from soldiering in Iraq. *Military Review,* 45–55.

Pruckner, M. (2002). Cwarel Isaf institute. Retrieved from http://www.kybernetik.ch/en/fs_intromankyb.html

Psychology Today. (n.d.). What is groupthink? Retrieved from http://www.psychologytoday.com/basics/groupthink

Richardson, J. M. (2017, May 17). *The future navy.* Retrieved from http://www.navy.mil/navydata/people/cno/Richardson/Resource/TheFutureNavy.pdf

Rifkin, J. (2015, May 1). 'Mission accomplished' was 12 years ago today. What's been the cost since then? *Huffington Post.* Retrieved from http://www.huffingtonpost.com/2015/05/01/iraq-war-mission-accomplished_n_7191382.html

Rohlfs, C., & Sullivan, R. (2012). The MRAP boondoogle. *Foreign Affairs*, 1–4.

Rumsfeld, D. J. (2001, September 10). Rumsfeld "adversary" speech. Washington, DC: C-SPAN. Retrieved from https://www.c-span.org/video/?c4497613/rumsfeld-dept-def

Schwartz, M. (2010). *Defense acquisitions: How DOD acquires weapon systems and recent efforts to reform the process* (CRS Report No. RL34026). Washington, DC: Congressional Research Service.

Shachtman, N. (2008, August 25). Army wants Hummer, MRAP hybrid. *Wired.* Retrieved from https://www.wired.com/2008/08/mrap-lite/

U.S. Department of Commerce. (2017, May 17). Bureau of Industry and Security. Retrieved from https://www.bis.doc.gov/index.php/other-areas/strategic-industries-and-economic-security-sies/defense-priorities-a-allocations-system-program-dpas

U.S. Army Training and Doctrine Command (TRADOC). (2010, May 10). Capabilities-based assessment (CBA) guide version 3.1. Fort Monroe, VA: Author.

Department of Defense. (2005, November 29). *News briefing with Secretary of Defense Donald Rumsfeld and Gen. Peter Pace*. Retrieved from http://archive.defense.gov/Transcripts/Transcript.aspx?TranscriptID=1492

Wood, S. (2007, February 12). Patraeus takes command of Multinational Force Iraq. *U.S. Department of Defense News.* Retrieved from http://archive.defense.gov/news/newsarticle.aspx?id=3032

Zeytoonian, D., Geldhof, L., Green, M., Hajjar, R., Litwhiler, C., Locke, C., Weathers, C. (2006, May–June). Intelligent design: COIN operations and intelligence collection and analysis. *Military Review*, 188–195.

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