ABSTRACT

WHEEL OF INNOVATION: HOW LEADERS' ATTITUDES
AND BEHAVIORS DRIVE DISRUPTIVE
TECHNOLOGY IN THE U.S. NAVY

by

Eddy Wayne Witzel

Chair: Shirley A. Freed

ABSTRACT OF GRADUATE STUDENT RESEARCH

Dissertation

Andrews University

School of Education

Title: WHEEL OF INNOVATION: HOW LEADERS' ATTITUDES AND
BEHAVIORS DRIVE DISRUPTIVE TECHNOLOGY IN THE U.S. NAVY

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Problem and Purpose

Innovative solutions in national defense are needed to respond to national security

threats in our uncertain environment. Leader attitudes and behaviors have a substantial

impact on innovation. Unfortunately we did not completely understand the effect of

leader attitudes and behaviors on innovation and the team dynamics that lead to

innovation, especially in the military. The purpose of this study was to determine how

leadership attitudes and behaviors contribute to product innovation within the U.S. Navy

and how leadership emerges within this complex adaptive system of innovation.

Method

The research was a qualitative design based on a multiple or comparative case

study. A theoretical/conceptual framework of complexity leadership theory was used as

a meso model to understand adaptive innovative processes at work in the context of bureaucratic forms of organizing.

Three teams based on three product innovations were selected because they demonstrated breakthrough innovation with disruptive technology and successfully fielded their capabilities within cost and schedule thresholds.

Data from three project teams were collected using interviews, focus groups, and program documentation. Eighteen individuals participated in interviews and focus groups. The attitudes and behaviors of nine formal leaders and several emerging leaders were analyzed and evaluated. The results were summarized in six different themes that were apparent across all three projects and multiple leaders.

Results

These six themes were a combination of leader attitudes and behaviors that contributed to the success of the three projects. These attitudes and behaviors were observed at all levels of the organization from the program manager, to the IPT leaders, to the engineers getting the job done. The first theme was urgency driven by a heartfelt need. The second theme was that these leaders would listen and were open to ideas. The third theme was to know the process and challenge the process while managing risk and ensuring it is good enough. The fourth theme was vision, passion, assertive, persistence, and moderating setbacks. The fifth theme was trusted leader with credibility, integrity, and was professional. The last theme was collaboration, teamwork, and recognition. Communication was apparent throughout all the themes and links them together.

Conclusions

The attitudes and behaviors of the leaders in this study contributed to the

innovation by keeping the polarity within these themes in creative tension. The leaders established a strong sense of urgency based on a heartfelt need while also creating an atmosphere and practice of making sure everyone had a voice and their voice counted. The leaders were professional with credibility and integrity. They knew the process, but also challenged the process, managed risk, and encouraged a solution that was good enough. The leaders were passionate about the vision and were assertive and persistent in removing obstacles. But they also encouraged collaboration and teamwork. They moderated setbacks and prevented the team from getting discouraged and took opportunities to recognize the team both informally and formally. These leader attitudes and behaviors contributed toward leaders emerging in the organization.

A wheel of innovation is proposed that demonstrates the themes in a synergistic and balanced approach. While this improved our understanding of how leader attitudes and behaviors drive innovation, there are still significant areas for further study. Further case studies are needed to determine if this wheel of innovation is applicable outside of the U.S. Navy. Quantitative studies based on these findings are needed to expand the understanding and generalizability of the model.

Andrews University

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A Dissertation

Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

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External: Joseph L. Rakocy   Date approved

To the brave men and women who paid
the ultimate price for the freedom
which we too often take for granted

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LIST OF ABBREVIATIONS

AoA   Analysis of Alternatives

APM(T&E)   Assistant Program Manager for Test and Evaluation

APME   Assistant Program Manager for Engineering

APML   Assistant Program Manager for Logistics

ATAR   Atelier technique aéronautique de Rickenbach

BFM   Business Financial Management

BH   Bell Hall

BMW   Bayerische Motoren Werke

CAS   Complex Adaptive System

CEO   Chief Executive Officer

CLT   Complexity Leadership Theory

CNO   Chief of Naval Operations

CSRA   Civil Service Reform Act

DAPML   Deputy Assistant Program Manager for Logistics

DNA   Deoxyribonucleic Acid

DT   Developmental Testing

ECPs   Engineering Change Proposals

EOC   Early Operational Capability

FAAFP   Fellow of the American Academy of Family Practice

FRP	Full Rate Production
GPL	General Public License
ICD	Initial Capability Document
INP	Innovative Naval Prototypes
IOC	Initial Operating Capability
IPT	Integrated Product Team
IPTL	Integrated Product Team Leader
IPTLs	Integrated Product Team Leaders
IRB	Institutional Review Board
LtCol	Lieutenant Colonel
LPC	Least Preferred Coworker
MD	Medical Doctor
MHA	Master of Health Administration
MS	Master of Science
NASA	National Aeronautics and Space Administration
NAWCAD	Naval Air Warfare Center Aircraft Division
N/A	Not Applicable
ORD	Operational Requirements Document
OT	Operational Test
OTRR	Operational Test Readiness Review
PCO	Procurement Contracting Officer
PhD	Doctor of Philosophy
POC	Point of Contact

R&D	Research and Development
RDA	Research, Development, and Acquisition
SAFTI	Small Arms Fire Threat Indication
SIPRI	Stockholm International Peace Research Institute
SYSCOMS	Systems Commands
T&E	Test and Evaluation
TAP	Technology Assessment Project
UAVs	Unmanned Air Vehicles
U.S.	United States
UUNS	Urgent Universal Needs Statement

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CHAPTER 1

INTRODUCTION

Background of the Problem

The United States spends more on national defense than any other country in the world (Stockholm International Peace Research Institute, 2010). Yet there are still threats to our national security that have not been adequately addressed (Gates, 2010; Jackson et al., 2007). These threats are no longer straightforward and homogeneous. The attacks on the World Trade Center and Pentagon of September 11, 2001, changed the military's focus of concern from nation states to small groups of actors like terrorist cells (Coons & Harned, 2009; Gorka, 2010). This new threat cannot be addressed by simply buying more war planes and increasing the size of the Navy (Sapolsky, Friedman, & Green, 2009). The current Navy and Marine forces are well organized for buying and applying ships, submarines, aircraft, weapons, and warfighters toward conventional warfare, but are not necessarily well suited for asymmetrical warfare (E. N. Thompson, 2009). The solution to this organizational and economic dilemma may lie in radical innovation.

Studies in the commercial sector have found radical innovation to be critical to the growth of corporations. Radical innovation can thrust small outsiders into industry leadership and can bring down huge incumbents that fail to innovate (Tellis, Prabhu, & Chandy, 2009; Christensen, 1997; Utterback, 1994).

While many have studied various approaches to managing innovation, there is still no consensus on the best strategy (Dougherty, 2008). Top manager attitudes and behaviors have an impact on innovation and performance within companies (Chartier, 1998; Elenkov & Manev, 2005). However, specific leader attitudes and behaviors are not equally effective across all cultures (Elenkov & Manev, 2005; Westwood & Low, 2003). Additionally, top managers cannot take all the credit for innovation (Stevenson & Jarillo, 1990). An innovation advocate down in the ranks is often critical to the success of new innovations within the military (Wolff, 1970).

Centralization and formalization have been found to have negative mediating effects on transformational leadership in innovation (Jung, Wu, & Chow, 2008). Centralization and formalization are both common characteristics of military organizations (Wilson, 1989). Standardization is another common attribute in the military that runs counter to innovation (Alberts & Nissen, 2009). Leader attitude is critical in government innovation (Wilson, 1989). The context of innovation in the military is important (Tomes, 2004).

The Chief of Naval Operations (CNO) recognized the importance of innovation. He said, "We will seek out and embrace 'game changers' and innovative solutions to current and future challengers" (U.S. Navy, 2009a, p. 5). There are likely many possible innovations that could increase defense responsiveness to threats before things escalate into full military engagement. Creating and embracing "game changer" innovation requires a culture of innovation. The CNO reiterated the importance of innovation, "We must look at this time as one of opportunity where boldness and innovation are the path to the future" (U.S. Navy, 2010, p. 15). But it was not clear what specific actions senior

leaders could take to encourage more innovation.

How does such innovation occur? How does an organization like the Navy foster, embrace, and organize itself for such innovation? How can a new system be produced within the regulations and statutes guiding the current production, acquisition, and implementation processes? How can the organization determine which innovations will be worth the investment and which will not? While this study did not examine all these issues, it attempted to focus on one area—the attitudes and behaviors of leaders within Integrated Product Teams to foster innovation in the Navy.

Integrated Product Teams (IPTs) have become popular with the military to develop and improve weapons systems (Stem, Boito, & Younossi, 2006; Younossi, Stem, Lorell, & Lussier, 2005). An integrated product team includes members from diverse disciplines and competencies. A typical team includes individuals who represent the government specializing in project management, engineering, logistics, business financial analysis, cost analysis, contracting, and test and evaluation. They may be civilian employees or support contractors. Additionally there are typically the similar disciplines working for the prime contractor. Some of the work may be done by government labs or other contractors. This diverse group of individuals must come together successfully as a cohesive team (Clements, 2002; U.S. Department of Defense, 1998). Social networks of people comprise the necessary environment for military technology innovation and the type of network emerges based on the evolution of the project (Hewitt, 2010). Leadership is a critical component of these teams. Each team has many leaders at various levels. The attitudes and behaviors of the leaders can have a significant effect on product innovation within the team (Chartier, 1998; Elenkov & Manev, 2005; Yadav, Jaideep, &

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Chandy, 2007).

Since Chartier (1998) demonstrated that the attitudes and behaviors of leaders in California's high tech industry can lead to innovation, then taking a focused look at leadership attitudes and behaviors in teams that have demonstrated radical product innovation within the Navy should provide valuable insight. This research took a focused investigation of innovation in these teams.

Statement of the Problem

Today's volatile global political environment requires innovative solutions to our national defense (Tomes, 2004). Product innovation can address specific threats to our national security. Leader attitudes and behaviors can have a significant impact on product innovation within a team (Chartier, 1998; Elenkov & Manev, 2005; Wilson, 1989). Unfortunately we do not completely understand the effect of leadership attitudes and behaviors on innovation (Elenkov & Manev, 2005; Yadav et al., 2007). A better understanding of the relationship between innovation and leadership attitudes and behaviors was needed.

While many studies have looked at innovation in non-military organizations, only a few have examined potential innovative practices in the military. None have examined the role and place of leadership attitude and behavior in innovation in the Navy.

Purposes of the Research

The purposes of this research were to characterize how the attitudes and behaviors of leadership emerge in successful and innovative integrated product teams within the United States (U.S.) Navy, and to identify new processes by which attitudes and behaviors contribute to product innovation.

Research Questions

The two questions that guided this research are the following: How do leadership attitudes and behaviors contribute to product innovation?   How does leadership emerge in a complex adaptive system?

Rationale and Significance of the Research

The rationale for this research was to contribute to several fields of study that could help organizations foster innovation. Leadership attitudes and behaviors have an impact on the level of innovation within an organization. An understanding of attitudes and behaviors that promote innovation will give future leaders the ability to empower innovation. Attitudes and behaviors that encourage innovation can be nurtured and encouraged.

Little is known about how to foster innovation within the government. The results of this research can be used to increase innovation across the Navy. This innovation could result in both a significant increase in capability with shorter development cycles and lower costs. The results of this research can be used by existing leaders and organizational development consultants to help foster additional innovation within integrated product teams and across organizations.

Theoretical Framework

The theoretical/conceptual framework for this research is based on Complexity Leadership Theory. Uhl-Bien and Marion (2009) have proposed a meso model of complexity leadership theory in the context of bureaucratic forms of organizing. They emphasize the unique functions of both the formal administrative function and the informal adaptive function called a Complex Adaptive System (CAS). When the two

functions are effectively enabled and entangled, then innovation, learning, and adaptability occur naturally within the organization. The complexity dynamics are non-linearity, bonding, and attractors. The specific enabling conditions where complex leadership emerges include dynamic interaction, interdependence, heterogeneity, and adaptive tension. Uhl-Bien and Marion suggest a different approach to studying this field: "Instead, it requires leadership researchers to explore methodologies that allow us to gather rich, dynamic, contextual and longitudinal data that focus on processes (mechanisms) rather than static, de-contextualized variables" (p. 647). They encourage a qualitative approach including case studies to address the problem.

Definition of Terms

The following terms and definitions are important concepts in this study.

Attitude: Attitude is a frame of mind affecting one's thoughts or behavior.

Behavior: Behavior is the actions or reactions of a person.

Disruptive Technology: Disruptive technology is a capability so significant that it changes the rules of the game.

Innovation: Innovation is the process of introducing a new idea that creates a widespread or long-term change.

Integrated Product Team: Integrated Production Team is the group of people from diverse organizations and companies who are responsible for the lifecycle of a system.

Product Innovation: Product innovation is the process of creating and introducing a new product.

Radical Innovation or Breakthrough Innovation: Radical innovation or

breakthrough innovation is the creation of a disruption technology.

Assumptions

The following assumptions were made: There are multiple leaders within an integrated product team. The attitudes and behaviors of these leaders influence the ability of the team to innovate. There are pockets of innovation within the military acquisition system. These pockets of innovation can be identified and studied.

General Methodology

This research was based on a qualitative approach (Creswell, 2008). The general methodology was multiple case studies (Merriam, 1998). Three cases of successful radical innovation within the U.S. Navy were analyzed. The purposeful sample was based on unique attributes (Merriam, 1998). Criteria for selection of cases included significance of the innovation as a game changer and successful fielding of the capability within the cost and schedule thresholds established for the project.

Data were collected from interviews, focus groups, and program documentation. The data were analyzed in the context of complex adaptive systems in bureaucratic forms of organizing (Uhl-Bien & Marion, 2009). The cases were written in a narrative that conveys both the emerging leadership and evolving attitudes and behaviors.

Delimitations of the Research

This research was based on three teams who have successfully fielded a radical innovation or breakthrough technology within a specific systems command in the U.S. Navy within the last 5 years.

Summary

The U.S. Navy is embracing game changers and innovative solutions to future challenges. These are the radical innovations and disruptive technology that change the rules on a battlefield. The emerging leadership attitudes and behaviors within an integrated product team could have a significant impact on product innovation. An in-depth understanding of the complex adaptive systems that foster innovation was needed. This qualitative research, based on case study methodology, was analyzed based on the theoretical framework of Complexity Leadership Theory and Complex Adaptive Systems. The research contributed to academic fields involved with innovation, and the results will help increase the chances for breakthrough innovation across the Navy.

Outline of the Dissertation

Chapter 1 addressed the background and statement of problem, purposes of the research, research questions, and introduced the theoretical framework. Chapter 2 addresses the literature review pertaining to innovation through individuals, organizational structure, and processes. Additionally it addresses breakthrough innovation along with government and military innovation. This chapter expands the conceptual framework on complexity leadership theory. Chapter 3 addresses the methodology, research design, purposeful sampling, data collection, analysis, validity, reliability, and generalizability. Chapter 4 reviews the findings of the analysis and describes the themes that emerged from the data. Chapter 5 summarizes the results of the research and makes recommendations for future research.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

Many scholars have joined the quest for that elusive secret to breakthrough innovation (Danneels, 2004). Some have focused on leadership effects such as transformational leadership or the attitudes and behaviors of leaders (Osborn, Hunt, & Jauch, 2002). Others focus on the organizational structure that promotes innovation while arguing either the individualist or structuralist perspective (Slappendel, 1996). Several believe that the key to success lies in the correct innovation process (West & Anderson, 1996). Still others have focused on the social interactive and collaborative nature of innovation (Brantle, 2010; Paletz & Schunn, 2010). Only a few have looked at innovation within the military (Horn, 2003). This diversity in approaches, along with the wide variety of contexts, makes an orderly presentation of innovation literature both challenging and exhilarating.

There are three major streams of literature related to breakthrough innovation (Slappendel, 1996). The first focuses on the individual as the innovator (Stevenson & Jarillo, 1990). The second stream relates to the organization and its structure providing the innovation (O'Connor, Leifer, Paulson, & Peters, 2008). The third stream blends both approaches under the general label of complexity theory (Uhl-Bien & Marion, 2009).

Innovation Through Individuals

General Leadership Theory

For many years the leadership field has struggled to comprehend what leadership is, under what conditions or contexts it is effectively exercised, and how to identify leadership processes (Fry & Kriger, 2009). Many leadership theories have been based on behavior, interactions, traits, skills, or styles (Northouse, 2001). Leadership skills have been defined by several theorists to include technical skills, interpersonal skills, and conceptual skills (Katz, 1955; Mann, 1965; Yukl, 2006). Technical skills include the methods, processes, procedures, and techniques and ability to perform tasks related to a specific activity. Interpersonal skills include the ability to understand the feelings, attitudes, and motives of others, communicate effectively, and establish cooperative relationships. Conceptual skills include analytical skills, logical thinking, conceptualization of ambiguous relationships, creativity, problem anticipation, and recognizing opportunities. Other leadership theorists have looked to leadership traits for answers.

Studies have not found a universal set of leadership traits (Stogdill, 1948, 1974). A leader with certain traits may be effective in one situation but ineffective in a different situation. Some of these leadership traits include the ability to be adaptable, alert, ambitious, assertive, cooperative, decisive, dependable, dominant, energetic, persistent, self-confident, tolerant of stress, and willing to assume responsibility (Yukl, 2006). Yadav et al. (2007) studied the U.S. retail banking industry to determine the relationship between the Chief Executive Officer's (CEO) attention and innovative outcomes in the company. They found CEOs who attend to the future, detect new technologies faster,

develop initial products faster, and deploy these products more effectively. They also found that CEOs who attend to the external are faster at detecting new technological opportunities and developing initial products. CEOs who attend to the internal environment are slower at detecting new technologies, but faster at developing them.

Charisma is also important in the leader-follower relationship. Weber (1947) used the term *charisma* to describe a leader who the followers believe has special qualities. This charismatic leadership emerges from a social crisis with a vision the followers believe. Conger and Kanungo (1998) developed an attribution theory of charismatic leadership. In this theory, the follower attributes charisma to the leader based on the leader's behavior, expertise, and aspects of the situation.

Northouse (2001) gives a leadership continuum ranging from transformational, to transactional, to non-leadership. The transformational factors are charisma, inspiration, intellectual stimulation, and individualized consideration. The transactional factors are contingent reward and management-by-exception. The non-leadership factor is laissez-faire.

Other scholars take a slightly different approach to leadership. Kouzes and Posner (2002) identify the five practices of exemplary leadership: model the way; inspire a shared vision; challenge the process; enable others to act; and encourage the heart. Leaders model the way, showing what needs to be done by doing it. They set an example for others to follow. They also help guide people through the chaos of change and remove obstacles that may impede progress. Leaders inspire a shared vision by passionately believing they can make a difference and enlisting others in support of a better tomorrow. They see what the future can be and share that vision with those around

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them. Leaders challenge the process by looking for ways to change the status quo. They are constantly looking for ways to improve the system. They experiment and take risks, and they accept disappointments as learning opportunities. Leaders enable others to act by encouraging cooperation and building high-performance teams. They find ways to empower each person to act. They ensure that people have opportunities to grow and support decisions that others make. They let people choose how to do their work. Leaders encourage the heart by recognizing that improvement is hard work and recognizing the contributions that individuals make. They find ways to celebrate the teams' accomplishments. They make people feel like heroes.

Krause, Gebert, and Kearney (2007) researched the benefits of combining delegative-participative leadership with consultative-advisory leadership. Delegative-participative leadership was positively related to process innovation. Consultative-advisory leadership was also positively related to process innovation. They found the leaders who exhibited both delegative-participative and consultative-advisory leadership were most successful in implementing the innovation. Thus, a successful implementation of process innovation requires a holistic approach to leadership.

Johnson (1996) argues that a leader must manage polarities as sets of opposites that do not function well independently. A leader cannot choose one side and neglect the other. Johnson uses the example of individual versus team as a polarity. If a leader focuses too much on teamwork, then individual accountability is lost. However, if the leader focuses too much on individual accountability, the synergy of teamwork is lost.

Transformational Leadership and Innovation

One style of leadership that has been studied by theorists is transformational

leadership. Burns (1978) influenced transformational leadership theories. A transformational leader appeals to the moral values to energize followers through a shared vision. Several theorists have linked transformational leadership to innovation. Jung et al. (2008) developed and tested a model that links the direct and indirect effects of transformational leadership to organizational innovation. They found that transformational leadership can encourage employees to act and think creatively, make necessary changes, and facilitate innovative products. The climate for innovation, centralization, formalization, and uncertainty had significant mediating effects on firm innovation. Climate for innovation and uncertainty had positive mediating effects while centralization and formalization had negative mediating effects.

Sarros, Cooper, and Santora (2008) studied private-sector organizations in Australia to determine the role of transformational leadership and organizational culture in innovation. They found that vision is a major factor in organizational culture and innovation. They also found that setting high standards and caring for fellow workers through individual support have a powerful impact on the organizational culture and innovation.

Khan, Rehman, and Fatima (2009) studied the moderating effects of organizational size on transformational leadership's impact on innovation. They studied 296 managers from the Pakistan telecommunications sector. They found that size significantly moderated the relationship between transformational leadership and innovation. The facets of transformational leadership that were moderated included attributed charisma, inspirational motivation, intellectual stimulation, and individualized consideration. However, idealized influence was not moderated by organizational size.

One scholar focused on the visioning component of transformational leadership. Wilmot (2003) identified and described the eight primary dynamics of visioning. These dynamics are: "heeding the call; valuing the essence; experiencing the ideal; finding meaning in metaphors; realizing relationships of mutuality; affirming the promise; knowing the abundant present; and, installing hope" (p. xv-xvi). He found that these dynamics are triggered by an idealistic challenging of assumptions, beliefs, and behaviors. These conditions provide an appreciative climate for social innovation to thrive.

<center>Leadership Attitudes and Behaviors</center>

Another way of studying leadership is by exploring attitudes and behaviors. Fiedler (1967) developed a model that measured the relationship between leadership effectiveness and the least preferred coworker (LPC). The model asks the leader to recall of all the people with whom they have ever worked and then describe the individual with whom they have worked least well. A more intense description results in a low LPC score. A less intense description results in a high LPC score. Low or high scores are not good or bad. A high LPC score indicates human relations orientation while a low LPC score indicates a task orientation. Figure 1 shows that low LPC leaders will be more effective in some situations and high LPC leaders will be more effective in other situations. This is based on several studies summarized by Yukl (2006). While LPC theory has serious conceptual weaknesses, it remains a popular tool for measuring leadership. Rice (1978) proposed LPC as a value and an attitude. The attitude reflects the differences of interpersonal relations and the accomplishment of tasks.

One way of viewing leadership is as an act or behavior. Leader behaviors can be

<center>14</center>
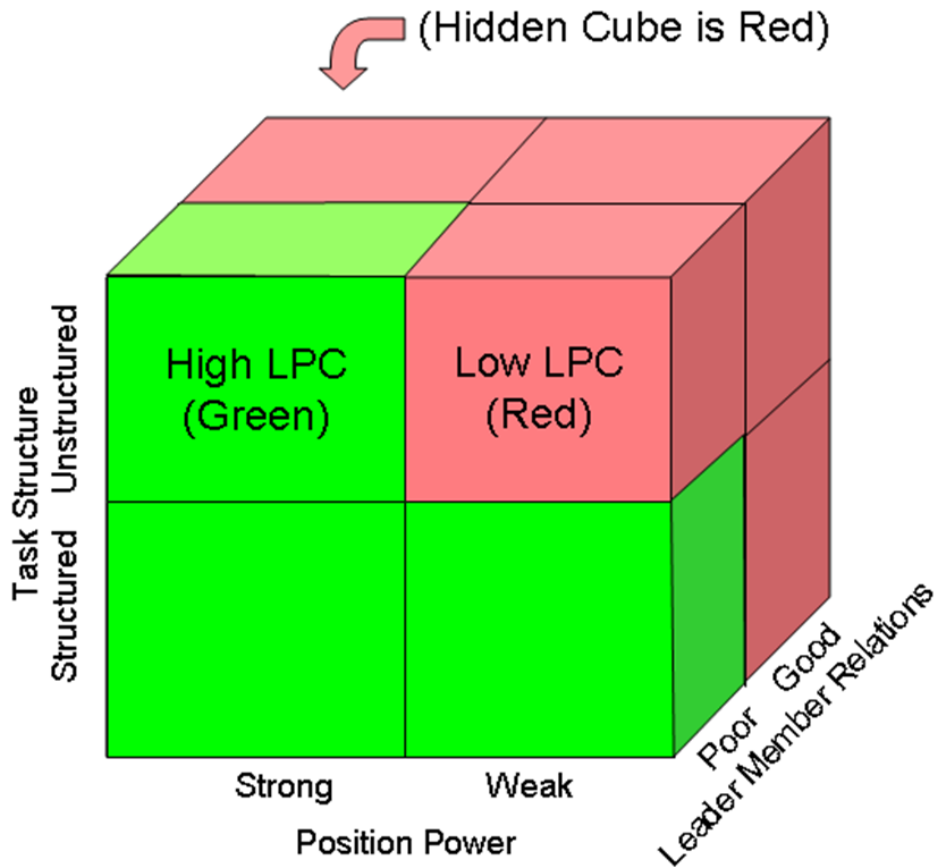
Figure 1. Situational leader effectiveness.

difficult to measure and categorize. Yukl (2006) lists 17 different taxonomies developed

over the last 60 years that address leadership behaviors. The taxonomies have significant

diversity. Behavior categories are abstractions rather than tangible attributes. The

purpose of the research also increases the diversity of the taxonomies. The method used

to develop the taxonomies also increases diversity. There are obvious differences in the

number and range of behaviors as well as the level of abstraction across taxonomies.

Yukl (2006) consolidated four recent taxonomies into 12 leadership behaviors. These

include: supporting, developing, recognizing, consulting, delegating/empowering,

clarifying roles/objectives, short-term planning, monitoring, envisioning change, encouraging innovative thinking, external monitoring, and taking risks/leading by example.

Chartier (1998) analyzed the relationship between top manager attitudes and behaviors, and innovation and performance within their company. Surveys were sent to 320 high-technology companies in California. He eliminated from consideration companies that were not in turbulent environments and companies where the top manager had less than 5 years of tenure. The responses from 27 of these companies were used for the analysis. Chartier found that in turbulent environments, companies with more effective innovation management organizations had better growth and profit performance. When top managers spend more time walking in the environment, they have more effective innovation management organizations. When top managers champion innovation, they have more effective innovation management organizations. He also found a strong relationship between top managers who champion innovation and spend time walking the environment. Managers with a greater need for achievement and openness to change spend more time walking the environment and championing innovation. Finally he found that top managers with a greater risk propensity had better growth and profit performance. Chartier's revised research model is shown in Figure 2.

Wilson (1989) studied bureaucracy in the government. He states that innovation occurs in the government because of leader attitude. He says that "innovations are so heavily dependent on executive interests and beliefs as to make the chance of appearance of a change-oriented personality enormously important in explaining change" (p. 227). He believes the variation in studies on innovation can be attributed to primarily the
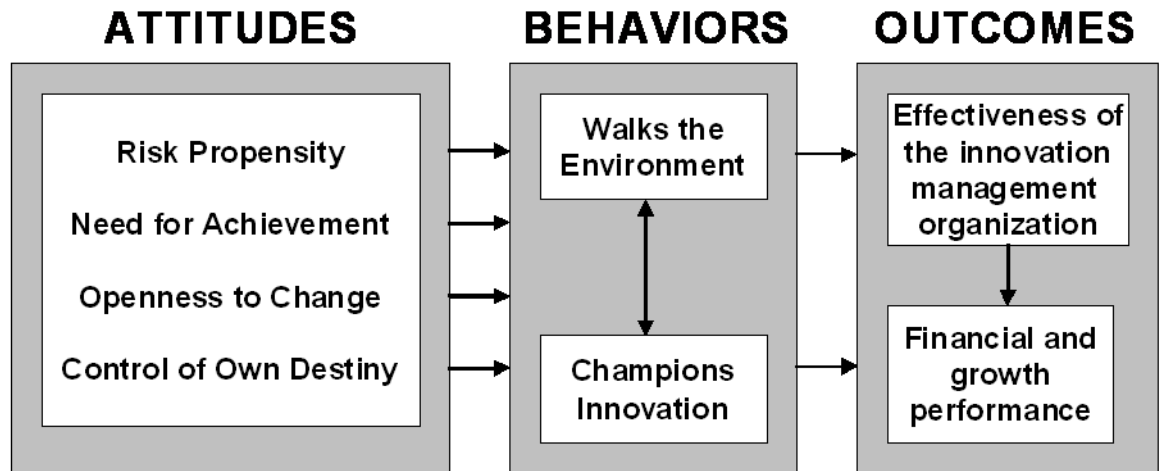
Figure 2. Chartier revised research model. Adapted from *Strategic Leadership: Product and Technology Innovation in High-technology Companies,* by C. T. Chartier, 1998, United States International University, San Diego, California, p. 157.

attitude towards change among the executives.

Leading Change

One important leadership role related to innovation is leading change. There are specific approaches to leading change that have been found effective (Kotter, 1996). These approaches to leading change can guide an organization through the steps necessary to achieve breakthrough innovation. Kotter's eight steps for leading change are: establishing a sense of urgency; creating the guiding coalition; creating a vision and strategy; communicating the vision; empowering broad-based action; generating short-term wins; consolidating gains and producing more change; and anchoring new approaches in the culture. He says we undercommunicate the vision by 10, 100, or 1,000 times.

Mino (2002) studied the role of organizational trust, organizational cynicism, and

organizational commitment in a change initiative. Mino carefully defines each of these

terms:

> Organizational Trust – Individual's belief or a common belief among a group of individuals that another individual or group: (a) makes good-faith efforts to behave in accordance with any commitments both explicit or implicit; (b) is honest in whatever negotiations precede such commitments; and (c) does not take excessive advantage of another even when the opportunity is available.
> Organizational Commitment – Strong belief in and an acceptance of the organization's goal and values. It is a willingness to exert effort on behalf of the organization and a desire to maintain membership in that organization.
> Organizational Cynicism – Negative attitude towards one's employing organization, composed of the belief that the organization lacks integrity; it includes negative affect toward the organization and a tendency to disparaging and critical behaviors toward the organization consistent with this belief and affect. (p. 13)

She studied a population of 9,000 people in a large public organization. She

found considerable correlations between organizational trust and organizational

commitment. She also found negative correlations between organizational trust and

organizational cynicism.

Kucia (2004) researched the role and process of collaboration in leading change.

He used DNA as a metaphor that brings both Eastern and Western culture and thought

into collaboration in a living organization. His metaphor uncovered some of the deep

paradoxes of leadership. A leader must balance the competing forces of continuity and

change, collaboration and competition, while being driven by external market forces and

internal values and purpose. There needs to be the right balance of speed in thought and

action.

Paglis (1999) surveyed leaders, along with their subordinates and supervisors, to

discover what motivates leaders in attempting change. She hypothesized that a tough-

minded manager had a healthy sense of self-efficacy. Her three dimensions of self-

efficacy included: direction setting, gaining followers' commitment, and overcoming

obstacles to change. Her results were somewhat consistent except with overcoming

obstacles. In this case managers higher in the organization made more attempts than their

counterparts lower in the organization.

Di Virgilio (2005) studied effective change leaders in a Fortune 100 insurance

company. She found that successful change leaders had the ability to work across

boundaries, gain support from others, overcome resistance, and build a supportive work

environment.

Hedley (2002) interviewed eight executive leaders to determine how to build the

capacity for an organization to learn and create sustainable change. He wanted to

determine leader perspectives on organizational learning, understand the leader roles in

building organizational learning, and how external forces shape the change initiative. He

found these leaders share a personal passion and complete commitment to the people

involved in the change. Leaders reinvented or realigned processes and structures

multiple times over a long period to profoundly change the organization.

Entrepreneurs

Entrepreneurs are another dimension of innovation through individuals. An

individual who is both the innovator and leader is frequently identified as an

entrepreneur. While entrepreneur often refers to individuals who lead a startup, there are

also entrepreneurs within large firms and the government. Pinchot (1985) proposed the

term "intrapreneur" and defined intrapreneur as people who are responsible for creating

any kind of innovation within an organization. Pinchot and Pellman (1999) provide

specific steps to promote innovation within an organization.

Stevenson and Jarillo (1990) identify three streams of study related to

entrepreneurs: why, how, and what. Psychology and sociology focus on why

entrepreneurs do what they do. They tend to emphasize the importance of the individual.

The management disciple tends to focus on how entrepreneurs do it, while economics

address what the effects of the entrepreneur are. They propose that entrepreneurship

within a firm is critically dependent on the attitude of individuals within the firm below

top management.

Elenkov and Manev (2005) studied 468 businesses in 12 European nations to

determine top management's leadership role in innovation and the sociocultural

moderation of the effect. They found significant and positive effects of top management

influence on product innovation and organizational innovation. They found that specific

leadership behaviors may be effective or ineffective depending on the cultural values in

the hosting society.

Tang, Kacmar, and Busenitz (2012) found that alertness is an important

entrepreneurial behavior. Alertness is defined as the ability to observe an opportunity for

innovation that others overlook. They propose a model with three distinct dimensions of

alertness: scanning and search, association and connection, and evaluation and judgment.

Scanning and search allows entrepreneurs to build a vast array of domain-related

information. Association and connection allows the entrepreneur to make extensions in

logic and consider multiple options and possibilities to make unique links. Evaluation

and judgment allows the individual to determine if an opportunity is positive, and then

assess his or her willingness to bear the uncertainties and engage in entrepreneurial

action.

O'Connor and McDermott (2004) studied the human side of radical innovation.

In some cases entrepreneurial people were driven from the environment by the slow-moving hierarchy and bureaucratic mind-set. But O'Connor and McDermott (2004) also found evidence to the contrary:

> There are aspects of large corporations that some very action-oriented, entrepreneurial, visionary people thrive on. They simply know how to work the system, and that system is based largely on human connections of immensely capable people. In half of our sample cases we identified individuals, key leaders in the radical innovation projects we studied, who not only survived, but also thrived in these environments. (p. 26)

Shukla (2003) argues that the reason existing evolutionary models are inadequate is because they fail to account for the recursive nature of the relationship between organizations and their environments and overemphasize the economic-technical factors of organizational life. Shukla developed a variation-imitation-convergence model to explain the socially constructed nature of organizations. Empirical data for the model are based on longitudinal data from the U.S. hospital industry from 1972-1992. Variation explains the creative acts of institutional entrepreneurs who strategically mobilize support for new ideas that challenge the dominant beliefs of the organization. Imitation explores both the relational and ideational connections among organizations. Convergence explores the evolutionary paths to change. He describes three different evolutionary paths: symbolic, hegemonic, and accommodative convergence.

<center>Creativity</center>

Creativity can be an important part of innovation, yet the impact of leadership on creativity is often overlooked (Amabile, Schatzel, Moneta, & Kramer, 2004). Matthew (2005) found that creativity was a predictor of leading change in organizations. She also found that social-emotional competency was a predictor of leading change, but to a lesser

extent than creativity.

Amabile et al. (2004) studied how leaders influence creativity in organizations. They found several behaviors that positively influence creativity. These included: *consulting*: asking people before making decisions and inviting participation; *monitoring*: coaching, career advice, professional development, and career advancement; *recognizing*: praise and recognition for performance, achievements, and contributions; *supporting*: listening, being friendly, considerate, patient, and helpful.

They also found behaviors that negatively influenced creativity: When (a) leaders provide clarification that created high pressure or shifting assignments, (b) the leader monitors excessively by checking too frequently, (c) the leader provides negative feedback or displays a lack of interest in ideas, and (d) the leader's problem solving either avoided problems or created more.

Bowen (2004) modeled organizational structures to determine the effect of an organizational structure on creativity. He found that reducing structure and increasing autonomy of individual producers will not necessarily increase creativity. The most profitable organizations converged to highly integrated structures.

Katz-Buonincontro (2005) developed a model for promoting creativity in leaders. Creativity was taught by thinking through emotional awareness, tolerating ambiguity, taking risks, and learning from mistakes. Leader creativity was taught through power sharing, group process, and organizational learning.

Risk

Risk, which is related to creativity, is another dimension of innovation. Latham and Braun (2009) explored the role of managerial risk taking on innovation when a firm

is in decline. They explored the personal risk of the manager based on ownership in the company. They sampled 327 publically traded software firms during the technology downturn of 2001-2002. Scholars understand risk taking in decline from two distinct perspectives. The rigidity theory predicts that managers faced with a declining environment will adopt a conservative strategy. This manager might focus on increased efficiency, cost cutting, and increased accountability. The prospect theory suggests that managers will seek additional risk when falling below a specific reference point. Under this theory a manager might engage in higher risk initiatives such as disruptive innovation or a new management team. Latham and Braun found that managers with more equity participation and available slack resources reduced research and development (R&D) spending more than those with less. Their results also indicated that firms with higher R&D spending tended to fail at a higher rate. This means that owner-managers may be properly incentivized to reduce unnecessary risk. They found that managers with low ownership and few slack resources tended to "bet the farm."

O'Connor, Ravichandran, and Robeson (2008) explored risk management by learning. They examined three practices, "a) a real options approach to funding and evaluating projects, b) propensity to experiment in the marketplace, and c) commercialization of early applications quickly, which we call a harvesting strategy" (p. 70). They found that all three practices correlated positively; however, the harvesting strategy had greater impact when the industry clockspeed was low.

Other Leadership Considerations

Other considerations for innovation through individuals include ways to foster innovation, leadership in extreme contexts, and spiritual leadership. France (2008)

studied innovation in a company known to be innovative. She found that for individuals

to be innovative in organizations they need both domain knowledge and skills in

business, finance, and identifying customer requirements. Innovators must have the

interpersonal skills to interact effectively with others. Sponsors and others may need to

refine the innovator's interpersonal skills or lend personal networks. Lending credibility

may be necessary. It is difficult to be both leader and sponsor. Hierarchical

organizations with tight roles inhibit innovation. Organizations foster innovation by

providing clear expectations and resources. Balancing tensions is necessary for

innovation.

Hannah, Uhl-Bien, Avolio, and Cavarretta (2009) propose a framework for

examining leadership in extreme contexts.

> In defining these terms we suggest the presence or threat of one or more extreme
> events is a necessary, but not a sufficient condition to constitute an extreme context.
> We hold that the event(s) must 1) have potential for massive physical, psychological,
> or material consequences that occur in physical or psycho-social proximity to
> organization members, 2) the consequences of which are thought unbearable by those
> organization members, and 3) are such that they may exceed the organization's
> capacity to prevent those extreme events from actually taking place. Therefore, we
> define an extreme event as a discrete episode or occurrence that may result in an
> extensive and intolerable magnitude of physical, psychological, or material
> consequences to—or in close physical or psycho-social proximity to—organization
> members. Going beyond an extreme event, we define an extreme context as an
> environment where one or more extreme events are occurring or are likely to occur
> that may exceed the organization's capacity to prevent and result in an extensive and
> intolerable magnitude of physical, psychological, or material consequences to—or in
> close physical or psycho-social proximity to—organization members. (p. 898)

Thankappan (2005) explored the role of spiritual leadership in implementing

organizational change. She found that spiritual leadership is important to promoting

positive change. Increasing spiritual leadership in organizations will lead to more

fulfilled and productive employees.

Innovation Through Organizational Structure and Processes

One stream of literature proposes that organizations rather than individuals innovate. This means that the appropriate structure will increase the chances for breakthrough innovation. It seems obvious that an organization of poor leaders might want to improve its leadership before trying to improve its organization. This topic brings up the age-old argument in leadership and organizational theory of studying leaders without organizations versus organizations without leaders. Both sides are important to fully understand innovation. Another way to describe this stream of literature is that the researcher is simply using organization as the independent variable and innovation as the dependent variable, while holding the leadership variable constant.

O'Connor, Leifer, et al. (2008) studied 12 companies that tried to develop a capability for breakthrough innovation. They offer advice for establishing innovation as a sustained business function. They show how a management system for innovation is different from a traditional one. Elements of a sustainable breakthrough innovation function include identifiable organization structure, rich internal and external interfaces, powerful networks, innovation skills and talent, innovation processes and tools, governance of the project, portfolio, and system levels, appropriate metrics and rewards, and culture and leadership that values innovation.

Karim (2002) studied how acquisition and internal development reshape firms. She found that internal development groups have more innovation than those that are acquired. However, acquisitions can be reconfigured faster.

Hill and Rothaermel (2003) studied incumbent firms that successfully crossed the abyss in the face of radical technological innovation. They wanted to discover some of

the secrets of those few firms that succeeded. They concluded that

> investments in basic research can help to raise awareness of emergent technologies, thereby counteracting limited search and enabling a firm to accumulate the necessary absorptive capacity. Such investment is likely to be particularly effective if the basic research and applied business units are loosely coupled. . . . The legitimization and institutionalization of autonomous action within the incumbent organization can help counteract internal inertial forces and increase the probability that the incumbent will commit early on to commercializing a radical technology. . . . In addition, an autonomous division can promote product cannibalization and help the firm to discount feedback from its existing value network. . . . Moreover, incumbents may be better able to deal with a radical technology if its appearance does not diminish the value of their downstream assets. . . . We also have argued that history plays a role. Incumbent firms that have successfully navigated radical technological changes in the past are more likely to do so in the future. Finally, the accumulated organizational slack derived from prior dominance may help incumbents to successfully navigate the abyss created by a technological discontinuity. (p. 271)

Organizational Innovation

West and Anderson (1996) studied innovation in top management teams in the

healthcare industry. They found that group process predicts the overall level of team

innovation. They also found that the magnitude, radicalness, and novelty of innovations

increased as the percentage of innovative individuals increased.

> Overall, the findings lead us to speculate that the contributions of input and group process factors may be differentially potent at different stages of the innovation process. Individual innovativeness may be most important at the initial stage in determining the quality of ideas available from the pool of individual innovativeness. At the second stage— the proposal, development, and implementation of ideas—group processes may become important in either hindering or facilitating the expression and development of ideas via articulated and enacted support from team members, as well as through participation (interaction, information sharing, and decision making) and constructive conflict processes (task orientation). Finally, perhaps one can speculate that the longer a management team is in position (at least for the relatively short duration enjoyed by the teams in our study), the more the team is constrained to consider the needs of staff when introducing organizational change. (p. 691)

Roberts (1997) studied the National Aeronautics and Space Administration

(NASA) and Xerox Corporation to identify the characteristics, best practices, and lessons

learned in their capacities to lead and manage change. She found that both emphasized the importance of vision, communications, strategic partnerships, and employee involvement. However, she found that NASA's strategic planning and quality were significantly less mature than Xerox. Several recommendations were made as a result of the study. Large organizations should place a major emphasis on employee empowerment, involvement, and teamwork. Continual learning needs to become the norm. Align rewards and recognition systems with risk taking, innovation, and shared leadership. Strategic alliances and partnerships are essential.

Vaccaro (2007) found that change was facilitated when people became engaged as subjects of the emerging organizational narrative, connected the narrative to a deeply meaningful purpose, and aligned the organization by embedding the new narrative in the organization's culture.

Hillon (2005) compared and contrasted two methods of bringing about strategic change in an organization. The socio-ecological method develops an active adaptive relationship with the external turbulent environment. The socio-economic method diagnoses dysfunctions within the organization and identifies a quantifiable economic cost for each dysfunction. Both methodologies employ an open-systems perspective. He found that although they advocate different paths to strategic change, both are guided by values. Progress at a strategic level must be rooted in a different domain than the action itself.

Epperson (2006) proposes a prescriptive methodical approach to organizational change called a brain trust model. The model combines processes from new product development, creative problem solving, and organizational change management. He

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found the model to be a viable alternative to traditional change management methodologies.

Camison-Zornoza, Lapiedra-Alcami, Segarra-Cipres, and Boronat-Navarro (2004) noted that there has been disagreement between researchers on the impact of organization size on innovation. They performed a meta-analysis of 87 correlations from 54 different studies. They found that size of firm correlated positively with innovation. This was a surprise to me because I love the stories from Silicon Valley of entrepreneurs who started in a garage and grew into Hewlett Packard, Apple, Microsoft, Google, and Facebook. But this meta-analysis demonstrated the opposite is more likely to occur.

Networks and Communities

Fiore (2007) compared and contrasted communities of innovations with networks of innovation. He differentiated communities from networks as two extremes in a continuum. Communities tend to have tension toward homogenization, conservation, confirming communication, and a space of belonging. Networks have tension towards differentiation, evolution, creative communication, new paths of sense, and space of comparing. He found that communities are social containers for incremental innovation while networks are containers that promote radical innovation.

Conflict

De Dreu (2006) studied the relationship between task conflict and innovation. He found a curvilinear relationship between conflict and innovation. Figure 3 demonstrates his finding in two cases. When conflict was low (1) innovation was lower. As conflict increased, innovation increased. However, as conflict increased even more, innovation
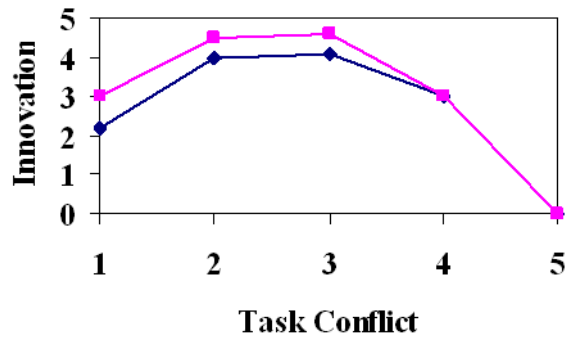
Figure 3. Task conflict versus innovation. Adapted from "When Too Little or Too Much Hurts: Evidence for a Curvilinear Relationship Between Task Conflict and Innovation in Teams," by C. K. W. De Dreu, 2006, *Journal of Management, 32*, pp. 92, 99.

dropped. When conflict was intense (5) innovation dropped to the lowest level.

Isaksen and Ekvall (2010) studied the two faces of tension in creative climates—debate and conflict. They define debate as idea tension and conflict as personal tension. They identified the positive and negative outcomes of debate and conflict. A positive outcome of debate is idea tension with many different points of view that are heard and appreciated. A negative outcome of debate could be premature closure or overload. A positive outcome of conflict is acceptance and appreciation of differences. A negative outcome of conflict is personal tension where people dislike and work against each other. They found that debate is more productive than conflict in innovation and creativity.

Caldwell and O'Reilly (2003) studied the determinants of team-based innovation. They found four norms associated with group innovation: risk taking, tolerance for mistakes, teamwork, and speed of action. They note that when behavior is under social control such as norms and climate there is more autonomy, which also helps innovation. These social norms may actually have a stronger influence over attitudes and behaviors

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than formal control. They found that a tolerance of mistakes and risk taking is necessary to promote innovation in organizations. Teamwork and speed of action work synergistically together to implement new approaches.

De Dreu and West (2001) studied minority dissent and team innovation. They found that the higher levels of minority dissent resulted in more innovation when there was a high degree of participative decision making. However, minority dissent actually hurt innovation when participation in decision making was low. Organizations that want to harness the power of minority dissent must also ensure that participative decision making is encouraged.

Collaboration and Teamwork

Osman (2004) studied the antecedents to effective interorganizational collaboration to innovate. She analyzed surveys from 46 companies in the communications, pharmaceutical, and oil industries in Canada. She found that the length and strength of past relationship along with the knowledge acquired are the three major antecedents. She also found that predicting the partner's behavior and supporting collaboration by allocating resources will result in more successful innovation.

Savage (1999) found that those who implement change speak a different language from those who write about change. Leaders speak of performance and people, while the literature is more concerned with the process. He found leader philosophies included experimentation, seeing possibilities, teamwork, and openness. Two subthemes were performance and people. There is a constant need to balance day-to-day performance with the needs of people who are experiencing the change. This focus on the people was driven by the need to improve the organization. Savage also discovered a concept of

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personal capital. Each person in the organization is willing to put a specific amount of

time into the change effort. For some individuals, this is much, while for others it is just

a little or none at all. The sum of all of this time is the personal capital available to the

change implementer. Personal capital is a limit on the time a leader has to implement

change and acts as an umbrella, shielding the organization from some of the pain during

the change.

West (2002) studied the internal and external environment of an innovation team.

He wanted to learn the difference between teams that were sparkling fountains versus

stagnant ponds. West (2002) concluded that

> for creativity and innovation implementation to emerge from group functioning—for groups to be sparkling fountains of ideas and changes—the context must be demanding but there must be strong group integration processes and a high level of intra-group safety. This requires that members have the integration abilities to work effectively in teams; and that they develop a safe psychosocial climate and appropriate group processes (clarifying objectives, encouraging participation, constructive controversy, reflexivity, and support for innovation). Such conditions are likely to produce high levels of group innovation, but crucially too, the well-being which is a consequence of effective human interaction in challenging and supportive environments. (pp. 379, 380)

Other Organizational Considerations

Other organizational considerations include the creation of partnership

organizations, knowledge creation in open innovation teams, and human resource

practices. King (2004) finds ways to create partnership organizations in a heroic and

hierarchical world. She uses the hero in several myths including the Odyssey, the Holy

Grail, and Adam and Eve to create additional archetypes including the trickster, the sage,

the shaman, and the crone. The trickster uses jokes and pranks to break up and detoxify

the rigid conventions to create new alternatives. Important messages can be sent through

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humor. The trickster is a risk-taker who provides critical leadership in shifting to another system. Someone must go through extreme rituals and initiation rites to become a shaman. Today many individuals who have gone through difficult and traumatic events such as divorce, economic misfortune, and catastrophic injury or illness emerge as shamans. This experience is transformed into deep compassion and wisdom. A sage is an older adult who is actively engaged in living a radiant and vibrant life while transmitting a legacy to future generations through service. In ancient history the term *crone* carried more reverence than today. The crone role included wise women and healers. King wants to bring out the positive aspects of crone. All of these archetypes become transformed elders who help others make the journey. She recognizes that the move to partnership organizations will take time and suggests that we "hospice the old paradigm while midwifing the new" (p. 323).

Du Chatenier, Verstegen, Biemans, Mulder, and Omta (2009) reviewed the literature on knowledge creation within open-innovation teams. They found that human resource development could play an important role in open-innovation teams by providing concepts and tools to improve the external collaboration process. There are many models of collaborative knowledge sharing, but most share four common stages. Externalizing and sharing occurs when professionals share their knowledge, information, and needs with other professionals. Interpreting and analyzing is always contextualized, linking new information to one's own framework. Negotiating and revising may result in shared knowledge and meanings. Combining and creating can result in new ideas for innovation. They found that several factors influence knowledge creation including team-emergent states, team composition, and team level.

Beugelsdijk (2008) analyzed the impact of human resource practices on innovation in 988 Dutch firms. He found that task autonomy, training, and performance-based pay contributed to incremental innovation. He also found that task autonomy and flexible work hours contributed to radical innovations. On the flip side, Bowen (2004) found that increasing autonomy of individual producers will not necessarily increase creativity.

J. R. Thompson (2008) reviewed the effects of the Personnel Demonstration Project provision of the Civil Service Reform Act (CSRA) of 1978 on human resources innovation. Several demonstration projects were initiated. The most notable was the Navy Demonstration Project also known as China Lake Project. This project was extended indefinitely and included the concepts of paybanding, pay for performance, higher starting salaries, and recruitment bonuses. Although the China Lake project was successful, the overall Personnel Demonstration Project did not bring about the kind of human resource innovation desired across the government.

Breakthrough Innovation

Christensen (1997) studied the disk-drive industry to demonstrate the effect of disruptive technology on the industry. The disk-drive industry went through five different innovations from 1975 through 1990. The technology moved from 14 inch to 8 inch to 5.25 inch to 3.5 inch to 2.5 inch. In each transition the industry leader was toppled by a new entrant into the market. Christensen suggests that the industry leaders were held captive by their existing customers. He argues that companies should commercialize disruptive innovations in small organizations so that the project is viewed as critical to the success of the organization. He points out that sound market research

might paralyze investment in a disruptive technology because the new markets don't yet exist. Finally he points out that technology supply may not equal market demand. Technological improvement often exceeds what customers want. This means that an immature technology may rapidly become a competitor to the established order. Figure 4 demonstrates disruptive technology. The second technology becomes a disruptive technolgy when its performance exceeds the first technology. The third technology becomes a disruptive technology when its performance exceeds the second technology. This occurs when the curves cross.

Christensen and Raynor (2003) present a solution to the innovator's dilemma. Companies that thrive during disruptive technology tend to be flexible, respond quickly, and are leaders in the disruptive technology. Disruptive technologies tend to be developed in small companies, or sometimes small groups within large companies. This technology is developed in downscale markets that the industry leaders tend to ignore.

Danneels (2004) carefully reexamines disruptive technological change along with its mechanism and consequences for firms. He gives examples that counter some of Christensen's (1997) fundamental arguments. He considers several questions related to the definition of disruption technology. The predictive nature of technological disruption is explored. He also explains some of the success of incumbents and the merits of being customer oriented during a disruptive technological change.

Strocchia (2003) found that innovation takes place where there is strong socialization among individuals, technology at the center of organizational activity, and customers pulling the innovative process. Strocchia suggests that firms that want to innovate should foster interpersonal interactions, increase freedom to be more
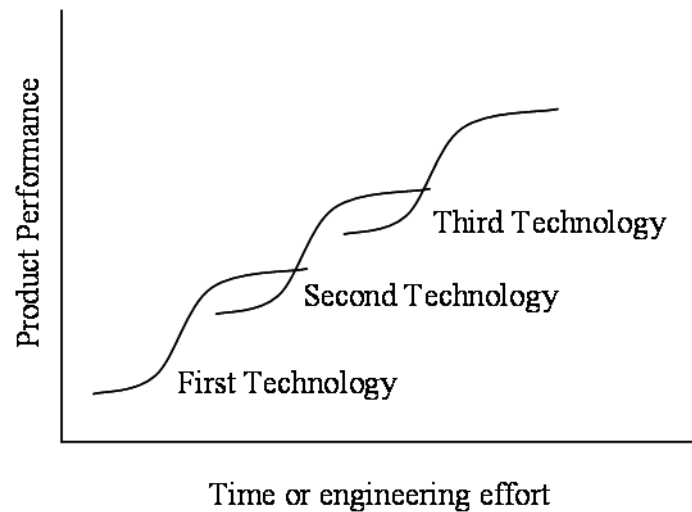
Figure 4. Notional disruptive innovation curves.

autonomous, and allocate time and resources for formal education.

Shinn (2005) identifies new sources of radical innovation for advanced research technologies in instrumentation. These instruments and tools allow scientists and engineers to explore questions not previously possible. He says that these technologies transverse across a wide scope of academic, technological, military, and economic domains that are far away from the nexus of origin. He acknowledges the post-modern state of excessive cognitive and organizational fragmentation and identifies the modes by which knowledge and communication transits between diverse groups. He argues that research technology integration and differentiation are complementary sides of the same coin.

McDermott and Connor (2002) explored the process of radical new-product development from a strategic perspective. They conducted a multidisciplinary longitudinal study of 12 radical innovation projects from 10 large firms in North

America. Three strategic themes emerged from the study: market scope, competency management, and people issues. Figure 5 demonstrates how risks are managed or reduced. The subtopics that emerged from the study included: risk management, team composition, product cannibalization, and searching for a divisional home.

Plowman, Baker, et al. (2007) studied radical change that occurred accidently. Their research centers around a mission church that started a pancake breakfast on Sunday morning to feed the homeless. This single change eventually transformed the church dramatically. Table 1 shows the characteristics of change based on the scope and pace of the change. Quadrant 3 embodies the type of environment where something small can lead to a radical change.

Andersen (2008) takes a bottom-up perspective on innovations. He borrows from the concept of bricolage to explain how innovation occurs by using what is available in an organization. He focuses on innovation at the grassroots level. What really matters is how individuals respond to day-to-day contingencies with the resources available. He concentrates on the problem-solving behavior of actors in an organizational and institutional context. He also discusses the historical heritage of crafting innovative solutions with what is available. He argues that the innovative processes of bricolage based on a bottom-up approach are pivotal for releasing creativity.

Government and Military Innovation

Innovation in the government and military is both similar and different from innovation in the commercial sector. One of the difficulties of innovation in the government is the measure of value (Rosen, 1991; Wilson, 1989). An innovation in the commercial sector lives and dies by the economics of the marketplace. However, a bad

Risk

High

Market
Uncertainty

Radical

Low

Incremental

Low   High

Technological
Uncertainty
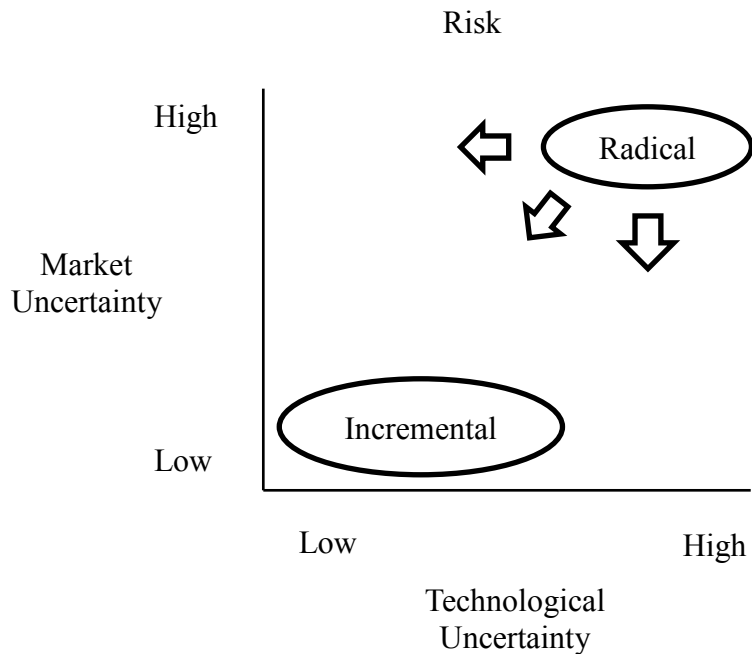
Figure 5. Uncertainty reduction in radical innovation. Adapted from "Managing Radical Innovation: An Overview of Emergent Strategy Issues," by C. M. McDermott and G. C. O'Connor, 2002, *Journal of Product Innovation Management, 19,* p. 430.

innovation in the public sector can linger on for decades.

Smith (2002) studied innovation in the electronics industry of the former Soviet Union. The industry is in transition away from military applications to commercial products. Her model contains four dimensions of a national innovation system: formal institutions, science and technology policy, informal institutions, and firm operations. She found that the preconditions for successful innovation did not exist in the industry.

Horn (2003) studied military innovation by comparing helicopter development in the United States Army and Marine Corps between 1945 and 1965. He believes that internal and external political factors are critical to explain military innovation. His study provides a historical example of the complex inter-relationship between strategic threats,

Table 1

Types of Change

Pace	Scope	
	Convergent	Radical
Continuous	**Quadrant 1** Minor system instability Small adaptations Emergent and local Positive feedback Loose coupling	**Quadrant 4** Major system instability Pattern of adaptations Emergent and system wide Positive and negative feedback Tight coupling
Episodic	**Quadrant 2** Minor inertia Minor replacement Intended and local Negative feedback Loose coupling	**Quadrant 3** Major inertia Dramatic replacement Intended and system wide Negative feedback Tight coupling

Note. Adapted from "Radical Change Accidentally: The Emergence and Amplification of Small Change, " by D. A. Plowman, L. T. Baker, T. E. Beck, M. Kulkarni, S. T. Solansky, and D. V. Travis, 2007, *Academy of Management Journal, 50*(2), p. 518.

bureaucratic politics, technology, operational adoption, and developing doctrines. He found that air mobility and vertical envelopment were not good examples of military innovation in the Army because it did not change how the Army waged war. The Army simply took cavalry doctrine and substituted helicopters for horses. The rest of the Army simply added helicopters as additional vehicles. However, the Marines provide a good example of military innovation. While they did not achieve the desired all-helicopter assault, they did alter the doctrine, organization, and education system to best exploit the technology.

Jensen (2010) studied military innovation in the U.S. Army based on the changes in doctrine between 1975 and 1995. He argues that military innovation reflects the interaction of anarchy and bureaucracy.

Hewitt (2010) studied early-stage military technology innovation in unmanned aerial vehicles. He found that non-technological factors were more important in innovation network emergence than technical factors. He found three different innovation networks based on the stage of innovation. During the concept phase there was controlled social capital. The development phase had uncontrolled social capital. The adoption phase had strong control of social capital. He found several factors that influenced network function. Supporting conditions were necessary, networks emerged to satisfy non-technical needs, and individual catalysts advanced emergence. Resources were exchanged in both informal and formal channels.

Evangelista (1988) suggested a five-stage process for military innovation in the United States. The first stage is technocratic initiative where a scientist's discovery is advocated for a military application. The second stage builds consensus. The third stage is promotion to policy-makers at all levels. The next stage, "open windows," is when a perceived threat becomes an open window of opportunity to produce the new weapon system. The final stage is high-level congressional support to fund development and production.

Gibbert and Scranton (2009) studied the role of constraints in jet propulsion innovation. They reviewed four historic cases to determine whether the constraint was the source of the innovation or if the innovation occurred despite the constraint. The two types of constraints were resources and rules. Table 2 summarizes their findings. Each of the four cases represented a different condition. They found that sometimes less is more and other times less is less. In some cases resource limitations actually facilitates innovation by forcing creative solutions. But other times it hurts innovation. They

recommend that further study is needed to more fully understand the impact of constraints on innovation.

Wolff (1970) studied the structure of military innovation. He found that an innovation advocate was critical to success. The characteristics of an innovation advocate include technical expertise, many contacts, unusual career path, field grade rank, holding a position where the need for change is felt, and low status and small stake in the existing structure.

Posen (1984) reviews the sources of military doctrine between the world wars. While he focuses on doctrines, most changes in doctrines are based on revolutionary technological innovations. He found that most military innovations were the direct result of civilian interventions. While civilian intervention was the driving force, military mavericks were critical to implementation. These military mavericks are officers who advocate an innovation in opposition to their superiors.

Tomes (2004) studied military innovation during the Cold War era of 1973 to

Table 2

Role of Constraints in Jet Propulsion Innovation

Type of Constraint	Despite constraint	Because of Constraint
	Source of Innovation	
Resources	General Electric and jet propulsion uncertainties	Pratt & Whitney's turbofan development
Rules	France and the ATAR project	BMW's airflow cooling system

Note. Adapted from "Constraints as Sources of Radical Innovation? Insights from Jet Propulsion Development," by M. Gibbert and P. Scranton, 2009, *Management & Organizational History*, *4*, p. 396.

1986 in broad and general terms. He developed a framework for the conceptualization of

innovation. Figure 6 demonstrates his framework. Figure 7 shows the setting where

innovation occurs. He explains:

> The framework suggests one way to consider the interaction effects of the full complement of influences on military innovations, their diffusion and adoption, and their effect on military effectiveness. This includes the primary elements of innovation systems, processes, and actors that exist in specific moments within specific organizational settings. (p. 374)

He (Tomes, 2004) believes that "military innovation is a social process in which

technological, operational, and organizational elements conjoin in a specific context" (p.

405). He goes on to say:

> Current defense transformation strategy appears to be pursuing a mix of technology innovation and diffusion processes as well as fostering management capabilities to support, lead, and execute transformation plans. Within defense agencies and the armed forces, much of this involves business process innovation, particularly those involving knowledge management and information technology. This is a profoundly social area of innovation that, although technology intensive, is fundamentally about organizational cultures and workforce communication. (p. 405)

Rosenwasser (2004) studied weapon systems innovation in the context of

governance structure using unmanned aerial vehicles (UAVs) as a case study. While

many blame the slow adoption of UAVs on immature technology, interservice rivalry,

and pilot reluctance, he found these explanations inadequate. He explored four

dimensions of relationships integral to weapons acquisition: intra-service, interservice,

civil-military, and congressional-executive. He found that there may be multiple theories

of innovation associated with various services. Centralized entities can elevate attention

to innovation, but cannot replace the function each service plays in integrating the

innovation into the force structure. OSD civilians play an important role in identifying

innovations.

Contextual Factors

1. Security Environment
   - Threats/Necessity
   - Requirements
   - Operations
   - Uncertainty
   - Security dilemma effect

2. Perceived Innovation Attributes
   - Degree and type of innovation required
   - Internal and external expectations
   - Views of technology
   - External support to organization
   - Approach to risk

3. Enablers
   - Prioritization
   - Strategy, vision, and leadership
   - Flexibility in planning system
   - Talent mix and professionalism
   - Vision-funding alignment

Organizational Factors

- Existing plans and expectations
- Process for discovery/experimentation
- Decisions about mitigating risk
- Degree of flexibility tolerated
- Cultural biases (including definitions of strategic effectiveness)
- Approach to technology (push vs. pull)
- Complexity and duration of innovation diffusion/insertion process

Innovation Millieu

A Mix of Change Initiatives

Revolutionary "Big Bets"
Discontinuous Change
Incremental Modernization

Figure 6. Framework for conceptualizing innovation. Adapted from *Military Innovation and the American Revolution in Military Affairs,* by R. R. Tomes, 2004, University of Maryland, College Park, p. 373.

The figure shows a square diagram with axes. Left side labeled top to bottom: "Discontinuous" (top), "Incremental" (bottom), with "Type of overall organization change" along the axis. Right side top to bottom: "Divergent" (top), "Convergent" (bottom), with "Orientation with existing core values, tasks, mission" along the axis. Bottom axis labeled "Sustaining" (left) and "Disruptive" (right), with "Overall implication for technology / policy modernization path". The shaded upper triangle is labeled "Zone of Major Innovations". A diagonal line labeled "Level of difficulty / Risk of failure / Failure rate" and a dashed arrow labeled "Organizational adoption / diffusion strategy, process, and aptitude."

Figure 7. An operational view of the innovation milieu. Adapted from *Military Innovation and the American Revolution in Military Affairs*, by R. R. Tomes, 2004, University of Maryland, College Park, p. 403.

Congress can highlight innovations that align with political sensitivities. He also found that a blend of smaller and larger contractors improves innovation.

Builder (1989) analyzes the culture of the three services and its impact on strategy. He describes the Air Force bond as a love for flying. The Navy jealously guards its independence and is happiest when left alone. The Army is a modest servant, yet has grand memories of the closing months of World War II. Builder does not explore the culture of the Marine Corps which most would characterize as different from the other services. Later, Builder (1994) delves into the Air Force subculture in much more detail. He explains the great divide between those who fly aircraft and those who don't.

Scranton (2006) studied jet engine building in America during the Cold War. He found that when there is an insufficient knowledge base and extreme urgency then rational approaches to management and planning can be more confusing than helpful.

Viewed from a distance, the development of jet propulsion in the U.S. may appear to have been a chronicle of progress through skillful management of technology and organization. Examined closely, it stands rather as a shining example of non-linear, irrational, uncertain, multi-lateral, and profoundly passionate technological and business practice, yielding success not through planning but through dogged determination, a certain indifference to failure (which secrecy aided), and massive expenditures of public funds. (Scranton, 2006, p. 149)

Moscarelli (2001) studied the Arsenal Ship as a case of innovative departure in the United States military. He believes that the Arsenal Ship was the only case of innovative departure in the U.S. military during the 1990s. The Arsenal Ship program was cancelled in October of 1997. Moscarelli explains that

the story of the Arsenal Ship is one of visionary leadership, innovative programming and engineering, entrenched bureaucracy, and national level politics. These forces interacted in a context where threats to U.S. national interest had receded, but rapidly advancing basic and applied technologies portended a possible Revolution in Military Affairs. The Arsenal Ship program's conceptualization, initiation, implementation, and cancellation offer critical lessons for anyone interested in the phenomenon of revolutionary innovation and revolutions in military affairs in the post-Cold War era. (p. 145)

Moscarelli (2001) tested five hypotheses that other authors have offered as the reason for the success and failure of the Arsenal Ship. He found evidence that leaders of core missions and organizations threatened by the Arsenal Ship initiated or supported termination of the program. He found a lack of support for the program from civilian leadership in the legislative or executive branch. He found that interservice rivalry had little impact on the decision to terminate the program. He found that visionary leaders provided support for the program. He found no evidence to support the hypothesis that leaders who supported Arsenal Ship rose to flag rank through a promotion pathway.

Moscarelli (2001) concludes by emphasizing the importance of visionary leaders: "The importance of visionaries [*sic*] leaders was clearly demonstrated in the Arsenal Ship

case. Since visionary leadership is an important factor in revolutionary innovation, a key question that deserves further research is whether visionary leadership can be promoted in the U.S. military" (p. 219).

Moscarelli (2001) recommends that the curricula of the professional military education system include a more intense study of innovation. He cites an example where a 10-month program of study devotes only 2½ hours to the study of innovative leadership. He also states that a more innovative culture in the U.S. military would require more intellectualism in military officers.

Cote (1996) studied the Polaris and Trident II weapon systems. He found that interservice competition with the Polaris caused the Air Force to innovate by increasing the survivability of those land-based forces. However, interservice cooperation with the Trident II had no impact on innovation in the Air Force. He argues that civilian defense leaders can push doctrinal innovation by encouraging interservice competition.

El-Zoghbi (2007) studied four advocates of the United States Navy's rigid airship program as a case study of failed innovation. She found that existing innovation theories are insufficient to explain the failure of this technology, but "competing technologies, concepts, and a misunderstanding of the limited innovation timeline hampered the advocates' efforts" (p. vi).

The warfighting systems in the U.S. Navy are developed and acquired through Systems Commands (SYSCOMS). These SYSCOMS are organized under The Office of the Assistant Secretary of the Navy for Research, Development and Acquisition (RDA). Figure 8 gives the structure of the SYSCOMS within the U.S. Navy.

The Office of Naval Research's strategic plan emphasizes innovation within the
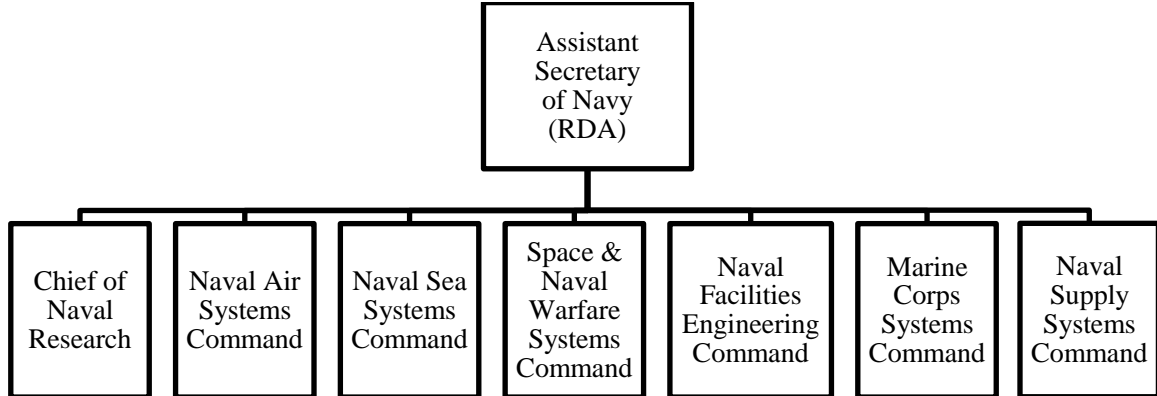
Figure 8. U.S. Navy Systems Commands. Adapted from *SYSCOM Organization Chart,* by U.S. Navy, 2008, https://acquisition.navy.mil/content/view/full/4540.

Navy. Figure 9 depicts the various types of science and technology. The Office of Naval Research (U.S. Navy, 2009b) discusses disruptive innovation:

> Leap Ahead Innovations include Innovative Naval Prototypes (INPs) and Swampworks, and are technology investments that are potentially "game changing" or "disruptive" in nature. INPs achieve a level of technology suitable for transition in four to eight years. Swampworks efforts are smaller in scope than INPs and are intended to produce results in one to three years. This category is where we typically accept higher risk in an effort to produce higher payoff for the warfighters. (p. 3)

Complexity Leadership Theory

The third major stream of literature related to innovation embraces both the individual as a leader and the organization for innovation in a complex interactive innovation system. It builds on leadership and organizational theory, and focuses on innovation in context.

Slappendel (1996) mapped the literature on organizational innovation. She found three distinct perspectives: individualist, structuralist, and interactive process. Table 3 provides her overview of the three perspectives.

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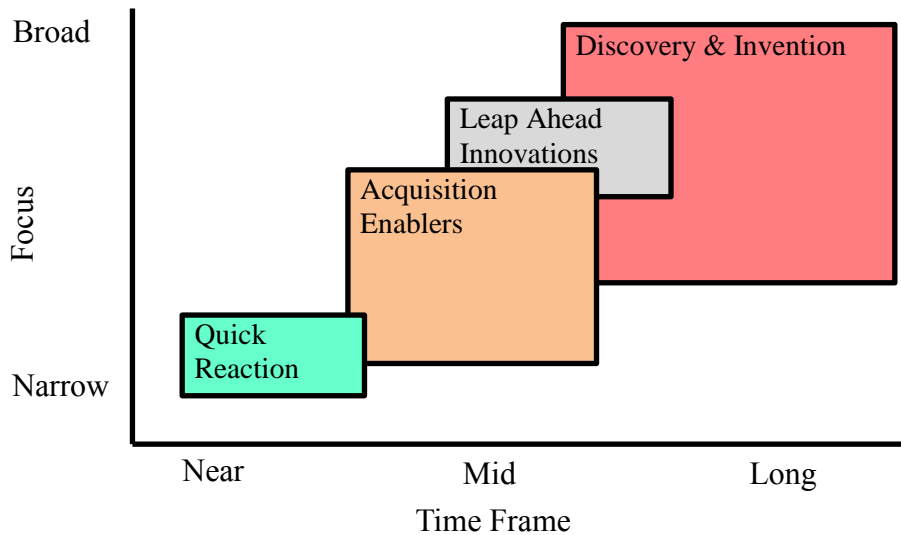
Figure 9. Science and technology focus. Adapted from *Naval S&T Strategic Plan: Defining the Strategic Direction for Tomorrow*, by U.S. Navy, 2009, p. 2.

Dougherty (2008) bridges the conflict in innovation literature between social constraint and social action. She reviews the persistent conflict between the two views in designing an organization for innovation. She uses the concepts of fluidity, energy, and integrity to show similarities in the two approaches. Table 4 summarizes the differences in philosophy between the two camps.

Bertels and Sternin (2003) discuss the challenge of replicating results. Positive deviance replicates the process which created the solution rather than simply copying the solution. They have six tactics for replication which include: size of the opportunity, scope for replication, goals and incentives, knowledge management system, communities of practice, and guidelines for knowledge preservation.

Taleb (2007) uses the metaphor of the Black Swan to demonstrate that there is a

lot more randomness than we like to think. We have trouble dealing with this

randomness because of the way we think. He argues that the Black Swan embodies three

characteristics: it is an outlier, it has extreme impact, and humans had doubtful

explanations after it was discovered. He states that most product innovation comes from

people looking for something different. His examples include penicillin, the laser, and

Viagra. Viagra was originally designed as a blood pressure medicine. He points out that

"while many worry about unintended consequences, technology adventurers thrive on

them" (p. 170).

Plowman, Solansky, et al. (2007) studied the role of leadership in emergent self-

organization. They found that leaders destabilize the organization, rather than stabilize it.

Leaders encourage innovation rather than innovate themselves. Leaders interpret

emerging events rather than direct them. And leaders manage words rather than people.

Interactive and Iterative Process

Brantle (2010) studied innovation as a complex network. He explored the

relationship between the competitive network of innovation and organizational size and

growth in innovation. He examined patent citations, invention collaboration, and patent

agglomeration in the context of a complex network. He confirmed that successful

innovation is interactive and iterative.

Paletz and Schunn (2010) proposed a framework based on cognitive science and

social psychology of team multidisciplinary innovation. They explore convergent and

divergent processes along with the relationship between each other. Science and

engineering innovation requires both. They conclude by stating: "If we seek to harness

the power of multidisciplinary science and engineering teams, it behooves us to unpack

Table 3

Comparison of Individualist, Structuralist, and Interactive Process

	Individualist	Structuralist	Interactive process
Basic assumptions	Individuals cause innovation	Innovation determined by structural characteristics	Innovation produced by the interaction of structural influences and the actions of individuals
Conceptualization of an innovation	Static and objectively defined objects or practices	Static and objectively defined objects or practices	Innovations are subject to reinvention and reconfiguration. Innovations are perceived.
Conceptualization of an innovation process	Simple linear, with focus on the adoption stage	Simple linear, with focus on the adoption stage	Complex process
Core concepts	Champion Leaders Entrepreneur	Environment Size Complexity Differentiation Formalization Centralization Strategic type	Shocks Proliferation Innovative Capability Context
Research methodology	Cross-sectional survey	Cross-sectional survey	Case studies Case histories

Note. Adapted from "Perspectives on Innovation in Organizations." by C. Slappendel, 1996, *Organization Studies, 17*, p. 109.

Table 4

Summary of Conflict in Innovation Literature

Social Constraint	Social Action	Dougherty Duality
Fluidity		
Directly force change	Let a thousand flowers bloom	Define and enact work as professional practice of innovation
Design Options: Add on venture units, skunkworks; bring in fresh blood, restructure by breaking up or eliminating units, formally train	Design options: build repertoire of routines, skills for action in organizational memory; enable maverick communities of practice; facilitate learning in situation via iterative problem surfacing in actual settings	Design options: formal institution of professional practice, all accountable for contributions to innovation, build reflection-in-action skills, use best practices to map and guide actions
Integrity		
Separate innovation from other work, rely on strategy to integrate	Group work around emergent flows of innovative action, use minimal structuring	Organize work into horizontal flows of innovation problem setting and solving
Design options: separate businesses into congruent units; senior managers create new units to experiment with opportunities; use strategic objectives	Design options: integrate entire organization to assure flows of learning; use a few 'semi-structures' only; shift from formal, quasi-formal, informal structures to make changes	Design options: formally recognize domains of innovation practice that flow apart from each other, provided each is guided by similar strategy (projects, businesses, capabilities, strategic management)
Energy		
Energize workers with a strong vision, culture	Energize workers by strategic participation, play	Energize work by directly resourcing work of innovation
Design options: develop culture to promote creativity, implementation; careful rewards for innovation; rigorous selection and socialization	Design options: engage people in strategic conversations, give them access to rules of interaction, content; enable play in various ways	Design options: direct access to others' time and attention; control over application of one's own expertise; access to multiple options for problems, choices

Note. Adapted from "Bridging Social Constraint and Social Action to Design Organizations for Innovation," by D. Dougherty, 2008, *Organization Studies, 29*, pp. 421, 426.

the interactions between social and individual cognition" (p. 90).

Osborn et al. (2002) propose a contextual theory of leadership. They argue that there is a gap between leadership theory and organizational theory based on the old debate of ''people without organizations vs. organizations without people" (p. 299). They propose four contexts of leadership: stability, crisis, dynamic equilibrium, and edge of chaos. They propose that each of these contexts aligns to specific leadership studies. Table 5 summarizes their findings.

Power Laws Versus Gaussian-based Research

McKelvey and Andriani (2005) explain the problems of Gaussian statistics when studying strategic organizations. They assert that many sciences have power law phenomena which exhibit Paretian distributions. Gaussian distributions are assumed to be independent. Complex systems tend to be interdependent. They state that researchers should start with the assumption that extreme events are a natural part of the social world.

Conceptual Framework: Complex Adaptive Systems

Wheatley (1999) provides an excellent foundation of complexity leadership by comparing the order and chaos in nature and science with the order and chaos in Leadership. It is important for leaders to be able to recognize and adapt to complex environments in contrast to more simple situations (Snowden & Boone, 2007).

One of the benefits of exploring leadership as a complex adaptive system is that we can understand issues that baffle us in the traditional view (Drath et al., 2008). It is important to note that complex does not mean complicated. Complicated systems can be

simplified by breaking down the structure into individual pieces. Complex systems must be studied as a whole, rather than the sum of the parts. Military jets and computers are complicated. A jet is designed and assembled one part at a time. Computers contain individual components that make up a whole. But the human brain is complex. Yes there are individual elements in a brain that can be categorized and understood. But neuroscientists are still trying to understand the brain as a complex system. Uhl-Bien and Marion (2009) explain that complexity science "conveys a sense of rich interconnectedness and dynamic interaction that is generative of emergence in and among complex adaptive systems" (p. 632).

Bureaucratic organizations are hierarchical, driven by rules, functionally compartmentalized, and impersonal (Weber, 1947). Most formal organizations today are organized around the concepts of bureaucratic principles and form the basis for many organizational studies. However, the artificial barriers of departmentalized structures that are simply sequentially interdependent are both unrealistic and counterproductive (Uhl-Bien & Marion, 2009). Uhl-Bien and Marion (2009) have proposed a meso model of complexity leadership theory in the context of bureaucratic forms of organizing. This meso model serves as the theoretical framework for my research.

Complex adaptive systems are embedded within the context of larger organizing systems. The primary focus of complexity leadership theory within a bureaucratic organization is entanglement between the formal organization and the informal complex adaptive system. This entanglement is the mechanism whereby the formal organization learns from the informal organization. Uhl-Bien and Marion (2009) use three terms to identify the formal and informal dynamics—administrative leadership, adaptive

Table 5

Four Contexts of Leadership

Key Aspects	Context 1 Stability	Context 2 Crisis	Context 3 Dynamic Equilibrium	Context 4 Edge of Chaos
Hierarchical level	Low	Middle	Top	Entire system
Organizational performance dimensions	Outside of leadership model	Interpreted by leaders	From Strategy	Definition of success is shifting and emanating from outside
Leader's attention	No need to focus	Identify crisis roots	Isolate and communicate relevant information	Priorities for change and stability
Leader's networking	Individual	Access new resources and building social capital	Breadth and depth of ties to strategic information	Diversification of schema, networks, and links to key constituencies
Leadership research approach	Individual, comparative statistics, longitudinal	Individual and collective, dynamic, process	Collective, comparative statics, dynamics, process	Collective, dynamic, process
Key issues	Importance of the informational aspects of leadership in interactive combination with context	Combinations of collective leadership and process that yield improvement across time	Composition of leadership associated with specific types of strategic performance	Role of informational aspects of leadership in combination with transformational leadership to yield sustainability of the system

Note. Adapted from "Toward a Contextual Theory of Leadership," by R. N. Osborn, J. G. Hunt, and L. R. Jauch, 2002, *The Leadership Quarterly, 13*(6), pp. 800-801.

leadership, and enabling leadership. Administrative leadership is the formal managerial function that addresses the bureaucratic functions. Adaptive leadership is the informal process of intentional human interactions that generate and advance novel solutions to the needs of the organization. Enabling leadership is the interface between administrative leadership and adaptive leadership. Entanglement recognizes that the administrative and adaptive leadership must work together. Innovation, learning, and adaptability naturally move from the adaptive function of the organization into the administrative function when there is effective entanglement between the two functions. Enabling leadership encourages this entanglement.

When the administrative and adaptive functions are well integrated, then the enabling function is not apparent. This is the case where the administrative leadership and adaptive leadership are operating at a healthy level relative to each other. They are combining so effectively that it is difficult to distinguish between the administrative, adaptive, and enabling leadership roles.

When the administrative function is overly stifling and powerful, the adaptive function may be limited by excessive controls. Adaptive leadership is needed for the health of the organization, but is not occurring because of the overbearing administrative leadership. In this case, the role of enabling leadership is to first protect and foster adaptive leadership and then integrate the emergent outcomes back into the bureaucratic structure.

In some cases the adaptive leadership function is vibrant but the emergent outcomes are not being captured by the organization. The tremendous ideas being generated by the informal organization are lost. The role of the enabling leadership

function is to integrate the adaptive leadership outcomes back into the formal organization.

Sometimes both the administrative leadership function and the adaptive leadership function are healthy, but somewhat disconnected. In this case, the enabling leadership function is to simply connect the two functions where needed.

Complexity Leadership Theory has a set of informal dynamics called the adaptive function that consists of three main elements: adaptive leadership, dynamics, and enabling conditions (Uhl-Bien & Marion, 2009). The unpredictability and non-linear behavior produced by dynamics is called mechanisms. The study of mechanisms generates an understanding of the dynamic processes. The dynamic processes are predictable but their outcomes are unpredictable.

Adaptive leadership is the natural human response to control the uncontrollable. It occurs in intentional interactive and interdependent acts of humans to generate and advance innovative solutions to adaptive needs of the environment. Adaptive leadership is contextual. This context is the unplanned and uncontrolled mechanisms that emerge naturally. Adaptive leaders are skilled at recognizing and engaging with their dynamic complex contexts. Adaptive leadership does not motivate and direct followers, but rather produces a rich flow of information such as ideas, innovations, changes, and technology. Key elements of innovation include networks, discovery, and adoptions of ideas (Chang & Harrington, 2007).

Uhl-Bien and Marion (2009) explain why qualitative research is so critical in expanding Complexity Leadership Theory (CLT):

CLT is a contextual theory of leadership and requires different methods (Osborn et al., 2002). Such research is not suitable to the "quick and easy" questionnaire approach to

which we have become accustomed in leadership research (Hunt & Dodge, 2000). This does not mean, however, that it cannot be tested; only that it may be more difficult. This difficulty, however, "does not justify quick, one-shot studies that fail to recognize important developments in the field" (Hunt & Dodge, 2000, p. 454). Instead, it requires leadership researchers to explore methodologies that allow us to gather rich, dynamic, contextual and longitudinal data that focus on processes (mechanisms) rather than static, de-contextualized variables. Such methods include qualitative approaches (Plowman, Baker, et al., 2007; Plowman, Solansky, et al., 2007), simulation and modeling, case studies (e.g., Hunt & Ropo, 1998), etc. (p. 647)

Summary

Chapter 2 addressed the three major streams of innovation literature. Innovation through individuals, organizational structure, and processes were discussed. The literature related to breakthrough innovation along with government and military innovation was reviewed. The conceptual framework on complexity leadership theory was explored.

CHAPTER 3

METHODOLOGY

Introduction

Multiple case study methodology was used to explore a purposeful sample of

three integrated product teams that have successfully fielded a radical innovation within

the U.S. Navy. The emerging leadership attitudes and behaviors and their contribution to

innovation were investigated in the context of complex adaptive systems. Data were

collected from interviews, focus groups, and program documentation. The project titles

and participant names were replaced with pseudonyms in the case study narrative to

ensure anonymity.

Research Questions

The two research questions that guided this research were the following: How

does leadership emerge in a complex adaptive system? How do leadership attitudes and

behaviors contribute to product innovation?

Research Design

This research was designed based on a qualitative approach (Creswell, 2008).

The general methodology was multiple case studies, which is also referred to as

comparative case studies (Merriam, 1998). The intent of this research was to develop

interpretive case studies, which contain rich and thick descriptions. Stories were used

extensively throughout the case studies.

This research used both narrative inquiry as a research method and narrative as a phenomenon which is the story in all we do. Narrative inquiry asks questions of meaning, social significance, and purpose (Clandinin & Connelly, 2000). Stories are an important part of leadership. Stories can be in the form of rites, rituals, ceremonies, myths, sagas, legends, folktales, symbols, gestures, and artifacts (Bass, 1990). Peters (1988) discussed the importance of stories: "People, including managers, do not live by pie charts alone—or by bar graphs or three-inch statistical appendices to 300-page reports. People live, reason, and are moved by symbols and stories" (p. 506). Stories were used throughout my research to both enhance communication and as the source of data for analysis. Metaphors are a valuable tool for managers and leaders (Nofsinger, 2001). Myth and storytelling are an important element in organizational change (Grant, 2005). Stories can improve organizational learning (Armentrout-Brazee, 2002). It is anticipated that the stories within my cases will encourage leadership attitudes and behaviors that foster innovation.

Van de Ven and Poole (2005) identify four approaches to researching organizational change. Table 6 demonstrates the relationship between the four approaches. They argue that no one method is the best, and a blending of the approaches provides a more holistic appreciation of the complex dynamics. This research will utilize the concepts of Approach III: process studies narrating emergent activities.

Self as Research Instrument

Qualitative research requires direct interaction between participants and the researcher. "The researcher needs to be aware of the need to suspend his or her own

Table 6

Approaches to Researching Organizational Change

Ontology An organization is represented as being:	
A noun, a social actor, a real entity ('thing')	A verb, a process of organizing, emergent flux
Variance method	
Approach I Variance studies of change in organizational entities by causal analysis of independent variables that explain change in entity (dependent variable)	Approach IV Variance studies of organizing by dynamic modeling of agent-based models or chaotic complex adaptive systems
Process narratives	
Approach II Process studies of change in organizational entities narrating sequence of events, stages or cycles of change in the development of an entity	Approach III Process studies of organizing by narrating emergent actions and activities by which collective endeavors unfold

Note. Adapted from "Alternative Approaches to Studying Organizational Change," by A. H. Van de Ven and M. Poole, 2005, *Organization Studies, 26*(9), p. 1387.

beliefs and predisposition" (Bogdan & Biklen, 1982, p. 9).

There were several potential areas of bias that I will need to address. These include risk, freedom, participative leadership, teamwork, and rebellion. My own experience caused me to believe that all of these contribute positively and significantly to innovation. I love taking risks and believe that appropriate risk taking can contribute to increased innovation.

I love being free to chase my own dreams. Most engineers will tell you that if you just leave them alone and let them solve the problem, everything will be great. Unfortunately I found that is not necessarily the case. Often the engineer will come back months later with a great solution to the wrong problem. There was a danger that my

love for freedom would bias the results toward greater freedom for innovators.

I love participative management and leadership. I have supervised or managed groups ranging from 10 to 300 employees. In addition to encouraging participation in decisions by my direct reports, I have also encouraged supervisors working for me to embrace the concepts of participative management and leadership. It was critical that I carefully analyzed the leadership attitudes and behaviors so that the results were not overly biased towards participative leadership.

I am a strong believer in teamwork. Extra effort in getting the whole team on the same page seems to go a long way. This love for teamwork could prove to be a bias for me. It may be difficult to determine how much teamwork to attribute to innovation. I needed to be careful when analyzing the data to stay true to what the team members said about the role of teamwork in innovation.

I am naturally a rebel. This is especially true when I am forced to be constrained by what I consider unnecessary rules. I have witnessed anecdotal evidence that many innovators are rebels. I needed to remain diligent in addressing these biases and staying true to the themes in the data.

I have always been fascinated by new and interesting ideas and gadgets. As a kid on my grandfather's farm I would just sit there and watch him work. I was curious exactly how the tractor worked and what was inside when my grandfather removed the wheel. Years later, I was just as fascinated with high-school chemistry and physics. I felt so empowered knowing why a helium balloon floated or calculating the arc a bullet would travel. I chose electrical engineering my first day of college and have never regretted the decision.

I have always been a creative and outside-the-box thinker. At work I have always seen creative possibilities. Sometimes my ideas were accepted, but other times no one else knew what I was trying to explain. I remember times when my idea was thrown out and ignored. Then months or years later, the same idea would resurface and be accepted and implemented. I have seen over and over in my career great ideas fall by the wayside while other times a different idea with less merit becomes a raving success.

I have often wondered how to encourage innovation in a large organization. There seemed to be little pockets of innovation. I stumbled across them as I worked. What makes these pockets survive and thrive? In many ways this research was a journey of my own curiosity. Would it be possible to understand how these pockets are created and nourished? What actions could a senior leader take to nurture and encourage more pockets of innovation? What leadership attitudes and behaviors encourage innovation in a group? How can we get more leaders with these attitudes and behaviors?

Purposeful Sampling

The purposeful sample for this research was specifically selected because of unique attributes (Merriam, 1998). Most acquisition teams in the Navy simply deal with incremental innovation. The teams in the sample were unique because they had demonstrated breakthrough innovation with disruptive technology. But they didn't just develop breakthrough innovation; they did it within cost and schedule thresholds, which was also unique. The fielding of the capability demonstrated that the innovation had successfully completed formal testing and reached the initial operating capability (IOC) milestone. The samples were also unique to a specific systems command. Three teams were included in the sample as three cases. While all three of these teams met the unique

criteria, a secondary attribute between the three teams was maximum variation (Merriam, 1998). Diversity across the three projects was also intentional. Where possible, the type of technology and relative size of the project was different between the three cases. The specific criterion for inclusion in the research was that the team developed a breakthrough innovation based on disruptive technology. Additionally, the project had reached IOC. Also, the project was completed within the cost and schedule thresholds that were established early in the project.

Data Collection

Data were collected from interviews, focus groups, and program documentation. The selection of individuals to participate in interviews and focus groups was an evolving and iterative process. Interviews revealed participants in future interviews or focus groups, and focus groups revealed additional participants in interviews or focus groups. Prior to participation in an interview or focus group, I sent an introductory e-mail explaining the background and purpose of the research. The sample questions and informed consent were also attached to the e-mail. The participant was asked to sign the informed consent. After the interview or focus group was completed, I sent a follow-up e-mail thanking the individual for participating. I also included the questions and asked for any further responses that the individual thought of after our meeting. This allowed each participant time to reflect on the questions and three separate opportunities for responses. Data from individuals who didn't have time to participate in the interviews or focus groups were still included if they chose to answer the questions by e-mail.

Interviews

Both the formal IPT leaders and the informal emerging leaders were interviewed for each team. The interviews began with formal leaders because they were the easiest to identify initially. The leaders were interviewed based on the interview protocol. The interviews were audio recorded and transcribed for analysis. As the researcher, I also took simple field notes during the interview. Sample questions are listed in Appendix A. Some interviews took place over the phone if a face-to-face interview could not be arranged.

The questions for interviews and focus groups made use of concepts of Appreciative Inquiry, based on positive questions rather than focusing on problems. David Cooperrider (1986) found that asking questions that focused on what people valued seemed to allow them to talk more freely. He is credited with the founding concepts of Appreciative Inquiry, although many have followed in his footsteps and built on his work (Reed, 2007). Appreciative Inquiry is also focused on stories which provide rich data for the case studies.

Whitney (1998) described most development models as "deficit based." They start with the assumption that the organization is a problem needing to be fixed. In contrast, Whitney describes Appreciative Inquiry as "strengths based." It builds on the strengths of the organization. K. D. Hunt (2001) compared a problem-solving approach with Appreciative Inquiry. She found that both approaches generated similar outcomes. However, the Appreciative Inquiry participants generated more diverse strategies and included multiple levels of community.

Araujo (2003) studied Appreciative Inquiry as a method for research. She found

four factors necessary for the creation of positive energy for change: common voice, leadership, generative learning, and empowerment. She found that positive change is possible using Appreciative Inquiry, inclusion, and the unconditional positive question.

Focus Groups

The focus groups were composed of team members who were not the formal leaders being studied. The primary reason for using focus groups was to use interaction data based on discussion among participants such as commenting on or questioning one another to reveal data that were otherwise less accessible (Barbour, 2005; Lambert & Loiselle, 2008). The homogeneity of the group had important implications for the outcome of the discussion (Krueger & Casey, 2009; Stewart, Shamdasani, & Rook, 2007). The focus groups were composed of peers from the same team. The focus group was interviewed based on the interview protocol. The focus groups provided an opportunity for those at the working level of the organization to provide a unique perspective on the leadership attitudes and behaviors that contributed to the innovation. The focus group was audio recorded and transcribed for analysis. I also took simple field notes during the focus group interview. In addition to the questions, each focus group recommended other individuals who could be included in an interview or focus group.

Program Documentation

A typical project has ample documentation to draw from. These documents may include the acquisition program baseline, acquisition decision memorandums, systems engineering plan, test and evaluation master plan, test reports, organizational charts, and contact lists. This program documentation was analyzed to gain an understanding of the

team relationships and project success. This documentation was used to supplement or confirm findings from interviews and focus groups. In addition to program documentation, other public sources of data were used including the internet, news articles, and the congressional record.

Data Analysis

Data analysis is the process of understanding and exploring the information collected in interviews, focus groups, and documentation. It is "consolidating, reducing, and interpreting what people have said and what the researcher has seen and read" (Merriam, 1998, p. 178).

The data were analyzed in the context of complex adaptive systems in bureaucratic forms of organizing (Uhl-Bien & Marion, 2009). The cases were written in a narrative that would convey the emerging leadership attitudes and behaviors. Multiple case study methodology was used to explore three integrated product teams that had successfully fielded a radical innovation within the U.S. Navy.

Narrative inquiry played an important role in the analysis. I interweaved my researcher experience with the experience under study to write the narrative case studies. The three-dimensional inquiry space of time, place, and people was explored (Clandinin & Connelly, 2000). I wrote found poems for each theme to help clarify meaning and my own understanding of the underlying emotions. Found poetry adds a holistic dimension to the findings that is not available in traditional descriptions (Butler-Kisber, 2002). Different representational forms improve meaning and understanding (Eisner, 1998). I moved from living stories of the participants to retelling the stories in the case studies.

The analysis began with the interviews of key individuals on each team. These

interviews progressed to interviews of focus groups of people involved in the innovation. Program documentation was used to validate and triangulate data collected in the interviews. I transcribed and coded the transcripts of the interviews and focus groups, looking for emergent themes in my topic.

The results of the interviews, focus groups, and program documentation were compiled into a case study narrative for each team. Each case provided the reader with a detailed understanding of the context of the innovation along with the emerging attitudes and behaviors. The product title and participant names were changed to ensure anonymity. However, key attitudes, behaviors, and outcomes were captured and portrayed in the case study. Key themes that emerged from the data were triangulated between individuals and were highlighted in the narrative.

Major findings that are common across at least two cases were explored in more detail. Several forms of narrative representation created opportunities for the reader to understand the results in various ways. Stories were used extensively throughout the cases.

Validity and Reliability

King, Keohane, and Verba (1994) argue that while quantitative and qualitative research uses dramatically different styles, they both use a unified logic of inference. This logic is explicit and formalized in discussions about quantitative research. Quantitative research uses numbers and statistics to abstract specific phenomena to a general description or test a hypothesis. In contrast, qualitative research does not use numbers but gathers a tremendous amount of information from a single case. They point out that the best qualitative research is based on a strong logic of inference.

Triangulation will validate the findings (Creswell, 2008). Triangulation is a method used in qualitative research to validate a research question from multiple perspectives. Three forms of triangulation were used in the analysis. Attitudes and behaviors of specific leaders were triangulated from multiple sources of data including different interviews and focus groups. The second form of triangulation was comparison of attitudes and behaviors of different leaders within a specific case. The third form of triangulation was comparison of attitudes and behaviors between the three cases.

Generalizability

This research was based on three Integrated Product Teams in a U.S. Navy Systems Command that successfully fielded a radical innovation or disruptive technology. The case study approach provided sufficient detail for the reader to generalize the story through a process called naturalistic generalization (Eisner, 1998). The reader will identify common themes portrayed in the stories that can be generalized to his or her specific environment. Generalizability can be viewed as what one learns from the case study in terms of skills, images, and ideas (Eisner, 1998). The skills, images, and ideas can be applied by the reader to a specific situation.

Ethics and Institutional Review Board

Participation in the research was completely voluntary. At any time in the process, any individual could decline to participate. The names of the three projects were changed to pseudonyms. The names of individuals in the case studies were also changed, although the gender remained the same. The type of work was disguised sufficiently to increase anonymity. The name of the organization studied was changed.

The dissertation proposal required approval of both the Andrews University

Institutional Review Board (IRB) and the Naval Air Warfare Center Aircraft Division

(NAWCAD) IRB. All subjects signed informed consent forms consistent with Andrews

University IRB and Navy IRB requirements.

The dissertation required approval for public release from the appropriate public

affairs office. All participants were asked to share only data that were unclassified and

that the individual believed could be released publically. The anonymity of the

organization, projects, and people greatly simplified the public release process.

Summary

A purposeful sample of three integrated product teams who have successfully

fielded a radical innovation within the U.S. Navy was explored using multiple case study

methodology. The stories of emerging leadership attitudes and behaviors and their

contribution to innovation provided the reader with skills, images, and ideas that can be

generalized to specific situations. Interviews, focus groups, and program documentation

formed the basis for the case study narratives. Pseudonyms were used throughout the

case studies to ensure anonymity and simplified the Navy's public release process.

CHAPTER 4

FINDINGS

Background

The grey clouds overhead hid the sun. But his heart wasn't gloomy. As he drove

down the road, he wondered if the clouds would affect his mood. It was sunny all the

time, where he had come from. Merging into a familiar string of cars backed up to enter

the gate to the base, he realized this would be his new routine. He chose a parking place

far from the building where there were plenty of open spaces. The walk to the building

would be good for him, and if he parked out there he could always find his car. He

walked briskly toward the large building, eager to begin his first day of work. Others

merged onto the sidewalk, each walking with a hurried confidence. He began to walk

with more self-assurance. Yes, it was his first day of work, but he knew where he was

going. He had been in this building dozens of times before, but always as a visitor—the

token representative from the West Coast.

The escalator ascended into the first floor of a massive atrium whose ceiling

suspended at the top of the five-story building. He mused that the upper balcony would

make a perfect launching point for a paper airplane. But somehow a paper airplane

contest seemed out of place in a headquarters building where billions of dollars of

defense budget decisions were made each day. The administrative assistant was excited

to meet him and walked him over to his cubical just a few feet away. His name hung

prominently over the cubical: "Evan Wilson, T&E Lead." Evan would be responsible for the test and evaluation of several systems in the office including an upgrade to the ABX-23, the CDX-45, and the XEF-67.

The three case studies in this research are specific projects under the ABX-23, the CDX-45, and the XEF-67 programs. All three programs were under the same program manager, but each was operated under a separate IPT leader. The story above demonstrates that the T&E lead was common across all three teams and was new to the programs partway through the projects. This was typical across the case studies. Some leaders and team members had supported the program for many years, but team leaders and team members also rotated in and out of the projects and the program office.

While each of these systems programs spanned many years, only one project under each program was included in this research. The scope and length of each project was marked by two specific events. The start of each project was considered a signed Urgent Universal Needs Statement (UUNS). An UUNS is a document that the warfighter uses to officially state a requirement. The end of each project was the IOC or the Early Operational Capability (EOC). The IOC varies from project to project, but is typically complete systems installed on an entire squadron of aircraft with all the documentation, training, and spares necessary to use the system in battle. EOC is similar to IOC, but is fielded before all of the testing has been completed. The squadrons chosen for IOC or EOC were headed directly to the conflict overseas or were already in theater.

In this chapter each of the cases is first generally described as systems. Then the program office structure and leaders are explained. This is followed by a discussion of each theme that emerged from the data across all three cases. The chapter concludes with

a summary and a found poem that reinforces the themes. A found poem is a compilation of direct quotes from the interviews.

ABX-23

The ABX-23 was first developed and deployed in the 1980s as a missile warning system. Thousands of these systems have been deployed on both U.S. and foreign aircraft. In November of 2006, the Marine Headquarters issued an UUNS asking the Navy to take all necessary action to ensure the rapid procurement and deployment of Small Arms Fire Threat Indication (SAFTI) which was pronounced "safety." The ABX-23 team had studied the feasibility of adding SAFTI with simply a software modification, but there was not sufficient funding. The FY08 budget included a congressional add to begin the development of SAFTI. A contract was quickly awarded and the development of SAFTI software on the ABX-23 proceeded rapidly. The ABX-23 team developed an aggressive schedule.

The ABX-23 was a first-generation warning system for the Marine transport helicopter, designed to prevent strikes from incoming missiles. Marine transport helicopters were already outfitted with the ABX-23, which was very effective against missiles. However, the conflict overseas indicated that small arms fire was increasingly responsible for damage to helicopters. Surface to air missiles can be both expensive and difficult for the enemy to operate, while machine guns are readily available and simple to use.

One of our foreign partners began to study options to counter these small arms threats. The Marines joined the study to include investigation of the ABX-23 as a possible solution to the small arms threats. An analysis determined that the ABX-23

could identify the incoming rounds from small arms with a fairly straightforward software modification. This software could be loaded on the ABX-23s already deployed and provide an immediate improvement to helicopter survivability.

But in the world of defense acquisition, a good idea is not enough. The idea must be approved as an official requirement and then it must be funded by Congress. A contract must be signed with the defense contractor and the engineering process is followed, including design reviews. After the contractor delivers the software to the government, an extensive test process must be followed including developmental testing and operational testing. The helicopter operation and maintenance manuals must be updated with the new capability, and the users must be trained. Any step in the acquisition process can derail a potential project.

The need for the ABX-23 improvement project was quickly funded by Congress and the requirement was officially endorsed by the Marines. An aggressive 14-month schedule was developed from initial contract award to fielding of the system. This kind of timeline is rare in defense acquisition where steps in the process are generally measured in years rather than months.

While the contractor was busy designing and developing the new software, the developmental and operational testers were brainstorming ways to test this new capability. The most realistic method for testing the software would be to shoot bullets at a manned helicopter. That option was quickly ruled out by both the test pilots and the range safety officer. One innovative idea was to mount a helicopter on top of a tower with the ABX-23 installed and shoot bullets at it. Another idea was to install the ABX-23 in the Marine's manned flight simulator and let the pilots evaluate the cockpit

indications. Both of these ideas were successfully adopted and completed.

The test was planned to exercise several variables in the environment including miss distance, shooter range, time of day, and azimuth of the aircraft. Once the testing was successfully completed, the focus moved on to the pilot interface. Several pilots evaluated the cockpit indications and suggested improvements. The contractor quickly updated the software and the pilots retested the indications.

Once the ABX-23 completed Developmental Testing (DT), the team began to prepare for the Operational Test Readiness Review (OTRR). A DT/Operational Test (OT) Transition Report was written which summarized the results of the testing. The ABX-23 software was fielded as soon as the OT was completed and the OT report was approved. The entire project was completed within budget and schedule thresholds and was considered a game changer by the warfighter.

CDX-45

It was recognized that improvements to the ABX-23 were limited and the next generation of technology was needed. A variation of the CDX-45 was already in use by another service. In 2005, PMX-246 initiated a Technology Assessment Project (TAP). The TAP effort compared three available systems. Flight tests were conducted and PMX-246 assessed the TAP results with an independent Analysis of Alternatives (AoA). The AoA concluded that an upgraded CDX-45 was the best solution. The other service's CDX-45 was in Full Rate Production (FRP) and successfully fielded. The other service and the Navy CDX-45 would leverage each other's efforts for production, upgrade, development, operations, and maintenance. Two variants of the CDX-45 were tested on separate Marine helicopters. Based on this testing, the Navy chose a specific variant

which offered better capabilities.

In 2006, the Marines issued an UUNS stating the operational requirement for improved assault support aircraft capability against threats. The CDX-45 requirements were derived from the Initial Capability Document (ICD) and subsequent Annex to the other service's Operational Requirements Document (ORD).

In 2007, ASN(RD&A) approved PMX-246's request to procure an initial 32 CDX-45 systems to support the rapid program schedule. In FY08, the Program Executive Officer, as MDA, approved procurement of an additional 26 CDX-45 systems. These procurements ensured sufficient systems were available to support test events and initial platform installation to support EOC. Additional systems were required to support sparing and continued fielding.

XEF-67

The XEF-67 was a system that works in conjunction with both the ABX-23 and the CDX-45 to provide a defensive countermeasure to the incoming threat. It was recognized that the existing XEF-67 needed improvements. These improvements proved both a greater capacity and better capability to defeat incoming threats.

In June of 2007 the UUNS for the XEF-67 was signed. A contract to deliver a prototype XEF-67 was awarded in August 2007, with the production contract awarded in February 2009. The IOC was completed within budget and schedule thresholds, and the new capability was considered a game changer for the warfighter.

Leaders

This research included the leaders and followers for three programs, the ABX-23, the CDX-45, and the XEF-67. All three programs were under the same program

manager, PMX-246. The organizational structure for PMX-246 is shown in Figure 10.

The PMX-246 Program Manager, Captain Peter, was a Navy Captain with over 20 years of acquisition experience including test pilot school, naval postgraduate school, test lead, chief engineer, and deputy program manager for several different programs. He was assigned to be PMX-246 program manager for 4 years. The Deputy Program Manager, Earl, was a civilian at the GS-15 level with over 20 years of acquisition experience including logistics and program management. The Operations Officer, Kim, a civilian GS-14, was responsible for the administrative functions. The program office was divided into three Level I IPTs which included a dozen level 2 IPTs. The nine level 2 IPTs that were not included in the research are not shown on the chart. The co-leads for IPT A were a Marine Lieutenant Colonel, Doug, and a civilian GS-14, Mike. Both the ABX-23 and CDX-45 were programs within the IPT A. The co-leads for IPT B that were not included in this research are shown in a dashed box for clarity. The lead for IPT C, Ken, was a civilian GS-14, which included the XEF-67 program. The supervisor of record for all of the civilians was the Deputy Program Manager, while all the military reported to the Program Manager.

The Competency Leads were assigned either full-time or part-time to the program office, but had a separate reporting chain to the competency. The team members within each IPT also reported through the competency. In some cases, such as logistics, the competency lead was also the supervisor of record for all logisticians within the program office. However, in most cases such as engineering, the competency lead was simply a senior engineer in the same branch as the other engineers in the program office.

The acquisition lead, Jane, was responsible for understanding all of the latest
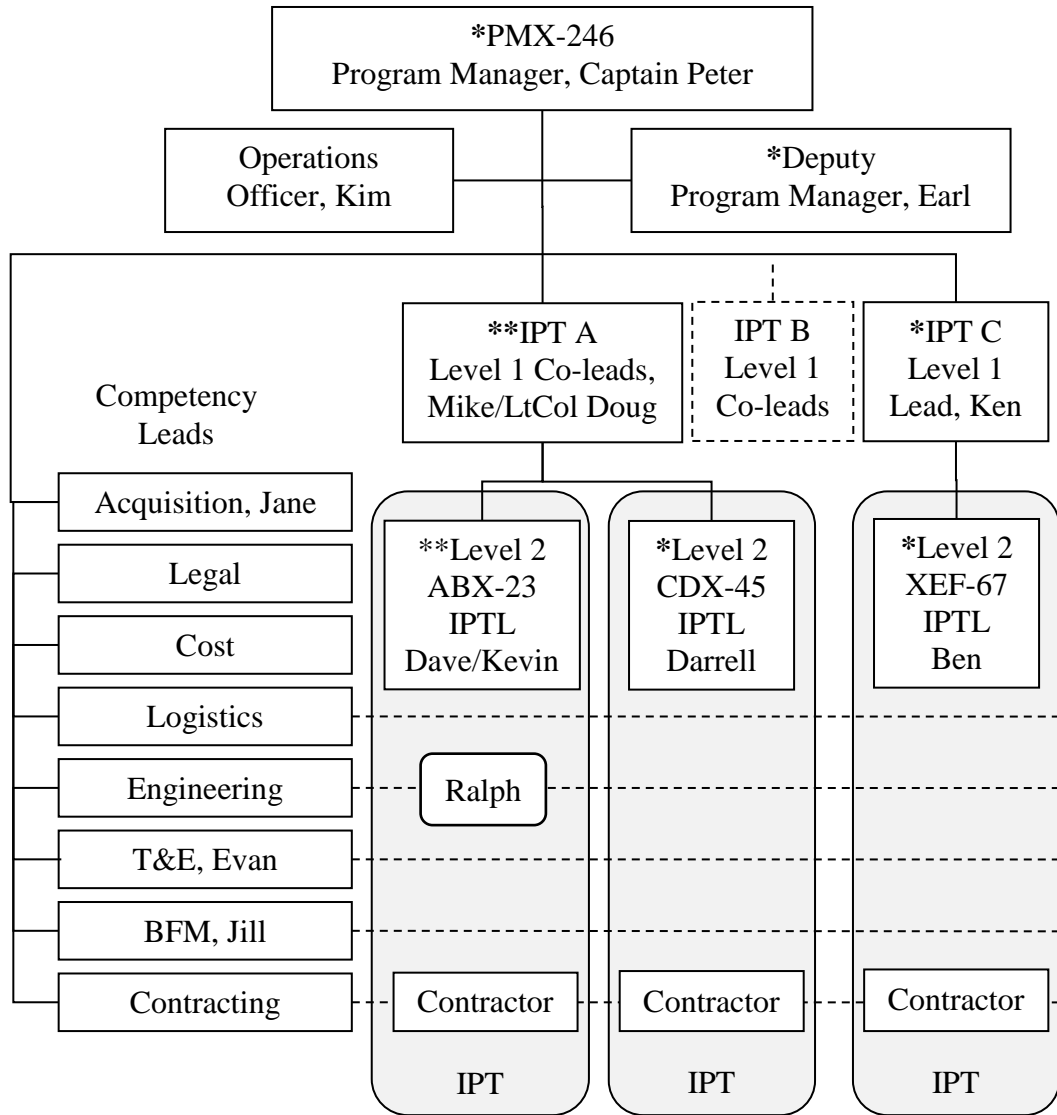
Figure 10. Partial PMX-246 organizational chart.

acquisition policy, regulations, and statues. Her job was to track and oversee all of the required acquisition documentation and track progress towards milestone reviews and gate reviews. Jane was also available to provide advice to the program manager and IPT leaders on possible options and alternatives in the acquisition process.

One attorney was assigned half-time to the PMX-246 program office. While the attorney was available to provide legal advice to the program manager and IPT, most of her time was spent reviewing contracting documents.

The cost lead was responsible for providing independent cost estimates for the program manager. The cost competency follows a structured and disciplined process for calculating costs.

The logistics lead official title was the Assistant Program Manager for Logistics (APML). Each level 2 IPT was assigned a Deputy Assistant Program Manager for Logistics (DAPML).

The engineering lead title was the Assistant Program Manager for Engineering (APME). The previous title was Assistant Program Manager for Systems Engineering, which was also known as the "Class Desk."

The T&E lead, Evan, was also the Assistant Program Manager for Test and Evaluation (APM[T&E]). Since there were only three APM(T&E)s in the program office, the T&E lead also served as the APM(T&E) for the ABX-23.

The Business Financial Management (BFM) lead, Jill, oversees all of the funding for the program office. Her military deputy was a Navy Lieutenant Commander. Each level 2 IPT had a civilian or military BFM assigned.

The contracts lead title is Procurement Contracting Officer (PCO). The PCO had

four contract specialists working for him who supported all of the IPTs in the program office.

This research included both the formal leaders and the informal emerging leaders. The nine individuals in these cases who are considered formal leaders are designated with an asterisk in Figure 10. This includes the program manager, Captain Peter; the deputy program manager, Earl; the level 1 IPT leaders, Mike, Lieutenant Colonel (LtCol) Doug, and Ken; and the level 2 IPTLs (IPT Leaders), Dave, Darrell, Kevin, and Ben. The ABX-23 IPT leader is counted as two individuals because partway through the program, the leader changed from Dave to Kevin. Both of these leaders are included in the research. In addition to the formal leaders, the informal emerging leaders were also studied. These informal leaders emerged from team members within the IPTs and from the competency leads.

Themes

Six themes emerged from the data in these case studies. These themes were a combination of leader attitudes and behaviors that contributed to the success of the three case study projects. These attitudes and behaviors were observed at all levels of the organization from the program manager at the top, to the IPT leaders in the middle, to the engineer who emerged as a leader, getting the job done. The first theme was urgency driven by a heartfelt need. Everyone knew in their heart that the warfighter urgently needed these capabilities and did whatever they could to deliver them as soon as possible. The second theme was that these leaders would listen and were open to ideas. The leaders encouraged creativity in not only the product, but also the process that was used to acquire, design, test, and deliver the product to the warfighter. The third theme was to

know the process and challenge the process while managing risk and ensuring the final product quality was good enough. Government acquisition has many regulations, rules, practices, and processes. The leaders knew these inside and out and also knew the exceptions that could be exercised to streamline the process and deliver the product faster. The leaders took conscious risk to accelerate the projects. They asked if the process was good enough and if the product was good enough. The leaders were not focused on a perfect solution, but rather a capability that was good enough to help the warfighter. The fourth theme was vision, passion, assertive, persistence, and moderating setbacks. These leaders knew where they were going and how to get there. Much of the passion came from the urgency of the need. The leaders were assertive in getting the job done and holding people accountable. These leaders were persistent and when something went wrong, they kept working until it was corrected. They didn't let setbacks discourage themselves or the team. The fifth theme was trusted leader with credibility, integrity, and professionalism. The leaders were professional managers who ensured that credibility and integrity remained a priority. The final theme was collaboration, teamwork, and recognition. The leaders encouraged collaboration and teamwork. They took every opportunity to recognize the team both formally and informally.

Each theme is described and analyzed. At the end of the theme a found poem summarizes the key thoughts in the theme. The found poems are a collection of direct quotes from the interviews and focus groups.

Urgency Driven by a Heartfelt Need

Evan knew something had happened when he arrived at work. There was tension in the air that wasn't normal. Some were whispering. Others scurried by. Evan walked

back to Ralph's desk. "What's going on?" Evan casually asked Ralph. When Ralph

looked up, Evan instantly saw that Ralph's face was ghost white. He knew something

was wrong. Ralph responded, "Did you hear the news?" Evan shook his head no. "A

helicopter was shot down last night." Evan waited for more, afraid to ask the inevitable

question. Ralph paused and then answered the look in Evan's eyes. "Both pilots were

killed." After a pause, Evan asked, "Can you tell me more?"

Evan followed Ralph over to a secure space where they could talk freely. As

Ralph explained to Evan the details of what happened, both of them knew. Yes, this

helicopter was equipped with the ABX-23. And yes, the software that Evan and Ralph

were testing might have saved the crew. Both of them instinctively understood what the

other was thinking: "If only we could have delivered the software faster."

Mourning the loss of these two American heroes, whom neither Evan nor Ralph

knew, somehow made all the past difficulties seem insignificant. Yes, they had

experienced significant stress trying to meet an impossible deadline. Yes, they had

worked long hours and made countless phone calls to accelerate the schedule. Yes, they

had battled bureaucratic delays together. Yes, they had overcome significant obstacles.

But each knew that everything that they had gone through was worth it if they could save

just one pilot. One pilot coming home to his family for Christmas was worth any

sacrifice they would make with their time. Yes, they would be even willing to work their

own Christmas, if it meant a pilot could come home safely for Christmas with his family.

After a few moments of reflection, Ralph turned to Evan and said emphatically, "We

have to get this software out there as soon as possible!" Evan eagerly shook his head in

agreement. They solemnly walked back to their desks with a renewed determination and

sense of urgency. Sitting at his desk, Evan thought to himself, "Is there something I could be doing right now to accelerate the project?"

The leaders of the ABX-23 improvement project demonstrated attitudes and behaviors that created a sense of urgency. Everyone on the team knew the deadline for completion of the project and worked to meet the goal. Each report of a helicopter damaged or shot down by enemy small arms was a reminder that the ABX-23 improvement was urgently needed. Leaders did not accept the routine timelines for steps in the process. They constantly challenged the status quo to find schedule margin.

Captain Peter came to PMX-246 when both ABX-23 and XEF-67 were just ideas. He said that "CDX-45 was slowly making its way out there. It was still not even through test and evaluation yet; it was still in the prototyping phase, and we were able to accelerate that and get it out there."

Captain Peter described his attitude towards the three projects: "So, there was never a doubt about the urgency; each was unique, each had their own challenges. I don't think anybody, at least not to me, expressed maybe we don't need these; it was clear, it was compelling, it was urgent, and there's not anybody within the acquisition team, also within leadership and Congress that did not believe that these things should be postponed or delayed or spread out. My attitude was we gotta do it, gotta do it, we gotta find a way, and let's get it done. And now we have CDX-45, ABX-23 SAFTI, and XEF-67s out there in the fleet."

He went on to say that each of these projects "came with an urgent operation needs statement, so that in itself separates them from the normal acquisition program. Each of these could not be successful in terms of urgency, in terms of the ability to

quickly get it out to the fleet if we treat it as a normal acquisition program."

He described what he did to make sure the programs were successful: "The most important thing you can do is make sure everybody understands what we're trying to accomplish here and why it's so important. Everything in life seems to be important. You have to have a way to filter out what is important in work and what is not. And by constantly talking about the capabilities, why it's needed, why we need it out there, showing the results of not having it out there, I think we get a lot more buy-in and personal satisfaction from the folks doing the work."

The ABX-23 SAFTI program had two different leaders--one early in the program and one that finished the program. Both of them described the urgency of the program. Dave said that "we were on the short leash to get this thing done." He went on to say that "it was the pinnacle of my career, working on something that saves lives, and I got to see the benefit by meeting some of the people that came and told us how we saved their lives by improving the system."

Kevin, who followed Dave as leader, described how he treated ABX-23 SAFTI different from other programs: "I absolutely treated it different. The difference is other projects that I've worked on have gone through this long, arduous process to come up with the requirement, and this one was, when you say 'urgent need', to me that's a Marine in the field saying 'Hey, my life is really on the line and while I understand you have these acquisition processes and stuff, what can you do to get it to me a little quicker? And let me evaluate a little faster.' So, to me, any time a guy in the field or girl in the field says urgent, then my job is to respond as urgent as I can." He went on to describe what he did to ensure the program was successful: "I think I was just trying to be a leader

and get it on time."

Some of the team members working on the ABX-23 SAFTI described the leaders: "Both Kevin and Dave are very assertive, aggressive managers about this SAFTI, I think both of them thought this was a strong need that the fleet had to do, and I think they were very instrumental in pushing, getting Captain Peter's buy-in and all that kind of stuff, and from what I sense from Captain Peter in conversation, and because of my position I had more interaction at that level which is more counting numbers and not actual doing, but at least from my perspective there was definite interest all the way up to Captain Peter, and I believe that they firmly believed that this was something that was absolutely essential to the fleet and did what they needed to do to get money out to make this happen."

The ABX-23 team went on to say: "There was no room for a slip. That was a big thing. It had to get done and we did whatever we had to do to meet the deadlines that we had." Another team member agreed stating: "Gail and Tyler pretty much worked nonstop without leave for several months. For flight testing, if something went wrong, we worked long hours to make sure we could try to fix it."

Several leaders noted that the CDX-45 "provided something that was extremely needed for warfighter capability so it was very fast moving. Leaders were getting barriers out of the way. They didn't let the emotion get in the way, but they used it to create urgency." It is easy for people to get upset when barriers block progress, especially when working on something urgent and important. Rather than allow that roadblock to drive everyone to frustration and discouragement, the leaders moderated the setback and then harnessed the emotion to increase the urgency.

The leaders went on to say that the CDX-45 leaders "did make sure things

happened on a restricted timeline and kind of got people out of the way or called people together, whatever was necessary."

One leader also said that "there were events that happened that triggered a universal urgent need. You have this piece of paper that essentially said, 'I need it now. Do whatever you have to do.' That changed things. That was a game changer." Another leader agreed, adding: "You can point back in some cases to a specific event or a situation calling for change in the urgent need."

One leader described the urgency and importance of the ABX-23 and CDX-45: "I think that for both of the programs there were events that happened that triggered a universal urgent need. You have a piece of paper that essentially said: I need it now! Do whatever you have to do. That changed things. That was a game changer."

Another leader described the importance of all three of the projects: "But the fact is that without these innovations, without these upgrades, we're going to have more of those men and women dying."

One of the leaders of the XEF-67 program described his attitude: "I saw the need for this capability was urgent. The product improvements we have developed over the years were all vitally necessary, but the XEF-67 was something that could be implemented relatively quickly and easily, with tremendous benefit immediately to the warfighters. We were already at war, and I treated this project as a priority as a direct consequence. We demonstrated in test just how much this comparatively simple aircraft mod could benefit the operators, and I pushed it as hard as civility and proper chain of command would allow."

Another XEF-67 leader described his leadership of the project as "fairly easy

from the get-go. It was an urgent operational need, so we were being shot at on a regular basis and so we put all the engineering talent that we had to bear, and that was one of the difficult things about asking for the right amount of funds. We knew that this had to happen quickly, and so we knew that we were in need of lots of smart folks in the right places at the right time and it crossed a lot of different disciplines so there was not just one side of the house that came into play. We had mechanical installation, structures, considerations, and all the other disciplines kind of running through the whole set of processes of making it happen. But we did it with urgency. Everybody was driven, they were very in tune to what was going on and so they were driven to make it happen."

The urgency and importance of the projects were interrelated. The projects were important because aircraft were being shot at and some were being shot down. The leaders believed that these projects could prevent loss of aircraft and prevent loss of life. The urgency came from the same source. If the projects were completed faster, then aircraft would be protected sooner. Every delay in schedule was the potential of another aircraft being lost.

The urgency and importance of the projects were communicated in all directions. It was communicated by leaders up the chain of command. And it was communicated by leaders down the chain of command. This communication and importance was clearly understood by everyone on the team. As new team members were included, the leaders explained to them the urgency and importance of the projects. One leader described the communication: "And by constantly talking about the capabilities, why it's needed, why we need it out there, showing the results of not having it out there, I think we get a lot more buy-in and personal satisfaction from the folks doing the work."

Every briefing began with a couple of slides with statistics reminding the audience that this project was important and urgent. The leader of the meeting asked the same question: "Is there anything we can do to get this to the warfighter faster?" This kept the urgency and importance of the project at the top of everyone's mind and increased the likelihood of completing the project faster.

The urgency and importance of the projects was also communicated through actions. Whenever a leader learned that something was slowing down the project, immediate action was taken. Sometimes decision makers outside the team did not understand the urgency and importance of the project. A simple phone call and e-mail from the right leader to the decision maker would often correct the situation. The phone call or e-mail would come from whatever level was appropriate. Sometimes it was the level 2 or level 1 IPT leader. Other times it came from the deputy program manager or program manager. In extreme cases the communication came from the program executive officer or his deputy. Often the leader would explain that if this phone call doesn't work, then there will be a phone call from the next level up.

Team members would communicate the urgency and importance of the project through example. Team members on the ABX-23 described fellow team members: "They pretty much worked nonstop without leave for several months. For flight testing, if something went wrong, we worked long hours to make sure we could try to fix it."

Several team members described the communication on the ABX-23: "So everybody was pulling the same direction. It was very consistent, everybody up and down the chain said this is high priority. I think it helped that everybody knew and worked toward the same end goal that this is going to make a difference in the fleet. It's

something that's easily understood when you see what the technology was doing. So it was viewed as important, not just high priority. You could see that it could make a real difference. We're hearing on the news that guys are being shot at. That's a big thing. This connects the dots."

The team had to communicate to the warfighter how the system worked and what is would do for them. One XEF-67 leader described his communication with the user: "It was, for me, an exhilarating feeling to show the Marine operators the test results and to see/feel their understanding and appreciation for what we had achieved. It was one of the single greatest moments of my career, showing them what we had done to help protect them." An ABX-23 leader described the communication with the users: "Communicating to the fleet, it was very important that the fleet knew what they were getting before they got it, and they understood it when they got it. I think our communication with the Marines out there and ensuring they were trained properly and introduced to the fleet properly was extremely important to our success."

All three of these projects were urgent. The leaders at all levels treated the projects as urgent. This urgency was based on a heartfelt need. Each leader and team member knew that the warfighter urgently needed the capabilities for their survival and did everything possible to get the capability there as soon as possible. The found poem below summarizes this theme of urgency

Urgent
people dying in combat without this capability
urgent needs statement
direction from leadership to act on a war footing,
you have to have a sense of urgency.
without these innovations
without these upgrades

we're going to have more of those men and women dying
aircraft getting shot down
Would our software have saved them?
I don't know, but I can tell you this
two fathers, two brothers, two uncles, two dads, two sons,
that aren't back with their families,
and maybe it would have—just maybe.
We did it with urgency.
There's a sole purpose to it all.
One person might get to come home
and have Christmas
because we put in this effort.

Listen and Open to Ideas

"You have to have faith that your voice will be heard. You have to believe that if you have an idea of merit, someone's going to listen. You must know that I'm going to listen to it." There was openness on the part of the leaders to listen to people. The leaders didn't just say "No, no, no, that won't work." The leaders were open to new ideas and new ways to do things. The leaders said, "Speak your mind. Don't sugarcoat anything and don't make anything sound worse because you don't like it."

"Here leadership allows innovation." People were willing to think outside the box. The team was constantly coming up with new ideas. If someone is set in his ways and incapable of seeing things differently then he will squash innovation. This may be because of the process, or because of their attitudes, or because of their own innate abilities.

"People in this group didn't feel like they needed to keep their hands down when they had a good idea. I mean I was in plenty of meetings, when they had an idea; they don't hesitate to raise their hands. But that comes from the top."

"There are a lot of good ideas that are missed because of the acquisition process that we go through." There are unintended requirements that for a very few dollars and a

little bit of time, could be included. "I would encourage the leaders that were working for me not necessarily to go out and look for them, but keep your eye open for opportunities and be prepared to take advantage of those opportunities that may save the taxpayers' dollars in the long run."

An urgent schedule both encourages innovation and stifles innovation. The compressed schedule can force leaders to find creative ways to get the job done. "You want to do your best, so that encourages hard work, innovation, people thinking beyond what they normally do every day." But if the leader is driven by pure schedule, just to get promoted, that's going to stifle innovation. "I really have to catch myself not focusing on those requirements too much. We've got requirements, but these are just little pieces. There are nuggets sitting out there waiting to be had. And as a leader it's so hard sometimes to slow down and let that nugget come out, and I know I'm guilty of it many, many times."

"Knowing that there were folks out there that you could go to and get mentored from and seeing good leaders as well as bad leaders allows you to develop." The leaders would mentor the team members. "I would come to him with a problem and he would guide me in the correct direction."

One XEF-67 leader pointed out that, "No one is ever going to speak their minds if leadership tells you to shut up and sit down every time you offer up a suggestion."

Management by wandering around was another topic mentioned. "I had an old crusty naval officer telling me when I was wet behind the ears about management by walking around. If you're not walking around you're not managing; you're not listening. You can't sit in your office in today's world with FB and Twitter and emails. I think

there is a tendency to believe that is in fact reality. Know that the people behind are

actually posting it. I don't do email wars. The first couple of times that I started getting

hate mail where you can read it in email, those individuals obviously are not talking to

each other. Pick up the phone. And that's the other thing as far as a leader trait is talk.

Pick up the phone. And management by walking around and going around and just do

that. I can't tell you how often I just walk around the building into different offices:

Hey, how's it going. Hey, there, everything's fine, but, and I always learn a little tidbit."

<p style="text-align:center">Listen</p>

If I'm going to say something to you
you gotta know that I'm going to listen to it
I'm not just gonna go, no, no, no, that won't work
People in this group didn't feel like they needed to keep their hands down
when they had a good idea.
I mean I was in plenty of meetings, when they had an idea,
they don't hesitate to raise their hands.
But that comes from the top.
I was a supportive enabler for the teams
in really kind of a servant leadership role
These are not rocket scientist ideas
these are just allowing folks to come up with creative ways
to get the capabilities out there.
You have to allow folks to have an understanding
that they have the freedom to be innovative
I guess what you do is actually listen to what people are talking about
So you have to listen to people most.
Listen that they are ideas, and I think you have to have, like people have to have some
freedom, not lock them into their job description.

Know the Process/Challenge the Process/Manage Risk/Good Enough

The leaders of the ABX-23 improvement project constantly challenged the status

quo. Review timelines were shortened and, in some cases, reviews were eliminated. Test

reports were delivered significantly faster than normal.

The leaders in the study knew the acquisition process well. They had completed

the required training and were certified in their respective career field. Yet at the same time they constantly challenged the process. Every requirement was questioned individually. Is this step in the process actually required? Who says it is required? Where is it documented? Are there exceptions to the process? Can we get permission to streamline or eliminate this step in the process? The unacceptable answer was, "We've always done it that way." Here are a couple of stories that illustrate these concepts well.

Steve was the test manager for the CDX-45. Testing is divided between DT and OT. The DT focuses on making sure the systems function correctly from a developmental perspective, while the OT can be viewed as a final exam of the system by fleet operators. Upon completion of the DT, the DT squadron writes and approves a DT/OT transition report. The DT/OT transition report explains any deficiencies found in the testing and provides a recommendation to proceed to OT. An OTRR is the final step in the process prior to certification to start OT.

Preparing for an OTRR is a major team effort by a program office. Even before the DT/OT transition report is signed, the program office begins preparing the OTRR presentation. The criteria for OTRR certification include 20 major elements with each major element containing numerous sub-elements. The OTRR presentation for the CDX-45 was almost 50 PowerPoint slides, not counting backup. The IPT collaborated to prepare the OTRR slides and conducted several internal dry runs of the presentation. The IPT then conducted dry runs with the level 1 co-leads. Once the level 1 co-leads were satisfied with the presentation, they conducted a dry run with the program manager. All of this was happening in parallel to the DT squadron approval of the DT/OT transition report. The next step in the process would normally be a pre-OTRR followed a couple of

weeks later by the formal OTRR. The pre-OTRR is chaired by the deputy-PEO while the OTRR is chaired by the PEO.

The program manager questioned the need for both a pre-OTRR and an OTRR. These separate meetings added 2 weeks to the schedule and meant that this critically needed CDX-45 would be delivered 2 weeks later. This was 2 extra weeks that Marine helicopters were vulnerable to the imminent threat. The program manager was able to convince both the deputy-PEO and the PEO to eliminate the pre-OTRR and go straight to the OTRR. The program manager's credibility, integrity, and professionalism helped with the convincing process. The fact that the team understood the process and completed a very successful pre-OTRR also helped.

The pre-OTRR board normally consists of middle managers representing each of the competencies at the GS-15 level. The OTRR board is typically the O-6 or SES level department heads from each of these competencies. Because there was no pre-OTRR, each of the middle managers requested individual briefings from the IPT. So rather than having a single meeting for a pre-OTRR, the IPT had to conduct dozens of individual briefings. At the OTRR, both the department heads and the middle managers attended. Each of them was leery that the program office was trying to pull some kind of trick by skipping the pre-OTRR. Steve's primary lesson learned was to never skip the pre-OTRR.

When Evan began planning for the ABX-23 OTRR he asked Steve for advice. The program manager wanted to skip the pre-OTRR like CDX-45 had done. However, Evan took Steve's advice and recommended conducting the pre-OTRR. Both Evan and Steve knew that the instruction allowed the PEO to wave the OTRR requirement and certify for OT. The ABX-23 IPT followed the same process in preparing for the pre-

OTRR. But the program manager was able to convince the deputy-PEO to waive the requirement for a signed DT/OT transition report prior to conducting the pre-OTRR. Instead, a Power Point summary of the report was provided with the promise that the signed DT/OT transition report would be delivered prior to OTRR. The OTRR was scheduled to occur 2 days after the pre-OTRR instead of the normal 2-week timeline.

The pre-OTRR was completed very smoothly. The DT squadron was satisfied with the test results and promised to provide the DT/OT transition report as soon as possible. Later that day, the signed DT/OT transition report was delivered. The program manager immediately went to the deputy-PEO and argued that there was no need for a formal OTRR. There was complete concurrence at the pre-OTRR that the system was ready for OT. The deputy-PEO agreed and proposed waving the OTRR to the PEO. The PEO agreed and the OTRR was cancelled and the ABX-23 was certified to go into OT.

In both of these cases, valuable time was saved by tailoring the acquisition process. The leaders both understood the process and challenged the process. Engineering Change Proposals (ECPs) were used to shorten the acquisition timeline.

The leaders of the ABX-23 and CDX-45 were described by a focus group as having "an openness with the process." The focus group also suggested that "they were given certain leeway on things too, were they not along the way because of that, on documentation and things. The ability to move contracts quicker and did not go through those particular wickets. Nontraditional acquisition. A lot of ECPs. Both of them were ECPs."

One leader in the XEF-67 stated, "Have the courage to focus on product, not process." He also stated that it was important to "let the engineers come up with viable

solutions."

Another XEF-67 leader said, "We knew that we were in need of lots of smart folks in the right places at the right time and it crossed a lot of different disciplines so there was not just the dispensers on the expendable side of the house that came into play. We had mechanical installation, structures, considerations, and all the other disciplines kind of running through the whole set of processes of making it happen." He went on to describe his own role as a leader: "And I really was just keeping things clear, making sure that any of their hurdles were easily accomplished in really kind of a servant leadership role, I guess, if you want to consider it like that." His previous experience had helped him know the process: "leading that team and working through all of these processes, understanding what has to happen from start to finish." He went on to say, "From an innovation standpoint, I think the only thing I would add is that we tend to be risk averse. I think that's a detriment to innovation. We need to understand the risks, but my experience has been that in looking at the XEF-67 project that we did and in other areas that we tried to expand the envelope, this community is risk averse, and that's a detriment to innovation."

Captain Peter described how he treated the ABX-23, CDX-45, and XEF-67 different than other projects: "As you know, each came with an urgent operational needs statement, so that in itself separates them from the normal acquisition program. Each of these could not be successful in terms of urgency, in terms of the ability to quickly get it out to fleet if we treat it as a normal acquisition program. I think a good example is ABX-23 SAFTI. We decided it needed to operate under an urgent needs statement, and the Army decided to go down a normal acquisition program. And here we've had SAFTI

in the fleet working in theater for 2 years, and the Army still has nothing. So there's

definitely an urgency behind it, CDX-45 had an urgency behind it, we were able to

muster all our forces, our funding and get it out there." He went on to say that "we were

allowed to sole-source things. We were allowed to take a bit of risk." He said, "I think

what you have to do as a leader is to allow the folks to challenge the acquisition

assumptions." Many times he used the terminology of "break down barriers" as an

important role of his leaders. He said that leaders need to "feel like they can do what

they need to do allows them to think outside of the box and challenge the assumptions."

Captain Peter also stated that "if the leadership sets the tone of the program office,

hey, we're going to do things a little bit different here, and we're going to try new things

and not to worry, I've got your back. That allows folks to get outside their cubicle and

challenge the assumptions that are out there and try to pattern their behavior on what their

leaders tell them to do."

An emerging leader on the ABX-23 suggested his experience: "I definitely think

it's making me more effective, just because I learned the process: what needs to be done

when, learning the engineering process and going through the check list and that kind of

stuff."

One leader described creativity, invention, and innovation as "circumventing the

normal acquisition process." He went on to say that "there are policies and procedures in

place, but we can work outside those boxes too." It is critical for the leader to know

when to follow the normal acquisition process and when to circumvent it. This is where

knowing the process and the leader's credibility, integrity, and professional experience

are needed.

A focus group suggested how processes were accelerated for both ABX-23 and CDX-45: "Traditional acquisition process is very labor intensive and traditionally long, but because of the urgency there were very innovative ways that we were able to, not skirt the system, but do things efficiently and effectively and maybe do the paperwork as we were moving forward." They went on to describe how a serial process was completed in parallel: "This person is worried about this particular review, but actually I can do this other item at the same time. You know, there's different ways of looking at marching through the process."

An engineer on the ABX-23 suggested: "I think that leadership that questions test processes and constantly refines them brings out innovation. If it's the right thing to do, that's fine, but if there is a question and the leadership questions it, then change the process."

The leaders across all three projects and at all levels in the organization knew the process, and challenged the process. They were intentional about taking risks to accelerate the process. Sometimes serial processes were collapsed to parallel processes with the understanding that some risks were added.

Several leaders mentioned the need to avoid perfection and deliver a product that was "good enough." One of the engineers on the ABX-23 team mentioned: "If we're giving them a new capability that could potentially make it worse for them, then you just gotta think about, not outside of engineering, every engineer wants to do the 110% solution, I want to give them all the bells and whistles. Sometimes all they want is the 80% solution. They just want something. And as long as it doesn't hurt their ability to fly an aircraft with people on board in harm's way, it's going to help them."

An ABX-23 leader told about feedback from the fleet: "When we first deployed the software, we got word back, this thing goes off all the time; it's horrible. And we started scratching our heads; we were worried about it, and then about 2 weeks later, a helicopter squadron was out there flying around. The captain of the squadron was the lead and a bad guy started shooting at them, and all four of their ABX-23 SAFTIs went off at the same spot. They were able to look out the door, identify the point of origin of the shot, they turned away, got around, the captain got to take the lead, and then he got to say, 'Suppress the target.' And we got the word back, and he said, 'Hey, Man, this is the best thing we've ever seen.' So it was good to see it actually perform. It hasn't always performed that well, but it allowed us the opportunity for them to say, Hey, maybe I can deal with it going off every now and then when it shouldn't, when every now and then it's going to give us some situational awareness and we may be able to suppress a target that could actually hurt somebody."

The CDX-45 was fielded with several known deficiencies. But it was more important to have something out there protecting our helicopters that had known problems than to wait until everything was perfect and have nothing.

Leaders of the ABX-23 and CDX-45 mentioned: "The risk of getting everything checked out and waiting until everything was perfect was also understood, in the sense that we don't have the luxury of time to get it 100% right and everybody understood that. All the way down to the users who were the air crew who want the most perfect system they can get, they came around at the end to say, okay, this is way better than what we have now." He said that everybody understood, and the reason he knew that everybody understood was because he had repeatedly helped them understand.

Another evidence of good enough is that all three of these programs continued to improve their systems and software after the initial operating capability. The concept was to give the warfighters what they needed to save lives immediately and then progressively make the system better. Something was better than nothing.

<center>

Challenge
Allow the folks to challenge the acquisition assumptions.
Have the courage to focus on product not process.
Leadership that questions test processes
and constantly refines them
brings out innovation.
Let them explore the boundaries
If it's the right thing to do, that's fine,
but if there is a question, then change the process.
This community is notably risk averse, and that's a detriment to innovation.
You're not going to get innovation out of one team if the entire program office,
or the entire industry or the entire company is worried about failure.
There's different ways of looking at marching through the process.
Sometimes all they want is the 80% solution.
They just want something.
And as long as it doesn't hurt their ability to fly an aircraft with people on board in
harm's way, it's going to help them.
We didn't have the luxury of time to get it 100% right and everybody understood that.
willing to think outside that box
leadership sets the tone
we're going to do things a little bit different here
we're going to try new things and not to worry
I've got your back
That allows folks to get outside their cubicle
and challenge the assumptions that are out there
and try to pattern their behavior on what their leaders tell them to do.

</center>

Vision/Passion/Assertive/Persistence/Moderating Setbacks

Dave glanced out the window at the snow but had to take a second look. He knew the forecast said a heavy snow, but what he saw outside was deeper than he expected. He turned on the news and confirmed that the federal government in DC was closed due to the snow storm. Only essential employees were required to report to work. Dave was

not an essential employee, but he knew that he had to somehow, some way, get to work.

Dave put on his warm coat and headed outside with his giant snow shovel. Two feet of snow were piled on top of his vehicle. The streets weren't even plowed yet. As he shoveled the driveway, his mind wandered to the Marines far away fighting the war. One of his coworkers was in the war zone waiting for the latest software update from the contractor. And test data from the field were urgently needed at another Navy lab.

Dave cleared the driveway just enough to get his 4-wheel-drive vehicle out of the driveway. In many ways, the drive to the base was especially lonely. His road was still not plowed, and he made the first tracks down it through the snow. When he got to the main road that had been plowed, he had to stop and shovel a small opening just to get past the giant pile of snow created by the plows. The main road was cleared, but most of the vehicles he saw had a blade on the front and were heading out to clear parking lots and driveways. He thought that a blade would be nice on his vehicle, but it seldom snows this much in Maryland.

There was no line at the gate entering the base. The guard was bundled up to keep the cold weather out. As Dave pulled into the parking garage, he had his pick of the prime parking spaces. Just a few cars were there. They were from the essential employees who managed to get past the snow ahead of him.

The office was dark when he opened the door. After sitting at his desk a couple of minutes he realized that there was no one to unlock the classified computer room so he could retrieve his classified e-mail from the war zone. The data were critically needed to keep the project moving forward. And the classified package he was expecting was not there either.

Dave began calling people at home to figure out what to do. He found out where mail was delivered on base. Normally he would just wait for the package to arrive, but he knew how critical it was for the ABX-23 project to keep moving forward. Every day that the project delayed was another day that aircrew were without the protection that the ABX-23 software upgrade would provide.

Dave drove across the base to the mail center. A lone person manned the desk and was eventually able to find the package in a mountain of undelivered mail. Dave drove back to the office with the package. After confirming the contents, he locked it in the safe. It wouldn't do him any good until there was someone to open the classified computer room for him. He called Mike, the security manager, at home again. Mike was still shoveling his driveway, but his road wasn't plowed yet. And Mike didn't have a 4-wheel-drive vehicle. Dave offered to come to Mike's house to pick him up.

As Dave drove across town, he noticed a few more cars on the road. Some kids were out playing in the snow. A few more brave souls were out shoveling their driveways. A few driveways were completely cleared to the unplowed road. Dave chuckled to himself that those must be the people who just bought a new snow blower. Mike was bundled up and waiting by the street when Dave arrived.

It took less than an hour for Dave to receive and send all of his classified e-mails. The folks in the war zone had what they needed. And the lab in California could begin analyzing the data from the war zone. Now that Dave had completed his critical tasks, he could take Mike home and make a snowman with his kids.

The leaders in this study demonstrated vision and passion. This vision and passion drove Dave to extraordinary lengths to get the critical things done after a snow

storm. Many of the other leaders in this study talked about vision and passion.

Captain Peter described his attitude about the ABX-23, CDX-45, and XEF-67: "I'm very passionate about this when each of them had a specific need, there's no way you can argue in terms of one is more important than the other."

Kevin described his vision and passion leading the ABX-23 team: "I think my contribution to its success was putting true focus on the project. I think I was able to see the forest with all those trees right in front of me and guide the team down a path that got everyone working together." He went on to say, "My attitude is that as long as it doesn't hurt a sailor or Marine or Air Force, and it gives them any information that might bring them back alive, then I'm 100% dedicated to it." But he also said that sometimes his passion interfered with innovation, "Some of that's passion, and though passion is a good thing for a leader to have, it can also stifle innovation because people know that I'm passionate about getting done what we've got on our plate. Sometimes that passion keeps those guys from coming over and giving me that nugget."

Another leader described vision as "a good leader is the one that's always looking out far in the horizon to steer the rest of the group to the right location and make those minor adjustments in the direction of where the team needs to go."

A leader of the XEF-67 project describes his own vision and passion, "It is a fair statement to say that I was the person principally responsible for the suggestion for, and champion for application of this capability to Navy and Marine Corps aircraft." He went on to say that he was the "leading advocate" and that "this concept was known to others, and other services, but was not originally applied to Navy and Marine Corps platforms until I began advocating for it."

The vision and passion didn't just come from the leaders; it came from coworkers and team members. Several people described how they were inspired by others on the team: "Actually, in the middle of it, the inspiration of it was the tie-in to the fleet operator. Our test pilot at that time--young guy, pleasant guy--came from the fleet. He was passionate about what we were doing. It was interesting to think that we were doing something here, and it's late at night, it's a Saturday night, but I'm doing something to help him do better. That was inspirational to me. In addition to that, when you have so many people vested in this, like Gail working crazy hours. I mean we'd finish like at 9 at night and then send the data and they'd look at data all night. When you have so many people working like that, you do what you can to pull your weight."

Followers described the impact of the vision on the team: "I think it helped that everybody knew and worked toward the same end goal that this is going to make a difference in the fleet."

Leaders in these projects were persistent and moderated any setbacks that the team encountered. One leader working all three programs said: "There's many ways the organization says no, but very few ways that say yes." Captain Peter described his attitude about these projects: "My attitude was we gotta do it, gotta do it, we gotta find a way, and let's get it done, and now we have the systems out there on the fleet."

One XEF-67 leader described his role in the project: "I pushed as hard as civility and the proper chain of command would allow." He went on to say: "Innovation is not always forthcoming. Sometimes it takes a while to get something to work."

The leaders in these projects moderate their setbacks. One ABX-23 leader was described as "a very steady influence through that. He just kept saying, don't worry,

we'll get it, we're working on it." The leaders viewed challenges as a temporary hurdle to overcome. When a setback occurred, the leaders removed emotion from the situation. They would not go into dramatics like it is the end of the program or the end of the world. They would just work on solving the problems and moving forward. One emergent leader in the CDX-45 was described as persistent: "He kept going with it even when things were really hard."

One ABX-23 leader described his persistence: "I'm a get it done on time guy, right? I'm called a closer; if I was a baseball guy, I'm a closer. I don't pie-in-the-sky get stuff started. I take something that's out of whack and get it back on track, and I can get it closed. I'm a closer."

One leader described her experience during the difficult times with the ABX-23 and CDX-45: "When you're doing things like that, it's real easy for morale to slip if you're not keeping a really positive attitude in trying to be the person who says, Come on, let's go, let's keep it going." They not only listened, but asked, "How can we make this work?" This helped the team want to keep going. Another leader for ABX-23 and CDX-45 said that "being persistent drove us to success."

The leaders had a commitment to the team, and to the end product, and to the warfighter. The leaders had a positive attitude and kept the team pointed towards the goal during difficult issues. One follower said that "having a positive attitude and supporting the team can go a long way towards supporting the innovation."

Passion
you can't be a leader unless you know where you're going
I pushed it as hard as civility
and proper chain of command would allow
if you have an idea and it works

it's actually very motivating
passionate about what we were doing
passion can also stifle innovation
Sometimes that passion keeps those
guys from coming over and giving me that nugget
exhilarating feeling to show the Marine operators what we had achieved
it was one of the single greatest moments of my career
showing them what we had done to help protect them
Perseverance
because there's so many ways that this organization says no
but very few that say yes.
he kept going even when things were really hard
they don't go to extremes
they moderate their setbacks
see it as a temporary hurdle to overcome

Trusted Leader Credibility/Integrity/Professionalism

Integrity and credibility are the two halves of trust. In order for anyone to trust another, the trusted person must have both integrity and credibility. Integrity represents honesty and truthfulness, while credibility includes the capability of the person to perform the job. A leader builds credibility by delivering results and keeping promises. Another part of credibility is professionalism. Several leaders discussed various aspects of trust.

Captain Peter stated the importance of integrity, credibility, and trust: "I think that as a senior leader, integrity and credibility play a huge role, and if you work for somebody you know, when you have trust based on the integrity and the credibility of this person, you know and you trust that when they say, This is no kidding, really high priority, it must get done, that motivates people--that gets people. Yes, they'll complain, you know, because I did, but at the same time you know it's important. You want to do your best, so that encourages hard work, innovation, people thinking beyond what they normally do every day."

Captain Peter was also very intentional about recruiting more professional leaders: "It was clear when I came into the office, there were some skill sets that didn't match up with what we needed to do and some attitudes that didn't match where I needed this program office to go. It's taken awhile to get to where I wanted to be. It would have been easier to come in and just fire people, but that's also not typically a great way to do, because it puts everybody on a fear factor—if I screw up, then I'm fired. If you slowly transition people out that are not productive and are not meeting your command objectives, people tend not to notice that until they look around and say, wow, we've got a really strong program office. We had a really weak program office when I took over, but it just takes time to get the people and resources."

Another leader involved in both ABX-23 and CDX-46 stated: "Number one on all of my lists for leadership is always integrity, and that includes their own integrity and the integrity of the system."

Other leaders mentioned the role of professional leadership in the ABX-23 and CDX-46 projects: "Understanding your program and to plot the future. Being able to perceive or to predict what's going to happen in the future, not just this time frame but three or four years out." Another leader suggested: "Forward thinking. You can't be a leader unless you know where you're going."

One leader suggested: "I'd say a leader is a proactive planner. They put some time into thinking about how to get there."

One leader suggested of the leaders for the ABX-23 and CDX-46 projects: "They had to be very professional because there was such high visibility."

A leader for the XEF-67 stated that the single most important attitude and

behavior was "Trust." He went on to say: "It may sound cliché', but the best thing that

management can do is to get smart people and then empower/trust them. Innovation

comes from below, not directing from above."

The leaders for all three of these programs were seasoned professionals. They

had the knowledge, skills, and experience to perform their roles well. They had

completed the required training and certifications for their fields. They consistently built

trust and credibility.

Trust
Leadership is always integrity
and the integrity of the system
integrity and credibility play a huge role
and if you work for somebody you know
when you have trust based on the integrity and the credibility
you know and you trust that when they say
this is no kidding really high priority
it must get done that motivates people
Knowing that there were folks out there that you could go to
and get mentored from
and seeing good leaders as well as bad leaders allows you to develop.
not micromanage
allow some level of autonomy down.
put some time into thinking about how to get there

Collaboration/Teamwork/Recognition

Teamwork and recognition were evident across all three programs. All three

teams were recognized with formal awards. The competency leader focus group said, "A

leader is collaborative. They know how to make the best of the people that they have and

make them work together—creating a team environment. You all share a common

mission, a common goal." The focus group later described teamwork on the ABX-23 and

CDX-46: "And that's kind of the whole collaborative thing. We're all in this together,

and maybe somebody's not completely up to speed one day, so everybody else pulls a

little bit harder." They went on to say, "I think that overall the ABX-23 and the CDX-45 as a whole; they have a win-win attitude. That's always a positive reflection on the team as well as the outcome, so they always had that, and I think that's really supported the team thus far." One leader pointed out that the teams won many awards and that "I think that makes for wanting to keep with the program and keep going and make sure you do a good job of it." One leader responsible for writing awards said: "It was easy to write their awards."

One team member of the ABX-23 observed a "pass the kudos and pluck the arrows behavior from our leaders." He went on to say that "I would encourage team building and thinking outside the box to solve complicated problems especially between the two coasts. I believe the more people you have pointed at a solution, the more creative and effective the solution becomes."

One ABX-23 leader suggested, "And then there was also a good team behind all of that that made it possible. I think the key to the success of this was hinged upon that expertise at the research lab and of course the great relationship we had with the prime to get the work done." He later reflected, "I think ABX-23 was the pinnacle of my career. I really enjoyed working that because it was so rewarding. I have fond memories of that about 3 to 3½ years that I spent there. It was a good program. It got a lot of awards."

Another ABX-23 leader noted, "My contribution to the success was establishing the schedule and getting people to work together as a team to get it there." He went on to say, "It was a great program. I was lucky to fall into it. It was absolutely amazing to sit back as the new guy and watch this team. It was amazing to watch; it was fun."

A leader for the XEF-67 said, "No one person can know everything, or be

responsible for everything. I think the key to this, and any effort, is to define a goal, and let others bring their creativity and invention forward to create a path to that goal."

Another XEF-67 said, "We knew that this had to happen quickly, and so we knew that we were in need of lots of smart folks in the right places at the right time and it crossed a lot of different disciplines so there was not just the dispensers on the expendable side of the house that came into play, we had mechanical installation, structures, considerations, and all the other disciplines kind of running through the whole set of processes of making it happen."

The team had to communicate to collaborate and share information. ABX-23 team members shared, "There was a lot of communication leading up to the flights and the events that we were involved in." The compressed schedule led to rapid communication. Another ABX-23 team member stated, "The communication had to happen very fast."

It was important to pass information between various organizations. One person on the ABX-23 team was especially important in communicating with the developer, "My role is to interact with the developer, make sure that they are on course, listen to problems that they're having. Make sure that they're successful. Do everything I need to make sure they have everything they need so that they're successful. So I spend a lot of face time with them. So it was one-to-one meetings with the developer, watching the progress of the algorithms, making sure data was collected if they needed it, coming up with new types of data to collect."

Collaboration, teamwork, and recognition were clearly evident in all three programs and contributed to their success.

Teamwork
Pass the kudos and pluck the arrows
real life men and women say
I'm here because of you
if that doesn't motivate you to keep doing it, nothing will
getting that feedback just drives it home
make sure everybody understands
what we're trying to accomplish here
and why it's so important
have a sense of ownership
making folks feel like they are responsible
for both the success and the failures of the program
communication had to happen very fast
I probably interacted with almost everybody
we got it out there faster than anybody said we could
it was a pinnacle of my career
working on something that saves lives
and I got to see the benefit by meeting some of the people
that came and told us how we saved their lives
team awarded over and over and over again

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

Today's unpredictable environment requires innovative solutions to our national defense (Tomes, 2004). Fluctuations in the threats to national security are evolving so rapidly that the status quo cannot keep up. Product innovation can address explicit threats to our national security. Leader attitudes and behaviors can have a substantial impact on product innovation within a team (Chartier, 1998; Elenkov & Manev, 2005; Wilson, 1989). Unfortunately we do not completely understand the effect of leader attitudes and behaviors on innovation (Elenkov & Manev, 2005; Yadav et al., 2007). A better understanding of the relationship between innovation and leader attitude and behavior is needed.

The purpose of this study was to determine the attitudes and behaviors of leaders in successful innovative integrated product teams within the U.S. Navy. The results of this research can be used to help foster additional innovation within integrated product teams and across organizations.

Research Methods

The research questions that were addressed by this study were: How do leadership attitudes and behaviors contribute to product innovation? How does leadership emerge in a complex adaptive system?

The research design was based on a qualitative approach (Creswell, 2008). The general methodology was multiple case studies, which is also referred to as comparative case studies (Merriam, 1998). The theoretical framework was based on a meso model of complexity leadership theory in the context of bureaucratic forms of organizing (Uhl-Bien & Marion, 2009). Complexity leadership theory requires new research methods such as qualitative case studies (Hunt & Dodge, 2000; Hunt & Repo, 1998). The intent of this research was to develop interpretive case studies, which contain rich and thick descriptions. Stories were used extensively throughout the case studies. This research used both narrative inquiry as a research method and narrative as a phenomenon which is the story in all we do. Narrative inquiry asks questions of meaning, social significance, and purpose (Clandinin & Connelly, 2000).

A purposeful sample for this research was specifically selected because of unique attributes (Merriam, 1998). The teams in this sample were unique because they have demonstrated breakthrough innovation with disruptive technology. They also were selected because they completed within cost and schedule thresholds.

Data were collected from interviews, focus groups, and program documentation. The selection of individuals to participate in interviews and focus groups was an evolving and iterative process. The questions for interviews and focus groups made use of concepts of Appreciative Inquiry, based on positive questions rather than focusing on problems (Cooperrider, 1986). The data were analyzed based on themes that were common across all three cases and mentioned or demonstrated by numerous leaders.

Limitations of the Research

There were several limitations of the research. The participants may not have

been aware of the complex adaptive systems that contributed to the innovation. The participants may not have been able to recognize how leadership attitudes and behaviors contributed to innovation. The participants may not have had time to reflect on the innovation environment. The participants may not have had time to participate in the interviews and focus groups.

Theoretical Framework

Complexity Leadership Theory forms the basis for the theoretical framework of this research. Uhl-Bien and Marion (2009) suggested a meso model of complexity leadership theory that applies to bureaucratic forms of organizing. They highlight the unique functions of both the formal administrative function and the informal adaptive function. Innovation, learning, and adaptability occur naturally when the two functions are effectively entangled and enabled. The complexity dynamics include non-linearity, bonding, and attractors. Uhl-Bien and Marion encourage a qualitative approach including case studies to address the problem.

Summary of Findings

The sample for this research was based on interviews and focus groups with 18 individuals who participated in three projects. The attitudes and behaviors of nine formal leaders and several emerging leaders were analyzed and evaluated. The results are summarized in six different themes that were apparent across all three projects and multiple leaders.

First Research Question

The first research question that this study addressed was: How do leadership

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attitudes and behaviors contribute to product innovation?

The first theme, urgency driven by a heartfelt need, seems both obvious and somewhat counter-intuitive. I struggled with this theme because it goes against my grain as an engineer. Engineers love to solve problems and all an engineer needs to get a better solution is more time. So I wondered if the urgency actually contributed to the innovation, or if the innovation occurred in spite of the urgency. My informal description of this theme is a twist on the old adage of "A job worth doing is worth doing well." Instead I have changed it to, "A job worth doing is worth doing fast."

Everyone on these projects knew the urgency and why they were urgent. Each person did whatever they could to compress the schedule. Yet, at the same time, participants in the study said that time to reflect was also critical to innovation. If you ask an engineer what they need to solve a problem, their answer is consistently: "More time." However, these projects were able to solve difficult problems with less time. In fact, some of the innovation came from the lack of time.

Historically, many innovators and inventors have been in a rush. The Wright brothers were in a race to be the first to fly. Silicon Valley is known as a fast-paced environment where innovations and inventions are both frequent and highly competitive.

The reason that urgency based on a heartfelt need contributes to innovation is that the team was forced to use what it had. The urgency drove the team to upgrade the ABX-23 software to perform the SAFTI function instead of adding a new box dedicated to SAFTI on the aircraft. The urgency drove the team to adapt the CDX-45 from another service, rather than create a new system. Urgency drove the XEF-67 to build on the existing systems.

The second theme was that leaders would listen and were open to ideas. My informal description of this theme, "You have to have faith that your voice will be heard," is a direct quote from one of these leaders in the study. The participants in the study noted that this listening was outside the norm in these projects. This is probably the most obvious theme in my study, but is often overlooked by leaders. When the leader listens and is open to ideas, it encourages the team to think for themselves and generate more ideas.

This listening and openness to ideas was directly coupled to the urgency. The leader would ask the team to give any ideas and suggestions that could accelerate the schedule.

The third theme was to know the process and challenge the process while managing risk and making sure it's good enough. My informal description of this theme is "Good enough is best." Innovators need to know the rules better than those who only follow the rules. They must know the rules and know the exceptions to the rules.

This theme is related to urgency. Often a formal process has normal timelines and associated delays. In challenging the process, the leader shortened the schedule. Often steps in a process that were normally serial would be completed in parallel. It was understood this parallel approval added some risk, but the leader was willing to accept the risk to shorten the schedule. This challenging the process resulted in innovation to the process.

The fourth theme was vision, passion, assertive, persistence, and moderating setbacks. My informal interpretation of this theme is, "You have to know the difference between cotton balls and cannon balls." This quote came from one of the leaders in the

study. As a program manager, there are many people criticizing your work and decisions. When listening to the critics you have to know which ones are shooting cotton balls and which ones are shooting cannon balls. The cotton ball criticisms you can ignore. They will just bounce off you and not hurt you. But pay attention to the cannon balls. They will hurt you and you need to address them appropriately.

The vision and passion of the leaders came directly from the urgency based on a heartfelt need. The leaders were also assertive and persistent because of the urgency. They knew that being passive or giving up could mean another aircraft shot down. When there was a problem, the leaders didn't let the team get discouraged and slow down. They moderated the setback and reminded the team of the criticality of the project.

The fifth theme was trusted leader credibility/integrity/professionalism. The leaders in this study had credibility and integrity. They were professionals. A common expression in innovation is "thinking outside the box." But innovators must be both inside the box and outside the box. They must be inside the box enough to know the process. And they must be outside the box enough to find creative solutions to obstacles. My informal description is: "You must have one foot inside the box and one foot outside the box." If you are too far outside the box, you lose credibility. If you are too far inside the box, you are not open to ideas and become comfortable with the status quo.

Credibility, integrity, and professionalism were critical for the leaders because it allowed them to successfully take risk and challenge the process. These characteristics encouraged the organization to trust them with innovative approaches. The leaders were careful to increase their credibility by delivering on promises and mitigating risks.

In my study this was especially necessary when challenging the process. The

leader would often need to ask the process owner for an exception to the process. Or find someone who outranked the process owner to explain why the process needed an exception.

Credibility and integrity allow the leader to take more risks. The leader can say, trust me, I won't let this break. Professionalism can also give the leader more credibility. The leader would argue that a typical review was unnecessary. However, the superior would disagree and force the review. The leader would do such a good job preparing for the review that once it was done, the superior would agree that maybe it wasn't necessary. That would give the leader more credibility the next time.

The last theme was collaboration/teamwork/recognition. My informal description of this theme is, "Innovation is a team sport." The leaders in the study encouraged collaboration and teamwork. They praised and rewarded the team both informally and formally. It is clear that collaboration, teamwork, and recognition played an important role in all three cases.

The six themes are listed in Table 7 along with short titles and my informal descriptions. The short titles are used later in a figure.

These themes can be described chronically as the project progresses to more thoroughly understand how leader attitudes and behaviors synergistically contribute to innovation. Product innovation begins with a leader who is credible, has integrity, and is professional. The leader is trusted with a difficult challenge. The leader understands that

Table 7

Themes With Informal Descriptions

Short Title	Theme	Informal Description
Urgency	Urgency driven by a heartfelt need	"A job worth doing is worth doing fast."
Listen	Listens and is open to ideas	"You have to have faith that your voice will be heard."
Challenge	Know the Process/Challenge the Process/Manage Risk/Good Enough	"Good enough is best."
Passion	Vision/Passion/Assertive/Persistence/Moderating Setbacks	"You have to know the difference between cotton balls and cannon balls."
Trust	Trusted Leader Credibility/Integrity/Professionalism	"You must have one foot inside the box and one foot outside the box."
Teamwork	Collaboration/Teamwork/Recognition	"Innovation is a team sport."

the innovation is urgent with a heartfelt need. The leader shares the urgency with the team and helps them understand the need through emotional stories. The leader shares the vision and passion of solving the problem as quickly as possible. The leader listens to the team as they share their concerns with the impossibility of the vision. The leader is open to ideas and suggestions. The leader knows the acquisition process and challenges the team to find ways to streamline the process. The leader challenges the status quo.

The leader pushes for a solution that is good enough that can be completed rapidly rather than the perfect solution that takes too long. The leader encourages teamwork and collaboration. Whenever the team runs into an obstacle the leader takes immediate, extraordinary steps to remove or mitigate the obstacle. The leader is persistent and

assertive in solving the problems. The leader looks for small wins and successes along the way and praises the team. The leader encourages the team to take small risks that can accelerate the project without catastrophic consequences. When something goes wrong, the leader moderates the setback and keeps the team from getting discouraged. When the innovation is successfully completed, the leader formally rewards the team and celebrates the success.

Second Research Question

The second research question is related to the first: How does leadership emerge in a complex adaptive system? Leadership emerges from these same steps.

When a follower has a heartfelt understanding of the need and urgency, the follower begins to search for solutions. When this follower gives suggestions to the leader which are heard and acted upon, then the follower gains self-confidence. The leader praises the follower and the self-confidence increases more. When the follower runs into a problem and sees the leader take extraordinary action, the follower begins to feel more empowered and proactive. As a result the follower begins to emerge as a leader. The emergent leader begins to make independent decisions that are consistent with the formal leader's vision, passion, and assertiveness. When an obstacle is encountered, the emergent leader is proactive in removing the obstacle, while keeping the formal leader informed. The emergent leader is praised for being proactive. The emergent leader gains credibility and becomes more professional. Eventually the emergent leader is recognized as a credible, professional leader with integrity. When a formal leadership position opens up, the emergent leader is the natural choice and takes on the formal title of leader.

Discussion

In this section I will tie several of the themes that emerged from this research with literature that contains similar concepts. Then I will look at all of the themes holistically and align them with a few leadership and innovation theories. The themes will be explored in the context of my theoretical framework of complexity theory. And then the themes will also be portrayed as polarities. Finally, I will propose a wheel of innovation based on how these themes synergistically relate to each other.

Peters (1988) discussed the importance of fast-paced innovation. He recommends that managers practice purposeful impatience. Kotter (1996) said to establish a sense of urgency. Kotter (2002) emphasized the need for people to feel the need for change. This is especially consistent with the second half of the theme of urgency driven by a heartfelt need. Scranton (2006) found that extreme urgency drove the profoundly passionate and dogged determination of the leaders of jet propulsion during the Cold War which ultimately succeeded. Gibbert and Scranton (2009) establish that urgency played a role in jet propulsion innovation. Hewitt (2010) noted that urgency was a factor in innovation of unmanned aerial vehicles for the military.

Andersen (2008) borrows from the concept of bricolage to explain how innovation occurs by using what is available in an organization. One of the by-products of urgency in my case studies was that teams were forced to use what was available to them. This encourages creative solutions to the problems. It is the urgency that forced the team into a bricolage solution. They didn't have time to do it the normal way, so they had to use what was available.

Amabile et al. (2004) found that listening leaders improved creativity in an

organization. Chartier (1998) found that an openness to change encouraged innovation. Covey (1990) lists his fifth habit as "seek first to understand, then be understood," which is consistent with the theme of listening and being open to ideas. Savage (1999) found that leaders who implemented change had philosophies that included seeing possibilities and openness.

One leader in this study identified his role in the project as "servant leader." Listening and being open to ideas is consistent with servant leadership. Greenleaf (1977) said the essence of ethical leadership was servant leadership. The servant leader helps the followers become stronger, wiser, and more willing to accept responsibility. The servant leader listens and shares in the pain and frustration of the followers.

Kouzes and Posner (2002) list "challenge the process" as one of the five practices of exemplary leadership. Hedley (2002) found that leaders reinvented or realigned processes and structures multiple times over a long period to profoundly change the organization.

The leaders in this study had both vision and passion. Kouzes and Posner (2002) list "inspire a shared vision" as one of the five practices of exemplary leadership. Burns (1978) suggested that a transformational leader appeals to the moral values to energize followers through a shared vision. Sarros et al. (2008) found that vision is a major factor in innovation. Wilmot (2003) identified the dynamics of visioning. He found that these dynamics are triggered by an idealistic challenging of assumptions, beliefs, and behaviors and provide a climate for social innovation to thrive. One of Kotter's (1996) eight steps is creating a vision and strategy. Roberts (1997) found that vision was important in a major change effort. Moscarelli (2001) found that visionary leaders are critical to

innovation.

Passion is related to vision. A powerful vision can increase passion. Scranton (2006) found that innovation succeeded because of passionate leadership. Hedley (2002) found that leaders who profoundly changed their organization had a personal passion. Persistence is one of the leadership traits that have been identified (Yukl, 2006). Scranton (2006) found that innovation succeeded because of persistence.

France (2008) found that credibility is critical in innovation. It is sometimes necessary for a leader to lend credibility to an emerging leader. Mino (2002) found considerable correlations between organizational trust and organizational commitment. If followers trust their leader, then they will be more committed.

Roberts (1997) found that large organizations need to place more emphasis on teamwork. Caldwell and O'Reilly (2003) found that teamwork was one of the determinants for innovation. De Dreu and West (2001) found that higher levels of minority dissent resulted in more innovation only when there was a high degree of participative decision making. In the context of my study, minority dissent helps innovation because the leader listens and is open to ideas.

Osman (2004) found that the length and strength of past relationships along with knowledge acquired helped innovation succeed in collaboration. Savage (1999) found that those who implement change often speak of teamwork.

The themes that emerged from the data also have several correlations with existing literature. Several theories map across many of the themes. While some of the mappings are not one-to-one, they still provide an interesting insight.

Kouzes and Posner (2002) identify the five practices of exemplary leadership:

model the way; inspire a shared vision; challenge the process; enable others to act; and encourage the heart. Table 8 summarizes the alignment of the themes found in my study with the five practices.

Leaders in my study modelled the way by being credible, having integrity, and being a professional leader. The leaders inspired a shared vision by constantly reminding others why these projects were so important and urgent and through passion and being assertive and persistent with the project. The leaders constantly challenged the process and status quo. "We've always done it that way" was never a final or acceptable answer. The leaders enabled others to act by listening and being open to ideas and through collaboration, teamwork, and recognition. The leaders encouraged the heart through persistence, by moderating setbacks, and reminding everyone why projects were so urgent and important.

Kotter (1996) identifies eight steps for leading change: establishing a sense of urgency; creating the guiding coalition; creating a vision and strategy; communicating the vision; empowering broad-based action; generating short-term wins; consolidating gains and producing more change; anchoring new approaches in the culture. Table 9 aligns these eight steps with the themes.

The leaders in my study established a sense of urgency and communicated the vision by constantly reminding others of the importance of the three projects. The leaders created a guiding coalition through collaboration and teamwork. The leaders created a vision of completing these projects faster than anyone thought possible. They developed a strategy that accelerated the projects and maintained the credibility and

Table 8

Themes Aligned With Five Practices

Theme	Five Practices Kouzes & Posner (2002)
Urgency driven by a heartfelt need	Inspire a shared vision Encouraging the heart
Listen and open to ideas	Enable others to act
Know the Process/Challenge the Process/Manage Risk/Good Enough	Challenge the process
Vision/Passion/Assertive/Persistence/ Moderating Setbacks	Inspire a shared vision Encouraging the heart
Trusted Leader Credibility/Integrity/Professionalism	Model the way
Collaboration/Teamwork/Recognition	Enable others to act

Table 9

Themes Aligned With Eight-Stage Process

Theme	Eight-Stage Process Kotter (1996)
Urgency driven by a heartfelt need	Establishing a sense of urgency Communicating the vision
Listens and is open to ideas	Empowering broad-based action
Know the Process/Challenge the Process/Manage Risk/Good Enough	Generating short-term wins
Vision/Passion/Assertive/Persistence/ Moderating Setbacks	Creating a vision and strategy
Trusted Leader Credibility/Integrity/Professionalism	Anchoring new approaches in the culture
Collaboration/Teamwork/Recognition	Creating the guiding coalition Consolidating gains and producing more change

integrity of the final systems. The leaders empowered broad-based action by listening and being open to suggestions. The leaders generated short-term wins by managing requirements and expectations to good enough and through persistence and moderating setbacks. Something that helps sooner is better than perfect later. They also consolidated gains and produced more change through recognition of the successes achieved along the way. The leaders anchored the new approaches in the culture through credibility, integrity, and by being professional.

Yukl (2006) identifies 12 leadership behaviors across four taxonomies: supporting, developing, recognizing, consulting, delegating/empowering, clarifying roles/objectives, short-term planning, monitoring, envisioning change, encouraging innovative thinking, external monitoring, and taking risks/leading by example. Table 10 aligns these behaviors to the themes.

Leaders in this study supported followers by being persistent and moderating setbacks. Leaders developed and consulted by listening and being open to ideas. Leaders recognized their followers through both informal praise and formal awards. Leaders delegated and empowered followers by sharing the urgency and the reason for the urgency. Leaders continually clarified the roles and objectives of the projects to ensure that the product delivered was good enough. Leaders conducted short-term planning to ensure all the necessary tasks would be accomplished as fast as possible. Leaders continually monitored both internally and externally, the status of progress to ensure that the team was making the planned program and that the collaboration was successful. Leaders encouraged innovative thinking, took risks, and led by example through

Table 10

Themes Aligned With 12 Leadership Behaviors

Theme	12 Leadership Behaviors Yukl (2006)
Urgency driven by a heartfelt need	Delegating/empowering
Listens and is open to ideas	Developing Consulting
Know the Process/Challenge the Process Manage Risk Good Enough	Encouraging innovative thinking Taking risks/leading by example Clarifying roles/objectives
Vision/Passion/Assertive/Persistence Moderating Setbacks	Envisioning change Supporting
Trusted Leader Credibility/Integrity/Professionalism	Short-term planning
Collaboration Teamwork Recognition	External monitoring Monitoring Recognizing

challenging the process to shorten the schedule. Leaders envisioned change through passion and anticipating what was coming.

Chartier (1998) analyzed the relationship between top manager attitudes and behaviors, and innovation and performance within their company. He identified four attitudes: risk propensity, need for achievement, openness to change, and control of own destiny. Two behaviors were also identified: walks the environment and champions innovation. Table 11 links these attitudes and behaviors to the themes.

Leaders demonstrated an openness to change by listening and being open to ideas. They also demonstrated an openness to change along with a risk propensity by knowing the process and challenging the process. Leaders demonstrated a need for achievement through the urgency of the projects. The leaders demonstrated their desire to be in control of their own destiny through careful planning and being careful to maintain credibility and integrity. The leaders walked the environment through collaboration, teamwork, and recognition. Leaders championed innovation through vision, passion, being assertive and persistent, and moderating setbacks.

When these themes are analyzed in the context of my conceptual framework additional insights are gained. Uhl-Bien and Marion (2009) use three terms to identify the formal and informal dynamics—administrative leadership, adaptive leadership, and enabling leadership. In my case studies, the competency managers and process owners can be identified as the administrative leadership. The team leader can be identified as the adaptive leadership. The enabling leadership could be the team leader or one of his superiors, depending on the circumstances. When the team leader challenged the process, he was moving innovation from the adaptive leadership to the administrative

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Table 11

Themes Aligned With Attitudes and Behaviors

Theme	Attitudes & Behaviors Chartier (1998)
Urgency driven by a heartfelt need	Need for achievement
Listens and is open to ideas	Openness to change
Know the Process/Challenge the Process/Manage Risk/Good Enough	Openness to change Risks Propensity
Vision/Passion/Assertive/Persistence/ Moderating Setbacks	Champions innovation
Trusted Leader Credibility/Integrity/Professionalism	Controls own destiny
Collaboration/Teamwork/Recognition	Walks the environment

leadership. When the administrative leadership created a roadblock, he elevated the issue up the chain of command. The leaders who intervened and removed the road block performed the enabling leadership.

The fact that these three cases were successful is an indication that the organization had a healthy entanglement between the administrative leadership and the adaptive leadership.

These themes can also be explored in the context of polarity management. Johnson (1996) describes polarities as sets of opposites that do not function well independently. A leader cannot choose one side and neglect the other. Johnson uses the example of individual versus team as a polarity. Both are necessary and must be managed by the leader. In this context the six themes can be viewed at three polarities. Table 12 lists the three themes with the opposing polarity.

These themes can also be shown as a wagon wheel. Figure 11 is my representation of the six themes as a wheel of innovation. The short titles from Table 7 are used in the figure to enhance the graphic. Each spoke on the wheel is a theme with

Table 12

Themes Represented as Polarities

Theme	Opposing Polarity
Urgency driven by a heartfelt need	Listens and is open to ideas
Vision/Passion/Assertive/Persistence/ Moderating Setbacks	Collaboration/Teamwork/Recognition
Know the Process/Challenge the Process/Manage Risk/Good Enough	Trusted Leader Credibility/Integrity/Professionalism

Trusted Leader
Credibility/Integrity/Professional

Collaboration/
Teamwork/
Recognition

Urgency driven by
heartfelt need

Listens and
is open to ideas

Vision/Passion/
Assertive/Persistence/
Moderating Setbacks

Know the process/Challenge the process/
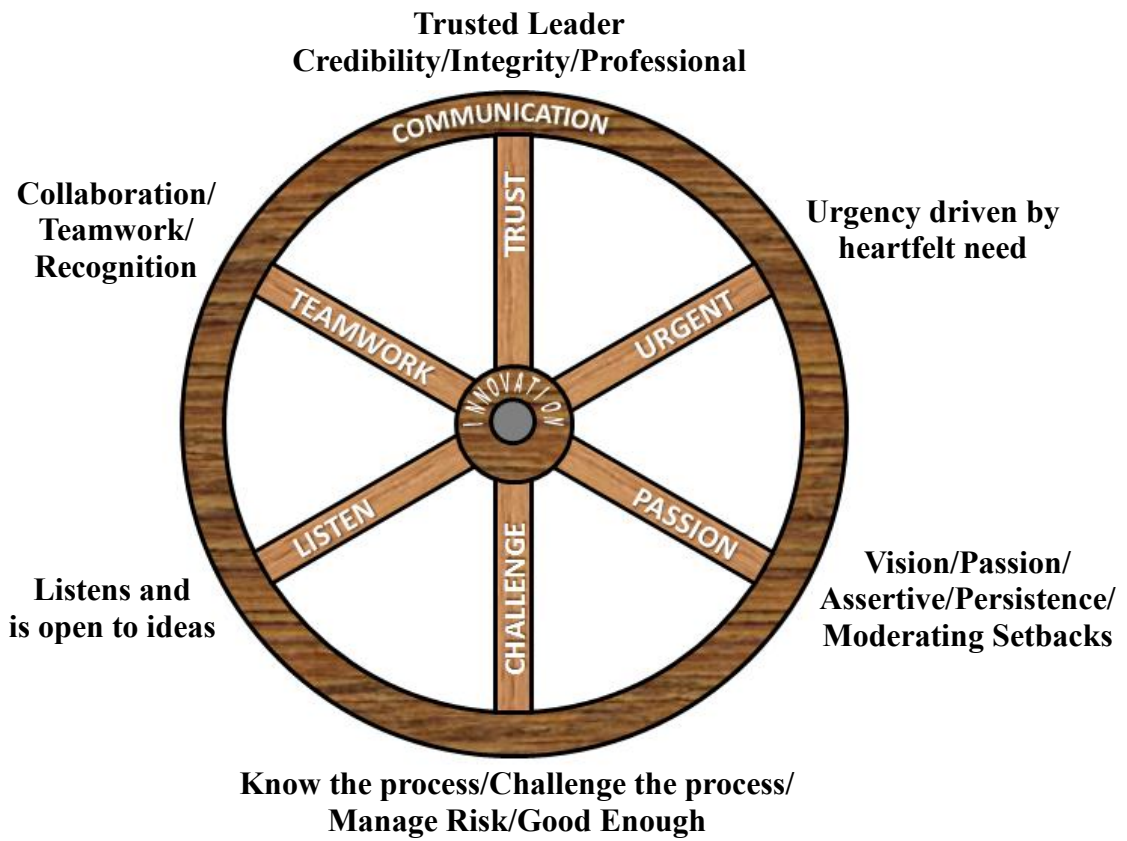**Manage Risk/Good Enough**

Figure 11. Wheel of innovation.

the rim of the wheel being communication which transcends all of the themes. Themes

on opposite sides of the wheel provide a synergistic balance to each other. A leader must

not only balance the themes but connect them synergistically and communicate

effectively.

A leader is trusted by the organization to lead an important innovation because of

proven credibility, integrity, and professional reputation. The leader understands the

urgency of the innovation which is driven by a heartfelt need. The urgency leads to

vision and passion. The leader is assertive and persistent in addressing issues and

moderates setbacks. The leader realizes that the need is too important to be slowed by

bureaucratic processes and the status quo. The leader also understands that there is not

enough time for the perfect product and searches for a solution that is good enough. The

leader's credibility, integrity, and professional reputation allow the leader to streamline

processes, take additional risk, and propose a solution that is good enough. The leader

listens to suggestions and is open to ideas, even though the project is urgent. Often

suggestions are implemented that shorten the schedule. Listening balances the urgency

and urgency balances the listening. The leader emphasizes collaboration and teamwork,

which balances the leader's vision, passion, assertiveness, and persistence. The leader

recognizes the team, which balances the times when the leader had to moderate setbacks.

The recognition of the success of the team increases the leader's credibility, integrity, and

professional reputation.

The wheel of innovation pushes innovation further, when it is attached to a piston.

Figure 12 demonstrates the themes as stages of a two cycle engine. The first stage of

intake and exhaust can be seen as a trusted leader with credibility, integrity, and

professionalism. The compression stage can be seen as both the urgency driven by a

heartfelt need and the vision/passion/assertive/persistence/moderating setbacks. Both

themes create pressure similar to the compression created by the piston. The ignition

stage can be seen as knowing the process, challenging the process, managing risk, and

seeking good enough. When the leader asks questions that challenge the process,

challenge the assumptions, challenge the requirements, it creates a spark in the team's

thinking. The questions create new possibilities. The next stage harnesses the power of

the ideas. The leader listens and is open to ideas and then encourages collaboration and
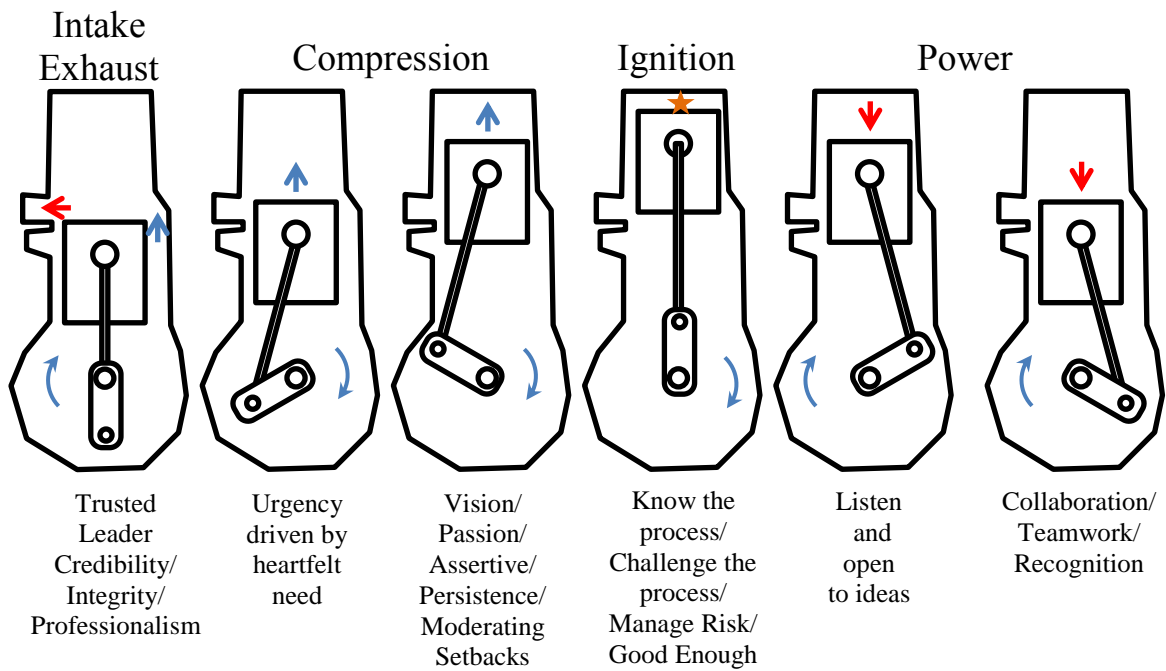
Intake Exhaust	Compression		Ignition	Power	
Trusted Leader Credibility/ Integrity/ Professionalism	Urgency driven by heartfelt need	Vision/ Passion/ Assertive/ Persistence/ Moderating Setbacks	Know the process/ Challenge the process/ Manage Risk/ Good Enough	Listen and open to ideas	Collaboration/ Teamwork/ Recognition

Figure 12. Innovation engine.

teamwork. At the end of the power stage, the engine begins to send the expended air out of the exhaust. This can be seen as the recognition.

The innovation engine model can be used to explain additional concepts that are not addressed in the wheel of innovation. The compression cycle represents the pressure that creates conflict. Some conflict helps innovation, but too much conflict hurts innovation (De Dreu, 2006). The exhaust and intake cycle is critical in preventing too much pressure, in the same way that a leader ensures that team conflict does not get so high that innovation is reduced.

Conclusion

1. The leaders established a strong sense of urgency based on a heartfelt need.

2. The leaders listened and were open to ideas.

3. The leaders knew the process, challenged the process, managed risk, and encouraged a solution that was good enough.

4. The leaders were passionate about the vision and were assertive and persistent in removing obstacles. They moderated setbacks and prevented the team from getting discouraged.

5. The leaders were professional, while maintaining or improving their credibility and integrity.

6. The leaders encouraged collaboration and teamwork. They recognized the team both informally and formally.

7. These leader attitudes and behaviors can be represented as polarities that synergistically contributed to the teams successfully delivering innovative products.

8. These leader attitudes and behaviors can be represented as a wheel of innovation that synergistically balances the environment to create optimum innovation.

9. These leader attitudes and behaviors can be represented as an innovation engine that creates the proper amount of pressure and conflict to propel the innovation.

10. These leader attitudes and behaviors contributed toward leaders emerging in the organization.

Recommendations

Innovation Leaders

Leaders in innovation need to find that compelling reason why their innovation is needed now. It should be a heartfelt reason that every follower can understand and feel. Stories are an excellent way to share the basis for the urgency.

Leaders need to listen and be open to ideas. Your followers must have faith that their voices will be heard. If your followers are not bringing ideas to you, then you have not successfully convinced them that you are listening and are open to ideas.

Leaders need to constantly challenge the requirements by asking if something is good enough. Aiming at the good enough solution that is better than nothing can keep the team from chasing that elusive dream of perfection. Something that is good enough now is better than perfect later. Know the process better than anyone and then challenge it. Be willing to take risks that can accelerate the innovation, but do not have catastrophic consequences.

Passion and vision can go a long way for a leader. Take immediate action to overcome obstacles by being both assertive and persistent. When something goes wrong, be sure to moderate the setback and keep the team from getting discouraged. Be professional, while maintaining or improving your credibility and integrity. Leaders should encourage collaboration and teamwork. Praise and reward the team both informally and formally.

Leaders should balance these polarities to synergistically drive innovation while mentoring, empowering, encouraging, and recognizing tomorrow's emerging leaders.

Policy Makers

Acquisition within the U.S. Department of Defense is full of rules, regulations, policy, and processes. Some of this policy is either conflicting or redundant. Policy makers need to streamline the acquisition process. Rules, regulations, policy, and process should have clear exceptions that make sense. There needs to be sufficient flexibility in the process to allow rapid fielding of urgently needed capabilities.

Future Research

The biggest gaps in the literature relate to urgency and the concept of good enough in product innovation. More research is needed about the role of urgency in product innovation. Most of the literature on urgency relates to organizational change or process improvement. More research is needed about the concept of good enough in product innovation. Most of the literature on the 80% solution is related to organizational change or process improvement.

Additional research is needed on the interrelationship and synergy of the themes identified in this research. The polarities that are identified in this research need further examination in other contexts and communities. Further study is needed to determine if these findings are limited to urgent Navy acquisition programs, or can be applied across the U.S. Department of Defense, in less urgent innovation. Finally, additional research is needed to determine if these findings apply to the commercial sector where fast-paced innovation is the norm instead of the exception.

Additional research is needed to more fully understand innovation in the military. Further studies could address failures in innovation. Studies could address the leader attitudes and behaviors that slow or stop innovation in the military.

Final Thoughts

I began this quest to find those elusive qualities of a leader that would cause an innovative product to magically appear. I had some preconceived ideas. In a few cases, my preconceived ideas were right. But many of my preconceived ideas were wrong. Unfortunately, the attitudes and behaviors that lead to successful product innovation are neither simple, nor easy. Leadership is hard work. All the leaders and teams in my three case studies worked hard. They worked long hours. They skipped vacations. They missed their kids' recitals and soccer games. They lost sleep. They endured what seemed like insurmountable obstacles. They rebounded from disappointments. They were persistent and passionate. They worked together and eventually their hard work and persistence paid off. The projects were successfully fielded and lives were saved. And for many of these leaders, it was the pinnacle of their careers, and included some of their favorite memories.

I can't help but wonder if some of these attitudes and behaviors might apply to other areas of my life. What if these were applied to that job around the house that never seems to get done? Could these principles be applied to leadership at church? Could these concepts be applied at school? What if I applied these themes to completing this dissertation?

In conclusion, I end with my informal descriptions that summarize the six themes:

1. "A job worth doing is worth doing fast."

2. "You have to have faith that your voice will be heard."

3. "Good enough is best."

4. "You have to know the difference between cotton balls and cannon balls."

5. "You must have one foot inside the box and one foot outside the box."

6. "Innovation is a team sport."

APPENDIX

APPENDIX A

SAMPLE QUESTIONS

APPENDIX A

SAMPLE QUESTIONS

The questions were drawn from the concepts of Appreciative Inquiry based on open ended positive questions and stories. Here are the sample questions:

- What was your role in (project name) and how did you contribute to its success and innovation?

- How do you define creativity, invention, and innovation?

- What is your favorite story that demonstrates innovation in (project name)?

- Who inspired or encouraged you the most to stick with (project name) and how did they inspire you?

- Who contributed most to innovation in (project name) and what was his or her most significant contribution?

- What previous knowledge, skills or experience prepared you the most for (project name)?

- How did (project name) experience or previous experience prepare you to be more innovative and effective?

- Who was your supervisor or supervisors during your involvement in (project name) and how did he or she encourage your participation?

- What leader attitudes and behaviors contributed to innovation and success? Give me an example of leader attitude or behavior that contributed to the innovation

and success of (project name).

- Who were some of the key participants in (project name)? How did they contribute to innovation?

- If you were a senior leader in the organization what would you do to encourage innovations such as (project name)?

- What was the event that moved (project name) to the forefront? What was the catalyst? What was the first domino that caused all the other dominos to fall, propelling (project name) to success?

- Has the team been recognized with any awards related to (project name)?

- Who is the best person to provide acquisition documents related to (project name)?

APPENDIX B

ANDREWS IRB APPROVAL AND EXTENSIONS

APPENDIX B

ANDREWS IRB APPROVAL AND EXTENSIONS

Andrews ⬧ University

November 15, 2011

Mr. Eddy Witzel
Tel: (760) 608-1601
Email: eddy.witzel@navy.mil

RE: APPLICATION FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS
IRB Protocol #: 11-111   **Application Type:** Original   **Dept.:** Leadership
Review Category: Expedited   **Action Taken:** Approved   **Advisor:** Shirley Freed
Title: Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams Within the US Navy: A Multiple Case Study

This letter is to advise you that the Institutional Review Board (IRB) has approved your proposal for research involving human subjects entitled: "Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams Within the US Navy: A Multiple Case Study " IRB protocol number 11-111 under Expedited category. This approval is based on Naval Air Warfare Aircraft Division (NAWCAD) IRB approval protocol number NAWCAD.2011.0005-IR which is duly constituted according to the Federal Rules.

This approval is valid for one year. If your research is not completed by the end of this period you must apply for an extension at least two weeks prior to the expiration date. We also ask that you inform the IRB Office whenever you complete your research.

Any future changes made to the study design and/or consent form require prior approval from the IRB before such changes can be implemented.

While there appears to be no more than minimum risks with your study, should an incidence occur that results in a research-related adverse reaction and/or physical injury, this must be reported immediately in writing to the IRB. Any project-related physical injury must also be reported immediately to the University physician, Dr. Hamel, by calling (269) 473-2222.

Please feel free to contact our office if you have questions.

We wish you success in your research project.

Sincerely

Sarah Kimakwa
IRB, Research & Creative Scholarship

Institutional Review Board
Tel: (269) 471-6361 Fax: (269) 471-6543 E-mail: irb@andrews.edu
Andrews University, Berrien Springs, MI 49104-0355

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November 15, 2012

Mr. Eddy Witzel
Tel: (760) 608-1601
Email: eddy.witzel@navy.mil

RE: APPLICATION FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS
IRB Protocol #: 11-111   **Application Type:** Continuation **Dept.:** Leadership
Review Category: Expedited   **Action Taken:** Approved   **Advisor:** Shirley Freed
Title: Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams Within the US Navy: A Multiple Case Study

This letter is to inform you that your request for time extension of your research entitled: *"Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams Within the US Navy: A Multiple Case Study"* has been granted based on the research protocol on file. This approval is valid until November 15, 2013. If your research is not completed by the end of this period you must apply for an extension at least four weeks before the expiration date. Please inform IRB office whenever you complete your research.

Any future changes made to the study design and/or consent form require prior approval from the IRB before such changes can be implemented. Please use the attached report form to request for modifications, extension and completion of your study.

While there appears to be no more than minimum risks with your study, should an incidence occur that results in a research-related adverse reaction and/or physical injury, this must be reported immediately in writing to the IRB. Any research-related physical injury must also be reported immediately to the University physician, Dr. Hamel, by calling (269) 473-2222.

Best wishes in your research.

Sincerely

Sarah Kimakwa
Research Integrity & Compliance Officer
IRB Office

Institutional Review Board - 4150 Administration Dr Room 322 - Berrien Springs, MI 49104-0355
Tel: (269) 471-6361 Fax: (269) 471-6543 E-mail: irb@andrews.edu

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Andrews ⚬ University

November 25, 2013

Mr. Eddy Witzel
Tel: (760) 608-1601
Email: eddy.witzel@navy.mil

RE: APPLICATION FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS
IRB Protocol #: 11-111   **Application Type:** Continutation   **Dept.:** Leadership
Review Category: Expedited   **Action Taken:** Approved   **Advisor:** Shirley Freed
Title: Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams Within the US Navy: A Multiple Case Study

This letter is to advise you that the Institutional Review Board (IRB) has approved your continuation request for research involving human subjects entitled: "Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams Within the US Navy: A Multiple Case Study " IRB protocol number 11-111 under Expedited category. This approval is based on Naval Air Warfare Aircraft Division (NAWCAD) IRB approval protocol number NAWCAD.2011.0005-IR which is duly constituted according to the Federal Rules.

This approval is valid for one year from the date of this letter. If your research is not completed by November 25, 2014, you must apply for an extension at least two weeks prior to the expiration date. We also ask that you inform the IRB Office whenever you complete your research.
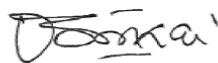
Any future changes made to the study design and/or consent form require prior approval from the IRB before such changes can be implemented.

While there appears to be no more than minimum risks with your study, should an incidence occur that results in a research-related adverse reaction and/or physical injury, this must be reported immediately in writing to the IRB. Any project-related physical injury must also be reported immediately to the University physician, Dr. Reichert, by calling (269) 473-2222.

Please feel free to contact our office if you have questions.

We wish you success in your research project.

Sincerely

Mordekai Ongo
Research Integrity and compliance Officer

Institutional Review Board
Tel: (269) 471-6361 Fax: (269) 471-6543 E-mail: irb@andrews.edu
Andrews University, Berrien Springs, MI 49104-0355

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APPENDIX C

NAWCAD IRB APPROVAL AND EXTENSIONS

APPENDIX C

NAWCAD IRB APPROVAL AND EXTENSIONS

6500
Ser DONIRB00008/1051
17 October 2011

From: Chair of Institutional Review Board, Naval Air Warfare Center Aircraft Division (NAWCAD)
To: Mr. Eddy Witzel, Advanced Tactical Aircraft Protection Systems AIR 5.1.1.1, Naval Air Systems Command (NAVAIR)

Subj: APPROVAL OF PROTOCOL NAWCAD.2011.0005-IR

1. I am pleased to inform you that the protocol for which you are the Principal Investigator, NAWCAD.2011.0005-IR (Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams within the US Navy) has been approved. An expedited review of this protocol was performed by the IRB Chair, LT Brian R. Johnson, on August 4th, 2011. The Institutional Official, Admiral Randolph L. Mahr approved the protocol on October 17th, 2011.

2. Please be aware that your protocol will expire on August 3rd, 2012. If your protocol has not been completed it is recommended that you submit it for continuing review via the IRB at least 45 days prior to the expiration date.

3. If you have any questions, you may contact me at (301) 342-8477, or the IRB Coordinator, Ms. Joan Brown at (301) 342-8813.

BRIAN R. JOHNSON

DEPARTMENT OF THE NAVY
NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION
22347 CEDAR POINT ROAD, UNIT 6
PATUXENT RIVER, MARYLAND 20670-1161

6500
Ser DONIRB00008/1075
07 Aug 12

From: Chair of Institutional Review Board, Naval Air Warfare Center Aircraft Division
To: Mr. Eddy Witzel, Test and Evaluation, Naval Air Warfare Center Aircraft Division

Subj: APPROVAL OF PROTOCOL NAWCAD.2011.0005-CR01-EP7 "Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams within the US Navy: A Multiple Case Study"

1. I am pleased to inform you that the continuing review protocol for which you are the Principal Investigator, NAWCAD.2011.0005-CR01-EP7 "Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams within the US Navy: A Multiple Case Study", has been approved. Protocol NAWCAD.2011.0005.CR01-EP7: Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams within the United States Navy: A Multiple Case Study was approved via expedited review by the IRB Chair, Dr. Cheryl Biron Sirmons, on July 16th, 2012. The Institutional Official, Admiral Randolph L. Mahr, approved your protocol on August 2nd, 2012.

2. Please be aware that your protocol will expire on Monday, July 15th, 2013. If your protocol has not been completed by the expiration date, a request for another continuing review should be submitted to the IRB at least 45 days prior to the expiration date.

3. Should any adverse events occur in the course of conducting your protocol, you are required to submit a completed Adverse Event form to the IRB Chair within 24 hours of said occurrence.

4. Once your research and/or analysis is complete, a Final Report needs to be completed, signed and submitted to the IRB Chair, Dr. Cheryl Biron Sirmons.

5. If you have any questions, you may contact me at (301) 342-9344 or the IRB Coordinator, Ms. Joan Brown, at (301) 342-8813.

Dr. Cheryl Biron Sirmons
IRB Chair

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From: Chair, Naval Air Warfare Center Aircraft Division, Institutional Review Board
To: Mr. Eddy Witzel, Advanced Tactical Aircraft Protection Systems AIR 5.1.1.1, Naval Air Systems Command

Subj: APPROVAL OF PROTOCOL NAWCAD.2011.0005-CR02-EP7

1. I am pleased to inform you that the protocol for which you are the Principal Investigator, NAWCAD.2011.0005-CR02-EP7, was reviewed via Expedited Review on Tuesday, 18 June 2013, and deemed to be minimal risk. The Institutional Official (IO), Rear Admiral M.W. Darrah approved the protocol on Monday, 1 July 2013.

2. Please be aware that your protocol will expire on Tuesday, 17 June 2014. If your protocol will not be completed by the expiration date, a request for a Continuing Review should be submitted to the IRB at least 45 days prior to the expiration date.

3. Should any adverse events occur in the course of conducting your protocol, you are required to submit a completed Adverse Event form to the IRB Chair, Dr. Cheryl Biron Sirmons, within 24 hours of said occurrence.

4. Once your research and/or analysis have ended, a Final Report must be completed, signed and submitted to the IRB Chair. The submission deadline is two months from the research expiration, or the end of data analysis, contingent upon which occurs earlier.

5. If you have any questions, you may contact me at (301) 342-9344 or the IRB Coordinator, Ms. Joan Brown, at (301) 342-8813.

Dr. Cheryl Biron Sirmons
Chair, NAWCAD, IRB

APPENDIX D

INTERVIEW PROTOCOL

INTERVIEW PROTOCOL

Naval Air Warfare Center Aircraft Division (NAWCAD)
Protocol for Human Subject Research

Submission Date: 9/26/2011

Protocol/Research Title: Leadership Attitudes and Behaviors in Three Innovative Integrated Product Teams within the U.S. Navy: A Multiple Case Stud*y*

Protocol Number: NAWCAD.2011.0005-IR

Principal Investigator: Eddy Witzel

Code: 5.1.1.1   **Phone:** 301-757-7942   **Fax:** 301-757-6035
Bldg/Room: 2272/535   Email Address: eddy.witzel@navy.mil

Co-Investigators (list all): none

Joint/Cooperative Research:
Organization/Company Name: Andrews University
POC: Dr. Shirley Freed, Chair Dissertation Committee   Phone: (269) 471-6163
Email Address: freed@andrews.edu
Business address: Andrews University, Leadership Department BH 173, Berrien Springs, MI 49104

Agreements/Contracts: N/A

Funding Source: Most of this research will be completed during non-duty hours as part of my doctoral dissertation. Duty hours of the principal investigator for interviews, focus groups, and coordination is funded by PMA-272 as part of my normal level of effort funding.

Anticipated Start Date: 15 October 2011

Expected Duration of Research Effort: 1 year

Number of Subjects: 30-50

Identification of Medical Monitor: N/A

Non-Technical/Lay Summary: The purpose of this study is to determine the attitudes and behaviors of leaders in successful innovative integrated product teams within the

United States (U.S.) Navy. The results of this research can be used to help foster additional innovation within integrated product teams and across organizations.

I. Table of Contents

Appendix C- Recruitment e-mail

II. Record of Changes to the Protocol

Date: 7-21-11   Initial Submission

Date: Changes Subsequent to Scientific Peer Review
                        1.

Date: Changes Subsequent to Safety Committee Review
                        1.

Date: 8-25-11   Changes Subsequent to Administrative Review
                        1. Addition of Appendicles to this document
                        2. Rewording and clarification
                        3. Added Header and footer

Date: Changes Subsequent to IRB Review
                        1.

Date: Changes Subsequent to Continuing Review
                        1.

III. SCIENTIFIC BACKGROUND AND OBJECTIVES

A. Background

Today's volatile environment requires innovative solutions to our national defense. Changes in the threats to national security are evolving so rapidly that the status quo cannot keep up. Product innovation can address specific threats to our national security. Leader attitudes and behaviors can have a significant impact on product innovation within a team. Unfortunately we do not completely understand the effect of leader attitudes and behaviors on innovation. A better understanding of the relationship between innovation and leader attitude and behavior is needed.

B. Purpose/Objective

The purpose of this research is to determine the attitudes and behaviors of leaders in successful innovative integrated product teams within the U.S. Navy. The results of this research can be used to help foster additional innovation within integrated product teams and across organizations.

C. Hypothesis

N/A This is qualitative research so a hypothesis is not necessary.

IV. Experimental methods

A. Experimental procedures and rationale

1. Experimental variables
N/A This is a qualitative study.
2. Environmental conditions (if required)
N/A
3. Procedure and rationale

Data will be collected from interviews, focus groups, and program documentation. The selection of individuals to participate in interviews and focus groups will be an evolving and iterative process. When team members are nominated to participate in the research, the name, phone number, and e-mail address of the nominee will be provided to the principle investigator by the team leader. Initial interviews will identify participants for future interviews or focus groups and focus groups may identify additional participants. Prior to participation in an interview or focus group, I will send an introductory e-mail explaining the background and purpose of the research. The introductory e-mail is provided in Appendix C. The sample questions and informed consent will also be attached to the e-mail. The participant will be asked to sign the informed consent and response with initial answers to the questions. After the interview or focus group is completed, I will send a follow up e-mail thanking the individual for participating. I will also include the questions and ask for any further responses that the individual thought of after our meeting. The follow up e-mail is provided in Appendix C. This will allow each participant time to reflect on the questions and three separate opportunities for responses. Data from individuals who don't have time to participate in the interviews or focus group will still be included if they choose to answer the questions

by e-mail.

Both the formal IPT leaders and the informal emerging leaders will be interviewed for each team. The interviews will begin with formal leaders because they are easiest to identify initially. The interview will follow the sample questions. Follow-up questions that add clarification to the answers may also be asked. If the topic steers off course too much, the principle investigator will simply change the subject by asking a different question from the sample. The interviews will be audio recorded and transcribed for analysis. The researcher will also take simple field notes during the interview. Sample questions are listed in Appendix A. In addition to the questions each person interviewed will recommend the other team members that should be interviewed and the ones that should participate in a focus group. Some interviews may take place over the phone if a face to face interview cannot be arranged.

The focus groups will be composed of team members who are not the leaders. The focus groups will provide an opportunity for those at the working level of the organization to provide a unique perspective on the leadership attitudes and behaviors that contributed to the innovation. The focus group will follow the sample questions. Follow-up questions that add clarification to the answers may also be asked. If the topic steers off course too much, the principle investigator will simply change the subject by asking a different question from the sample. Sample questions are listed in Appendix A. The focus group will be audio recorded and transcribed for analysis. The principle investigator will also take simple field notes during the focus group interview. In addition to the questions each focus group will recommend the other individuals that should be included in an interview or focus group.

B. Requirement for human volunteers and data analysis

1. Number required
30-50
2. Qualifications
The volunteer must be a leader or member of selected integrated product team that has successfully demonstrated innovation. Successfully demonstrated innovation is defined as the product has reached the Initial Operating Capability of a system that is considered a game changer by the warfighter within cost and schedule thresholds.
3. Justification for exclusion of specific groups
Individuals that do not participate on integrated product teams will be excluded. Team members that are not nominated by leaders or fellow team members will be excluded. Once sufficient data is collected for a specific team all remaining team members will be excluded. Team members that are not available for interview or focus group will be excluded.
4. Time commitments of subjects
1-2 hours
5. Anticipated testing periods
Interviews and focus groups will take place during normal work hours.
6. Volunteer recruitment
Volunteers will be nominated by coworkers and leaders of the team being studied. Appendix C is the recruitment e-mail.

C. Duties and procedures to be performed by human volunteers

    1. Physiological testing
None
2 Physical procedures
None
3. Subjective measures (if required)
None
4. Audio, video, or digital monitoring of trials
Interviews and focus groups will be audio recorded.
5. Termination criteria
Any time a participant withdraws from participation.

D. Required equipment and supplies
Audio recorder and blank paper and pens.

V. Risks and discomforts to research volunteers

A. Identification of risks to the volunteers and means of mitigation
Every effort will be made to keep comments anonymous. However, it may be difficult to completely hide participant identity in this type of study. The names of the integrated product teams and participants in the study will be replaced with pseudonyms.

B. Special risks to pregnant or potentially pregnant women
None

C. Safety precautions and emergency procedures
N/A

D. Assessment of sufficiency of plans to deal with adverse events or injuries
N/A

E. Qualifications of medical monitor and medical support personnel
N/A

VI. Organization of research effort

A. Duties and responsibilities of the research team
The principal investigator is responsible for collection and analysis of all data.

B. Chain of command
The dissertation committee chair oversees the principal investigator's technical contact. The NAWCAD supervisor of record ensures the principal investigator follows the NAWCAD process.

VII. Benefits

    The results of this research can be used to increase innovation across the Navy. This innovation could result in both a significant increase in capability with shorter development cycles and lower costs. The results of this research can be used by organizational development consultants to help foster additional innovation within integrated product teams and across organizations.

VIII. Compensation

The participants in the study are not compensated for participation other than their normal salary received during work hours.

IX. Description of the system for protecting subject privacy

    A. Experimental data

    Each participant in the study will be coded with a randomly selected identifier. The list of names correlated with identifiers will be kept under lock and key and only accessed by the principal investigator. The list will be destroyed three years after the completion of the research.

    B. Research and protocol, consent forms, and related documents for protection of human   research volunteers

    Signed consent forms will be kept under lock and key.

    C. Individual medical records

    N/A. Medical records will not be used for this study.

X. Appendices (add other appendices as needed)

    Appendix A- Sample Questions
    Appendix B- Dissertation Proposal
    Appendix C- Initial e-mail and follow-up e-mail

Protocol #: NAWCAD.2011.0005-IR-EP1

LEVEL OF RISK AND IRB REVIEW TYPE (To be completed by the IRB):

☐ Not research / Not research with human subjects

☒ Minimal Risk: ☐ Exempt   Category _____

                 ☒ Expedited   Category __7__

                 ☐ Convened IRB Review

☐ Greater Than Minimal Risk (Convened IRB review required)

__LT Brian R. Johnson__   _Signature_   _04 Aug 2011_
Name of Reviewer (print)   Reviewer Signature   Date

▪▪

IRB RECOMMENDATION:

☐ Not research / Not research with human subjects

☐ Exempt Research

Based on expedited review this protocol has been recommended for:

☒ Approval as submitted; no modifications required (all criteria of 32 CFR 219.111 have been satisfied)

☐ Approval pending the following modification(s):

☐ Convened IRB Review

Based on convened IRB review this protocol has been recommended for:

☐ Approval as submitted; no modifications required (all criteria of 32 CFR 219.111 have been satisfied)

☐ Approval pending the following modification(s):
_____. Modifications may be reviewed and verified by the IRB Chair via the expedited process.

☐ Approval pending the following modification(s):
_____. Modifications must be reviewed by the convened IRB prior to being forwarded to the Commander for approval.

☐ Disapproval due to:

__LT Brian R. Johnson__   _Signature_   _04 Aug 11_
IRB Chair/Vice Chair (print)   Signature   Date

Protocol #: NAWCAD.2011.0005-IR-EP1

▪▪

<u>**INSTITUTIONAL OFFICIAL**</u>

☑ Approved

☐ Disapproved

R. L. MAIR
Name (print)

Signature

17 OCT 2011
Date

APPENDIX E

RECRUITMENT AND THANK YOU E-MAIL

APPENDIX E

RECRUITMENT AND THANK YOU E-MAIL

Recruitment e-mail

I have been a civilian employee with the Navy for over 25 years. During that time I have held many positions including engineer, supervisor, team leader, and assistant program manager for test and evaluation. Innovation and ways to encourage it has always fascinated me. In addition to my current duties, I am pursuing a PhD in Leadership from Andrews University at night and on the weekend. As part of my dissertation I am researching the ABX-23/CDX-45/XEF-67 project. I plan to interview several participants in the ABX-23/CDX-45/XEF-67 project along with supervisors and leaders who encouraged them. My methodology is based on Appreciative Inquiry which focuses on the positive.

You have been recommended to me as a potential person to interview. Enclosed is a copy of my research summary, sample questions, and informed consent. The Navy and my university require each person interviewed sign an informed consent. Participation in this study is completely voluntary and optional.

Your confidentiality during the study will be ensured by assigning you a coded identification number. Your name will not be directly associated with any data. The confidentiality of the information related to my participation in this research will be ensured by maintaining records only coded by identification numbers. Additionally the name of your program will be replaced with a pseudonym.

This research has obtained the necessary approvals. Prior to releasing this research, I will go through the normal approval for public release process.

Any assistance you can give is appreciated. I believe the results of this research could help NAVAIR continue to provide innovative solutions to warfighter needs. Please contact me with any questions, comments, or concerns. I will be calling you shortly to discuss your involvement and to schedule an interview.

Sincerely,
Eddy Witzel

Thank You E-mail

Thank you for participating in the interview. I believe the results of this research could help NAVAIR continue to provide innovative solutions to warfighter needs. Attached is a copy of the questions. If you thought of something to add after our meeting feel free to e-mail or call me with further details.

Sincerely,
Eddy Witzel
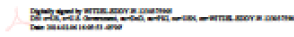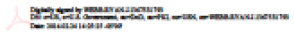
APPENDIX F

THEME SUMMARY MATRIX

APPENDIX F

THEME SUMMARY MATRIX

This matrix summarizes the themes and subthemes that emerged from individual interviews and focus groups.

Themes & Subthemes	Interview / Focus Group											
Urgency driven by heartfelt need	X	x	x	x	x	x	x	x		x	x	x
Vision	X	x		x	x	x	x	x		x		x
Passion	X	x		x				x		x		x
Persistence / Moderate Setbacks	X	x			x	x		x	x	x		x
Assertive		x	x				x			x		x
Know the Process			x		x					x	x	
Challenge the Process	X		x		x	x			x	x	x	x
Manage Risk	X	x								x	x	x
Good Enough		x	x							x		
Listen	X			x			x		x	x	x	x
Open to Ideas	X	x		x	x	x	x	x	x		x	x
Collaboration / Teamwork	X	x	x	x	x	x	x	x		x	x	x
Give Recognition	X	x			x	x	x			x		
Credibility / Integrity	X	x								x		x
Professional	X	x	x				x			x		x

APPENDIX G

APPROVAL FOR PUBLIC RELEASE

PUBLIC RELEASE AUTHORIZATION REQUEST

Tracking Number <u>2014-134</u>

Complete Sections 1 and 2 of this form. Submit to the appropriate Program Code point of contact to complete Sections 3 and 4. Upon authorization, the requestor and primary sponsor will receive notification stating the following: The "TITLE" material(s) submitted for public release has/have been approved. Distribution Statement A - Approved for public release; distribution is unlimited, as submitted under NAVAIR Public Release Authorization YY-(tracking number). Please retain the signed authorization for your records.

Section 1   MATERIAL DESCRIPTION & PURPOSE

1. Requestor (Name/Position Title) Eddy Witzel APM(T&E)	2. Company/Organization/Code NAWC-AD Code 5.1.1.1	3. Desired Release Date 19 February 2014

4. Telephone Number 301-757-7942	5. Fax Number	6. E-mail Address eddy.witzel@navy.mil

7. Work Address PEO(T) Attn: PMA-272, 47123 Buse Unit IPT Patuxent River, MD 20670	8. Material Title Wheel of Innovation: How Leaders Attitudes and Behaviors Drive Disruptive Technology in the US Navy. Doctoral Dissertation

9. List all contributing organizations (Programs/Codes/Services) whose subject matter is discussed in this material
Andrews University, School of Education

10. Information Category (Check all that apply) [X] Brief   [ ] Documents   [ ] Thesis   [ ] Press Release

[ ] Video   [X] Abstract   [ ] Photo/Graphics/Display

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Naval Air Systems Command, Senior Executive Management Development Program
Technical Management Curriculum

PROFESSIONAL LICENSES AND CERTIFICATES
DAWIA Certified Level III Test and Evaluation
DAWIA Certified Level III Systems Planning, Research, Development & Engineering
DAWIA Certified Level I Program Management
Member of the Acquisition Professional Community

AWARDS
Edward H. Heinemann Award as a team member   7/2011