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Business Process Re-Engineering: Application for Littoral Combat Ship Mission Module Acquisition

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June 2006

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ABSTRACT (maximum 200 words)

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BUSINESS PROCESS RE-ENGINEERING: APPLICATION FOR LITTORAL COMBAT SHIP MISSION MODULE ACQUISITION

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ABSTRACT

The purpose of this MBA Project is to investigate the possibility/feasibility of re-engineering the Littoral Combat Ship Mission Module (PMS-420) business process to function more efficiently. The Defense Acquisition system is designed to support the National Security Strategy by managing the technologies and programs that produce weapons system for the United States Armed Forces. This paper reviews the genesis of PEO LMW and its basic functionality, as well as discusses in detail the unique business processes of PMS-420 and its varied inter-agency relationships. Additionally, this paper discusses the business processes of two other acquisition programs within PEO LMW; 1) Naval Special Warfare (PMS-340) and 2) Explosive Ordnance Disposal (PMS-408). Business processes and management policies of these other acquisition programs that promote efficiency are presented and analyzed for their applicability to PMS-420. The final portion of this paper is a summary of the findings and recommendations to PMS 420 in order for it to function more efficiently.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAP - Abbreviated Acquisition Program

ACAT - Acquisition Category

ADS - Advanced Deployable System

ASW - Anti-submarine Warfare

BPR - Business Process Re-engineering

DoD - Department of Defense

DoN - Department of the Navy

EOD - Explosive Ordnance Disposal

LCS - Littoral Combat Ship

LMW - Littoral Mine Warfare

MIW - Mine Warfare

MOA - Memorandum of Agreement

MPI - Mission Package Integrator

PEO - Program Executive Office

SUW - Surface Warfare

UAV - Unmanned Aerial Vehicle

USV - Unmanned Surface Vehicle

UUV - Unmanned Underwater Vehicle

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I. INTRODUCTION

A. BACKGROUND

The Defense Acquisition system is designed to support the national security strategy by managing the technologies and programs that produce weapons system for the United States Armed Forces. In doing so, the acquisition objective is to provide the best quality weapons for the needs of the combatant commanders, in a timely manner, and at a reasonable price.[1] Because defense acquisition uses publicly generated funding in the form of tax revenue, it is incumbent upon the Department of Defense (DoD) and Service leaders to be good stewards of the public monies entrusted to them. The accountability for this stewardship is made easier as Congress has a significant say in where, when, and how public monies are spent on national defense. One defense acquisition program within congressional oversight is the Navy's Littoral Combat Ship (LCS) program. The LCS acquisition program is managed by two program offices: 1) The LCS Mission Modules Program Office (PMS-420), under Program Executive Office, Littoral Mine Warfare (PEO/LMW) and 2) the Littoral Combat Ship Program Office (PMS-501), under Program Executive Office, Ships (PEO/Ships). PMS-420 is responsible for six initial warfare mission module acquisitions: two each of Mine Warfare (MIW), Anti-Submarine Warfare (ASW) and Surface Warfare (SUW).[2] These mission modules are to be integrated into the LCS sea frame. PMS-501 is responsible for the acquisition of the LCS sea frame as well as final integration of the mission module with the sea frame.

B. OBJECTIVES

Although the overall acquisition system functions as designed, the purpose of this project was to investigate the business processes within the LCS Mission Modules

[1] Defense Acquisition University; Introduction to Defense Acquisition, (Fort Belvoir, VA, Defense Acquisition University Press, November 2003) 1.

[2] PEO Littoral Mine Warfare; Report to Congress Littoral Combat Ship Mission Packages, (Washington Navy Yard, March 2006) 3.

Program Office (PMS-420) and to determine whether another more efficient process design could be identified.

C. THE RESEARCH QUESTION

1. Primary Question

- Can PMS-420 be re-engineered for greater efficiency?

2. Subsidiary Research Questions

- What would have to change in the PMS-420 business process that would enable it to function more efficiently?
  - What are the internal design constraints?
  - What are the external constraints?
- Do smaller programs such as PMS-340 and PMS-408 provide any models for improving the larger PMS-420?

3. Is it possible to implement change in the current political environment?

- What are the barriers within PEO LMW and DoN?
- What are the barriers within DoD and Congress?

D. SCOPE, ASSUMPTIONS AND LIMITATIONS

1. PMS-420

This project focuses on the business process for PMS-420. The scope of this project includes a review of what comprises a business model, a review of the current acquisition process, and an analysis of the business process utilized by PMS-420.

2. PMS 340 and 408

PMS 340 and PMS 408 are two program offices located within PEO/LMW. Although smaller in scope than PMS-420, these programs were chosen as comparison because they have been identified by the Program Executive Officer as being two of the more efficient programs in PEO/LMW. PMS-340 and PMS-408 typically manage Acquisition Category (ACAT) program level III or below. Because the decision authority for these programs is typically at the PEO or System Commands level, they do not garner the same level of congressional scrutiny of a major program. Although the acquisition program managed by PMS-340 and PMS-408 differ in size from the PMS-

420 program, a comparison could identify transferable business processes. A detailed description of the acquisition categories is in Appendix A.

3. LIMITATIONS

The scope of this study is has been limited to the topic of business process re-engineering. There may be areas of knowledge pertaining to the operations of PMS-420 that could not be incorporated into this study based upon financial limitations or time constraints.

E. METHODOLOGY

The author conducted a series of interviews with members of the organizations. The individuals to be interviewed were identified by PEO/LMW. The interviews ranged from one-on-one, one-on-two, and in one case a group setting of eight. The interview sessions lasted anywhere from 40 minutes to 1-1/2 hours. Each interview session was conducted at the program offices at the Washington Navy Yard or at the Navy's Indian Head, Maryland location.

During the interviews the focus of the project was discussed and three basic questions were asked, 1) What is the history of your organization, 2) What is your business process, and 3) If you could re-engineer your process differently, what would it look like? The questioning was conducted in an informal atmosphere to allow for open communication and sharing of experiences by the interviewees.

F. ORGANIZATION OF PROJECT

Chapter II reviews the basics of business process re-engineering efforts in private industry and government organizations. Chapters III presents the history of PEO/LMW and the genesis of this relatively new PEO. Chapter IV briefly describes the acquisition process and environment, as well as presents the business processes utilized by PMS-408 and PMS-420. Chapter V presents an analysis of the collected data. Chapter VI presents a re-engineering recommendation and conclusion.

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II. LITERATURE REVIEW

A. BUSINESS PROCESS RE-ENGINEERING (BPR)

1. Business Re-engineering Overview

In the Michael Hammer and James Champy book, "Reengineering the Corporation", the two define business process re-engineering (BPR) as, "The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed."[3] The business processes of an entire organization can be the subject of re-engineering or it can be focused on the processes of a single department. Hammer and Champy emphasize four keywords in their definition: fundamental, radical, dramatic, and processes.

"Fundamental" means asking the basic questions, "Why do we do what we do? And why do we do it the way we do?"[4] Hammer and Champy suggest that the answers to these questions force people to look at rules and assumptions that are foundational to the way business is conducted. Many times however, these rules are, "obsolete, erroneous or inappropriate."[5] The example given is that of a business wanting to perform credit checks more efficiently on its customers. The question they say shouldn't be, "How can we perform credit checks more efficiently?" because that assumes that credit checks must be done. Instead, the business should ask the basic question, "Why do we perform credit checks on customers?" This basic question allows for the possible answer that the cost of performing the credit checks may exceed the bad debt loss the credit checks are designed to prevent.[6] If it is determined that credit checks are necessary and cost beneficial, then the business can began the fundament process of re-engineering by asking, "Why do we do it the way we do it?"

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[3] Michael Hammer and James Champy, Reengineering the Corporation: A Manifesto for Business Revolution, (London: Nicholas Brealey, 1995) 32

[4] Hammer and Champy, 32

[5] Hammer and Champy, 33

[6] Hammer and Champy, 33

"Radical" is how the business process must be redesigned. It is more than tweaking an existing process. It is like taking a 'clean slate' and starting from scratch. Hammer and Champy say, "In re-engineering, radical redesign means disregarding all existing structures and procedures and inventing completely new ways of accomplishing work."[7] In a perfect world with an unlimited budget, this particular approach to re-engineering would be possible. But critics of Hammer and Champy state, "Regardless of Hammer's exhortation: "Don't automate, obliterate!" clean slate change is rarely found in practice…a "blank sheet of paper" used in design usually requires a "blank check" for implementation." [8] This paper investigates government agencies which operate under fiscal constraints and "blank check" financing is not likely. For government agencies and many private companies, a more affordable approach is to consider using a clean slate design but implement the design over several phased projects.[9]

"Dramatic," the third key word, is essentially the type of performance change a business is expecting from the re-engineering investment. "Re-engineering is not about making marginal or incremental improvements but about achieving quantum leaps in performance." [10] From this perspective, a business seeking only a few more percentage points in sales or cost reductions most likely will not undergo re-engineering efforts. There are three types of companies that Hammer and Champy have identified that adopt re-engineering. The first is a company that has no other choice. If their costs far exceed industry norms or if quality is seen as worst in the industry, these companies can benefit from a quantum leap in performance. The second is a company that foresees a problem on the horizon and chooses to navigate around it by re-engineering their business process. The third type is the company that already sets the industry standards and has no foreseeable troubles. But because of their aggressive management style and business savvy, this third set of companies seek to raise the bar for the competition.[11]

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[7] Hammer and Champy, 33

[8] Yogesh Malhotra. "Business Process Redesign: An Overview," IEEE Engineering Management Review, vol. 26, no. 3, Fall 1998. (URL: http://www.kmbook.com/bpr.htm)

[9] Malhotra, 1

[10] Hammer and Champy, 33

[11] Hammer and Champy, 33

The last keyword word is "Processes." Hammer and Champy write that the process is a set of activities that take various inputs to produce a valuable output to the customer.[12] The value that is added to the output, is only realized when the customer takes delivery of the output. Therefore, processes that occur inside or outside the organization that delay or prevent delivery of the output to the customer must be changed or abolished. It is for this reason that re-engineering efforts must focus on the business processes of organizations or their departments.[13]

B. BUSINESS PROCESS RE-ENGINEERING METHODOLOGY

1. Adaptive Business Process: Sense and Respond

When asked the question, "What kind of change do you expect your organization to face during the next decade?" more than 75 percent of the executive attendees at the IBM Advanced Business Institute Strategy Courses held between May 1994 and November 1998, believed that some form of business environment discontinuity would be the greatest challenge they would face.[14] An adaptive business process is one that is designed to sense the changing needs of the business environment, and quickly adapt. In an unpredictable environment, where no reliable indicators of future needs exist, the ability to adapt to change must take precedence over business process efficiency.[15] Efficient business processes that support irrelevant tasks, or produce antiquated products are a waste of time and resources. The adaptive or "sense-and-respond" business model provides a means for meeting the ever changing business environment. The goal is not to predict the future business environment, but to identify environmental change as it happens, and to respond quickly and appropriately.[16] A simple sense-and-respond model is at Figure 1.

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[12] Hammer and Champy, 35

[13] Hammer and Champy, 40

[14] Stephen H. Haeckel, Adaptive Enterprise, (Boston: Harvard, 1999) 1

[15] Stephen H. Haeckel, 6

[16] Stephen H. Haeckel, 3

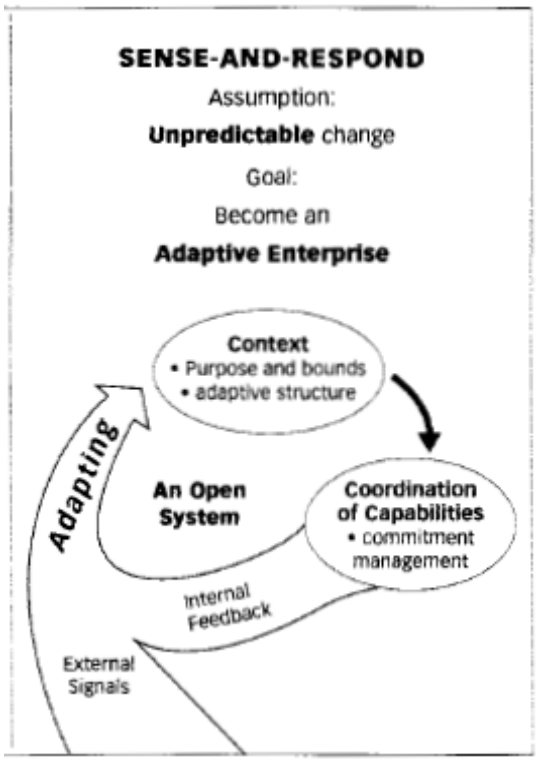

Figure 1. Sense and Respond Loop

Source: Stephen H. Haeckel, Adaptive Enterprise, (Boston: Harvard, 1999) 5

In Figure 1, the Organizational Context is comprised of three basic parts: the organizations reason for being, its governing principles and its high level business design. "Unlike typical mission and vision statements, which propose a (sometimes inconsistent) mix of goals and principles, a reason for being statement unequivocally defines the organization's primary purpose — the one outcome that justifies its existence."[17] Governing principles set forth the organizations limits of actions for its employees, and the high level business design is the organization's essential structure. The high level business design, "illustrates the relationships among elements both inside and outside the organization in terms of outcomes they owe one another — the outcomes essential to achieving the enterprise reason for being."[18] These three components of Organizational Context work together to provide accountable, empowered members the direction the

[17] Stephen H. Haeckel, 17

[18] Stephen H. Haeckel, 17

organization is headed, the boundaries set for member actions, and how members are to relate to what others do and how to relate to organizational purpose. [19]

Coordination of Capabilities, the next part of the Adaptive Business Process, is based on the organizational leaders' responsibility for commitment management. When organizational roles are defined in terms of commitments instead of activities; the emphasis is placed on the interaction of system elements vice actions. Deciding how the commitment is met is the responsibility of those making the commitment as long as the "how" falls with the limits set by organization. Therefore, the organizational leader's responsibility is to manage commitments in keeping with organizational context and purpose. Finally, internal feedback mixed with external signals from the business environment, are used to adapt the business process within the organizational context. The adaptive loop depicts the events that drive a sense and respond organization. An example adaptive loop process is at Figure 2.

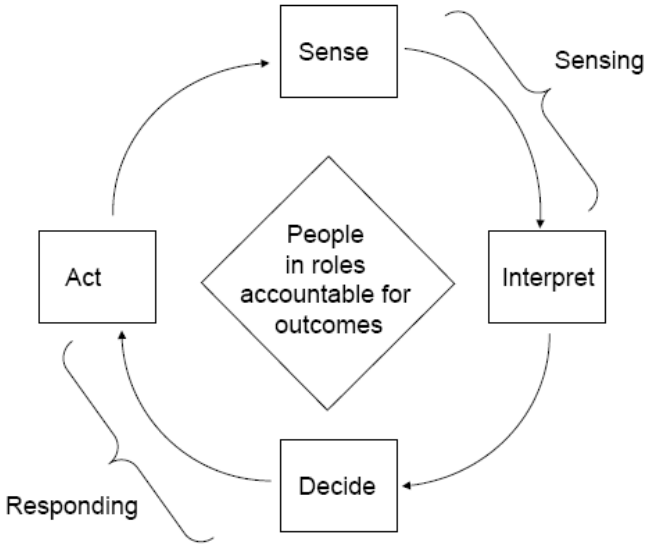

Figure 2. The Adaptive Loop

Source: Stephen H. Haeckel, Adaptive Enterprise, (Boston: Harvard, 1999) 76

[19] Stephen H. Haeckel, 17

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III. HISTORY OF PEO/LMW

A. CHANGING ACQUISITION ENVIRONMENT

The events of September 11th, 2001 changed the way an enemy is defined in the minds of most Americans. As a result, the DoD began to undertake an aggressive transformation plan geared to develop future military capabilities that are both flexible enough and lethal enough to address the challenges from a variety of threats. The transformation road map is laid out in the "Transformation Planning Guidance." In this plan, the scope of transformation is centered on transforming how we fight, transforming how we do business and transforming how we work with others.[20] Transforming how we do business in relation to the acquisition process is the focus of this paper.

In transforming the way we do business, DoD has directed programs offices create a more streamlined acquisition process to eliminate non-value added steps. A more streamlined process must allow for adaptive planning methods built on accelerated acquisition cycle concepts such as spiral development. And thirdly, a streamlined acquisition process must also be supported by capabilities based resources allocation. Putting these concepts together, there will be fewer people in the decision making process to help the process move faster. The decision makers who remain in the process must be flexible in their thinking and employ flexible planning systems to take advantage of technologies generated by spiral development. Finally, resource allocations must be aligned to fund warfare capabilities across a broad spectrum of platforms instead of the traditional platform specific funding.

B. REALIGNMENT OF THE PEO'S

In early October 2002, John Young, Assistant Secretary of the Navy (ASN) for Research, Development and Acquisition (RD&A) released a message calling for the realignment of the offices within ASN/RD&A as well as some PEOs and Systems

[20] Donald H. Rumsfeld, "Transformation Planning Guidance" April 2003, (Washington DC: Office of The Secretary of Defense) 6

Commands (SYSCOMS). This realignment came, "as part of an ongoing review of the effectiveness and efficiency of our existing acquisition structure…"[21] Secretary Young stated that the purpose of the change was to facilitate becoming better aligned to address the 21st century challenges the Navy and Marine Corps will face. To this end, the acquisition community should no longer optimize by program and platform but by integrated systems that cross many platforms and functions as needed in the 21st century.[22]

The business advantage for acquisition programs being realigned along integrated weapons systems vice platforms is that integrated systems, with open architecture, allow for mixing and matching weapon system based upon need. A weapon system that is used on multiple platforms increases business buying power for Navy Acquisition.[23] An example would be if the Navy was buying a new combat ship that required a surface mounted gun, the gun could be procured at a lower price if it was already in service on existing ships. The acquisition strategy for the gun system would then be for use on a variety of platforms for a variety on missions. The combat ships acquisition strategy would then be to use a surface mounted gun already in service that would meet the intended mission requirements for the vessel. Not only could this approach potentially save billions of dollars in weapon system development cost, but the training systems and the logistical support for training on a new gun system would be eliminated. But in order for this business advantage to be realized, the acquisition community would have to brace for the challenges that accompanied this realignment around integrated weapons systems. Secretary Young, aware of the challenges this realignment presented, closed his October 2002 message with the following:

"These changes have been carefully thought out by the existing PEOs and SYSCOMS…There are some significant changes here, especially the movement from a platform focus to an integrated system focus. There are always challenges when change

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[21] John J. Young, Jr., "Realignment of the Office of the Assistant Secretary of the Navy for Research, Development and Acquisition, SYSCOMS and PEOs," 112123Z Oct 2002, general administrative message from ASN/RDA (Washington DC: ASN/RDA) 1

[22] John J. Young, Jr., 1

[23] John J. Young, Jr., 2

occurs, but in the end it will improve how and what we deliver. Your support and feedback as we transition to this new structure will be most appreciated."[24]

C. THE GENESIS OF PEO/LMW

In November 2002, one month after the release of Secretary Young's message, the PEO for Mine and Undersea Warfare (MUW) received new tasking and a new name. PEO/LMW was formed and its roles expanded to include five other areas, namely: Explosive Ordnance Disposal, Special Warfare, Integrated Undersea Surveillance Systems, unique Mine Warfare systems and Assault vehicles. PEO/LMW is a "capabilities based PEO and is focused on bringing capability to the Littoral Battle Space."[25] Because of the inherent challenges of incorporating these warfare areas under a single PEO, the program managers for LMW must maintain close coordination with each other in order to ensure the proper capability perspective is integrated between the program managers and the program offices.[26] In total, the scope of LMW covers the life cycle responsibilities and management responsibilities for seven programs covering 210 systems.[27] The PEO/LMW program office codes and some of the programs and systems they managed are at Table 1.

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[24] John J. Young, Jr., 4

[25] LMW Program Office Descriptions, Program Executive Office for Littoral and Mine Warfare, Dec 2, 2005; 1. (unpublished paper)

[26] PEO/LMW Project Officer, Personal interview

[27] Program Executive Office for Littoral Mine Warfare, "Power Point Brief for Dr. Delores Etter, ASN (RD&A) 30 Nov 2005. (Unpublished paper: Washington Navy Yard, Washington, D.C.; Dec 2, 2005), 4

Table 1. PEO/LMW Program Offices and Tasks.
Source: PEO/LMW Program Office Descriptions, 1-2

Program Office	Description of Tasking
PMS 495	Mine Warfare Systems: Comprised of all Navy mining as well as the Surface Mine Countermeasures (MCM), subsurface MCM, Airborne Mine Defense, and Amphibious Mine Countermeasures systems and equipment.
PMS 480	The Anti-Terrorism Afloat Systems encompass the total life cycle management of Anti-Terrorism Afloat and Anti-Terrorism Expeditionary systems and equipment.
PMS 485	The Maritime Surveillance Systems encompass the Advanced Deployable System (ADS), Fixed Surveillance System (FSS) and Surveillance Towed Array Sensor System (SURTASS) programs.
PMS 403	Unmanned Undersea Vehicles (UUVs): Encompass those unmanned undersea systems, both tethered and non-tethered, which can operate independently from or in concert with submarines and surface ships.
	Explosive Ordnance Disposal

PMS 408	(EOD): Encompass systems used to detect/locate access, examine, identify, render safe and/or dispose of surface and underwater explosive ordnance.
PMS 420	Littoral Combat Ship Mission Modules: Encompass warfare specific mission modules for Littoral Combat Ship (LCS).
PMS 340	The Naval Special Warfare (NSW): Encompass equipment associated with Special Ops maritime support of fleet operations; SEAL diver life support; SEAL Delivery Vehicles (SDV), etc. Special Ops missions are non-conventional in nature, and clandestine in character.

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IV. BUSINESS PROCESS IN ACTION

A. INTRODUCTION

Not every program office within PEO/LMW is funded at the same level nor do they operate in exactly the same way. The dollar amounts invested in the acquisition of a system will usually define both its size and the flexibility the program has in how it operates. This chapter begins with a brief overview of the acquisition lifecycle process that is common to all acquisition programs, then concludes with discussions on specific business processes for the Explosive Ordnance Disposal Program Office (PMS-408) and the Littoral Combat Ship Mission Module Program Office (PMS-420).

B. ACQUISITION PROCESS OVERVIEW

The acquisition of the LCS Mission Module has its genesis in the Acquisition Life Cycle. The Introduction to Defense Acquisition Management defines the Acquisition Life Cycle process as being, "… made up of periods of time called phases and each phase is separated by decision point called a milestone."[28]

Throughout the life cycle of an acquisition, the program is under constant review. Prior to the completion of a milestone, the Program Manager decides whether or not the acquisition process meets the criteria to move onto the next phase of development. If the acquisition program meets the established criteria the Program Manager can propose to the Milestone Decision Authority (MDA) that a Milestone in the acquisition has been completed. The MDA is authorized to approve the acquisition programs transition to the next phase after exit criteria have been met.[29] "These milestones and other decision points provide the Program Manager and MDA the framework with which to review acquisition programs, monitor and administer progress, identify problems, and make corrections."[30] A typical life cycle management framework is represented at Figure 4.

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[28] Defense Acquisition University, 50

[29] Defense Acquisition University, 50

[30] Defense Acquisition University, 50

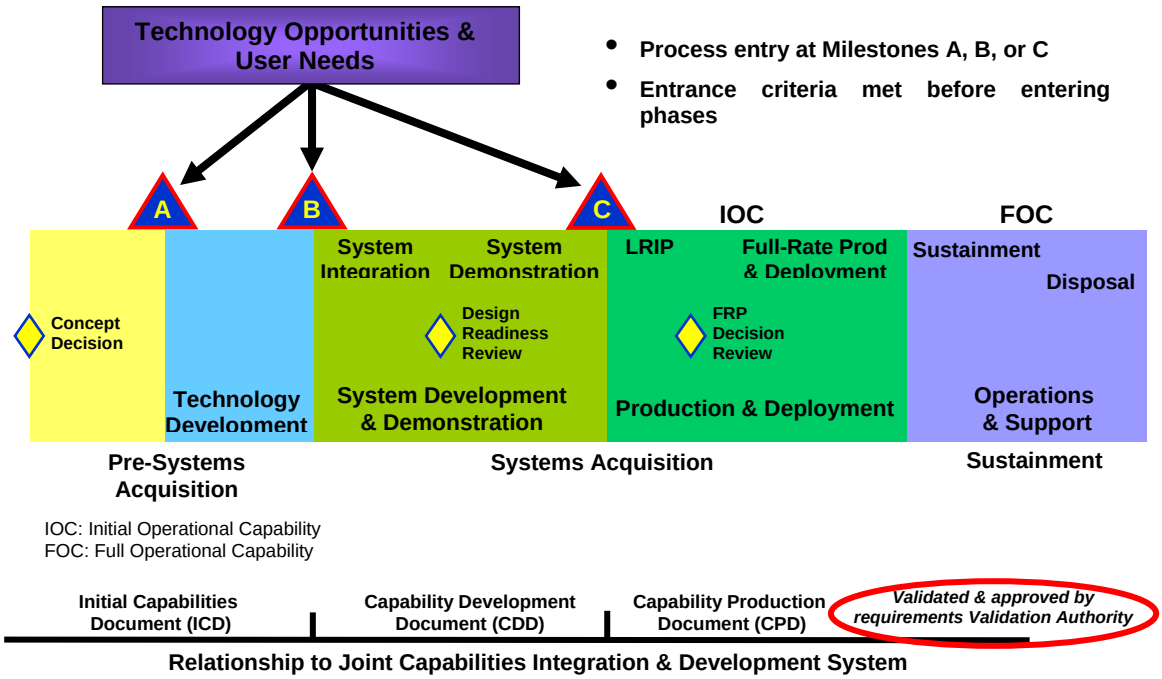

Figure 3. Defense Acquisition Management Framework

Source: Introduction to Defense Acquisition Management, 49

The life cycle of a program begins with the planning to satisfy a mission need before the program officially begins. Program initiation normally occurs at Milestone B and takes the program through research, development, production, deployment, support, upgrade, and, demilitarization and disposal.[31]

As each program goes through the life cycle process there are constant reviews undertaken to determine the programs effectiveness. One performance metric used by PEO/LMW to establish the effectiveness of the programs is the execution rate of budgeted resources. This execution rate is determined in large part by the expenditure rate of apportioned funds from annual congressional appropriations. Program Managers track program expenditures (costs) based on the terms of the program contract. As costs are incurred and milestone met, the program is considered progressing or commonly

[31] Defense Acquisition University, 50

referred to as being "executed" as budgeted. A more detailed description of the acquisition life cycle is provided at Appendix B.

C. STREAMLINE THE BUSINESS PROCESS

A streamlined business process seeks to eliminate non-value added steps to get the product to the customer sooner. Within PEO/LMW, Naval Special Warfare (PMS 340) and Explosive Ordnance Disposal (PMS 408) are two program offices that manage mostly ACAT III and IV acquisitions programs. A detailed description of the acquisition categories is at Appendix A. PMS-340 manages a variety of small arms programs and semi-autonomous underwater vehicle programs for Naval Special Warfare. Because of the smaller dollar amounts involved in PMS-340 ACAT III level programs, the classified nature of these programs and the highly-trained, operationally savvy, well-defined user group for these systems, PMS-340 can often receive special acquisition authority that allows them to tailor the acquisition process in order to speed delivery of the systems to the war fighters in the field.[32] Highly educated user groups, such as Naval Special Warfare forces, are those groups that are directly involved in the design and operational suitability of the systems being developed. The business process of PMS-340 is similar to that of PMS-408 in that both program offices manage what is considered smaller programs and both have highly-trained, operationally savvy, well-defined user groups. Not withstanding the classified nature of the PMS-340 programs, their basic business process is similar to that of PMS-408 which manages several unclassified ACAT IV level programs. In order to maintain the unclassified level of this research, this paper details the unclassified business processes for PMS-408 only, to determine if efficiencies can be transferred to PMS-420.

1. Business Process for Explosive Ordnance Disposal (PMS-408)

There are three basic reasons PMS-408 is able to operate efficient, streamlined acquisition programs. First, the MDA level for PMS-408 programs is at the PEO level or

[32] Senior PMS-340 personnel, Personal Interview, March 31, 2006

below. Second, PMS-408 programs leverage technology from pre-existing systems to shorten production and delivery times of Explosive Ordnance Disposal (EOD) tools to the fleet. And thirdly, PMS-408 uses User Operational Evaluation Systems (UOES).

PMS-408 is primarily responsible for ACAT IV level programs. An ACAT IV MDA is designated in accordance with service component policy with review and decision authority set at the lowest appropriate level. For PMS-408, MDA has been designated as the Program Executive Officer for Littoral Mine Warfare. If an acquisition programs falls below the ACAT IV level, it is considered an Abbreviated Acquisition Program (AAP). In these cases the MDA is delegated below the PEO level.[33] When the MDA works in close physical proximity to the system design teams and operational users of the EOD tool, there are fewer levels of management involved in the milestone decision process. As a result, there is less staff working hours spent developing and preparing briefs for the various levels of management and the time it takes to get a milestone decision from the MDA is shortened. Therefore, movement from one milestone phase to the next happens quickly, and time from requirements approval to production decision is greatly reduced. Of the 28 programs managed by PMS-408, 20 are currently or projected to be AAP.[34]

When advanced technology already exists, PMS-408 leverages this technology to bring required capability to the Navy. An example is the acquisition of the MK 1/2 EOD robots. During the Analysis of Alternatives in the acquisition life cycle, it was determined that a commercially available robot could meet the EOD requirement with a few modifications. PMS-408 contacted the commercial vendor, discussed the needed modifications, and a requirement approval was reached. The time from requirements approval to production decision was just three years. Initial Operating Capability is expected within six months of Milestone C production.[35] In this case, the technology leveraging could streamline the process because full scale development was not required

[33] Senior PMS-408 staff member, Personal Interview, March 30, 2006

[34] PMS-408 presentation, "Program Management Office Explosive Ordnance Disposal Presentation," March 30, 2006, 12-13

[35] PMS-408 presentation, 12-13

and explosives were not designed into the system. When existing technology is not available to meet EOD requirements, full scale development is required and can add a year or more to the acquisition process.[36] When explosive are required to be designed into the system, the acquisition must go through a Weapons Explosive Safety Review Board certification which can add two years or more to the acquisition life cycle. Where possible, PMS-408 works with system design teams to develop systems that can allow explosives to be added at the operator's location instead of designed into the system, saving both time and money.[37]

Finally, PMS-408 credits its business success to its dialogue with the operational customer, and through User Operational Evaluation Systems (UOES). UOES, are preliminary operational capability systems that are given to a special team of operators for use in an operational environment. These special operators evaluate the preproduction system, and provide immediate feedback to the design team so that adjustments are made prior to production decision and Low Rate Initial Production (LRIP). One of the first steps in this process is called "Industry Day." Industry Day is an opportunity for Navy officials to meet with private industry experts to discuss EOD requirements. Prior to Industry Day, Navy officials make an announcement to private industry experts outlining capabilities the Navy is trying to achieve. Companies having mature technology able to address the Navy's capability requirements meet for individual presentations on Industry Day. (Often the Navy can get an idea of the maturity level of required technology by the number of companies that respond to Industry Day announcements.)[38] Industry Day presentations is when the Navy finds out what is available, technologically, that can solve the problems that face the Navy. If the results of Industry Day presentations are that Navy requirements fall outside the realm of the possible, then written requirements are delayed. Industry Day helps PMS-408 refine the requirements before they are written as firm requirements. Industry Day also gives

[36] PMS-408 presentation, 14

[37] Senior PMS-408 staff member, Personal Interview

[38] Senior PMS-408 staff member, Personal Interview

private industry an opportunity to ask for specific details from the Navy in order get a better idea of what capabilities are being sought.

An example of an UOES program is the unmanned undersea vehicles (UUV) program. UUV programs are not the typical acquisition program. UUVs need operator design input to ensure the system meets Human System Interface (HSI) requirements. In other words, the operator needs to relay information on how easy the system is to use in the intended environment. Is it comfortable? Is it easy to figure out how to operate? HSI is an important component in system design when multi-tasking is required from minimally manned units. The ability of the operator to move from one system to another and quickly acclimate to the new system is the bases upon which HSI can determine the success or failure of a systems design. Failures in HSI can delay a production decision for acquisition program. UOES provide EOD teams with the opportunity for in-depth HSI, before the system enters LRIP. Additionally, UOES, employ an 80 percent solution design concept. This 80 percent solution capability is used in areas where previously no capability existed. The argument is an 80 percent solution to a given problem area is better than no solution at all. For PMS-408, the 80 percent solution is not the end of the design process. The remaining 20 percent is achieved through pre-planned product improvements after production decision.[39] By making a production decision with an 80 percent solution, PMS-408 can streamline the acquisition process, and place an asset in operation to fill a capability gap. In cooperation with the resource sponsor, the MDA and Program Manager have the freedom to redirect funds to work on programs that need to mature and become usable. So, rather that spend scarce resources to develop the remaining 20 percent solution on a test UUV, the remaining 20 percent solution is designed into the production vehicles as pre-planned product improvements. The money that would have been spent on the remaining 20 percent solution for a test UUV can be reprogrammed to develop mature technology in some other area.[40]

The interviews and archival data indicate that the level of flexibility within PMS-408 is possible as a result of at least two factors. First, the MDA is placed at the

[39] Senior PMS-408 staff member, Personal Interview

[40] Senior PMS-408 staff member, Personal Interview

appropriate level within the PEO, and thus avoids unnecessary staffing delays. Second, the acquisition program is further streamlined by the leveraging of existing technology for EOD tools, and by the introduction of UOES so that timely, capable systems can be delivered to EOD operators. When requirement approval and production decisions can be made quickly, acquisition resources and manpower can be made available for other acquisition needs.[41] The cyclical decision process of sensing the users needs and responding quickly, helps to streamline the acquisition life cycle for PMS-408.

2. Modeling the Process: Explosive Ordnance Disposal (PMS-408)

The business process design for PMS-408 can be graphically display using an adaptive loop model. EOD capability gaps are determined by the operational environment. Capability needs are sent to PMS-408, via the acquisition process, where available technology is leveraged to reduce costs and development time. UOES helps PMS-408 decide with system designs will fill the capability gap to at least 80 percent. After evaluation of the attributes of the UOES, a production decision can be made to further develop and procure the EOD system. The combination of capability gap identification and UOES gives PMS-408 the ability to understand the need to adapt to operational change and quickly respond with effective systems. A generic PMS-408 Adaptive Business Process is at Figure 4.

[41] Senior PMS-408 staff member, Personal Interview

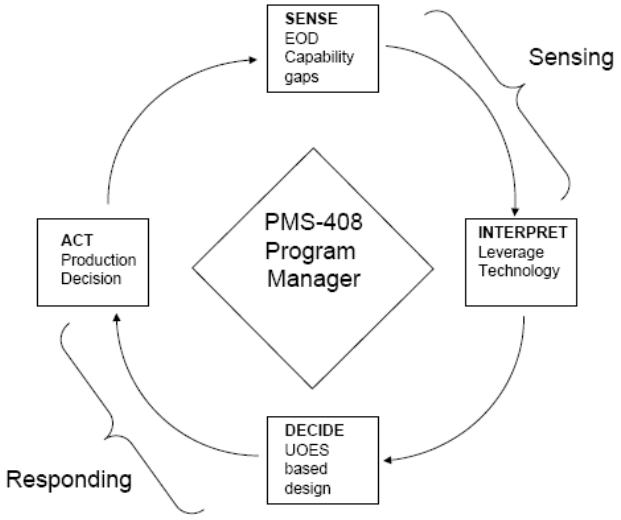

Figure 4. Generic PMS-408 Adaptive Business Process

D. BUSINESS PROCESS FOR LCS MISSION MODULES (PMS-420)

PMS-420 coordinates with five resource sponsors for development and procurement of those mission systems that are not resourced and developed within PEO/LMW. Each mission system is an independent ACAT program and is managed by a Program Manager who is not part of the PMS-420 organization. In addition, PMS-420 coordinates Mission Package integration with the contracted Mission Package Integrator; and coordinates system interface with PMS-501, which is responsible for the sea frame acquisition. Acquisition coordination across a broad spectrum of organizations makes program oversight and communication essential. The basic tool utilized by PMS-420 to facilitate program coordination is the Memorandum of Agreement (MOA). An MOA describes and specifies roles and responsibilities between PMS-420, the responsible resource sponsors and each system program office.

1. Mission System Resource Sponsors

A December 2003 MOA between the Director of Expeditionary Warfare, Director Air Warfare, Director Space, Information Warfare, Command and Control Division, Director Surface Warfare and Director Submarine Warfare, outlines the primary roles and

responsibilities for resourcing all systems identified as being a candidate for the LCS core system and mission packages.[42] The MOA provides functional system responsibility for platform, sensors, weapons and the communication relay packages. Although the MOA acknowledges that Sea Frame and Mission Modules will be procured and developed separately; and that this unique approach requires a *new* approach to resourcing the Mission Modules, the functional areas of responsibility for resourcing the Mission Modules remain the same as previous acquisition processes.[43]

For example, the responsibility for funding and development of sensors and weapons for the ASW mission package falls partly to Director Surface Warfare (N86); specifically surface and air launched weapons, and partly to Director Submarine Warfare (N87); specifically the Advanced Deployable System (ADS). The tactical Unmanned Aerial Vehicle (UAV) that is part of the ASW package is funded and developed by Director Air Warfare (N88). PMS-420 is responsible for integration of each of these ASW mission systems into the ASW Mission Module as well as being responsible for life cycle support for each module. Since the LCS program is designed around concurrent mission system development vice sequential development there is no physical mission module on which to base a life cycle plan. In order to develop a life cycle plan, without the aide of a working module, PMS-420 maintains communication with *each individual mission system* Program Manager within each resource sponsor. If the working module existed, the level of communication with each mission system Program Manager would be less.[44]

2. Independent ACAT Level Programs

As mentioned, without a working module, PMS-420 maintains communication with each individual system Program Manager. Each mission system in the MIW, ASW

[42] Department of the Navy, "Memorandum of Agreement between Director of Expeditionary Warfare, Director Air Warfare, Director Space, Information Warfare, Command and Control Division, Director Surface Warfare and Director Submarine Warfare," December 8, 2003, 2

[43] Department of the Navy, "Memorandum of Agreement…" 2.

[44] PMS-420 Staff member, Personal Interview

and SUW mission modules is an independent ACAT program and is managed by a Program Manager who is not part of the PMS-420 organization. Using an ASW mission module example, the surface launched weapons, air launched weapons, ADS, and tactical UAV each have a Program Manager who is responsible for their own ACAT program and reporting to their own MDA. This is separate from the PMS-420 Mission Module ACAT program. The PMS-420 ACAT program is dependant upon the successful delivery of certified mission systems from other Program Managers for integration into the Mission Module.

During the course of development, each mission system matures at varying rates and progress through the acquisition life cycle at different rates. Though specific time lines are provided for delivery of the LCS ship and Mission Module, updating the timeline can be challenging when each system is being concurrently development. Functional and design changes made by Director Air Warfare on the UAV, for example, may greatly affect the operation or interface compatibility of the air launched ASW weapon being developed by Director Surface Warfare. For example, if Director Air Warfare determines that the size of the UAV must be reduced to be operationally suitable for the intended platform, the resulting reduction in size of the UAV may affect its weapons carrying payload, and thus affect the weapon design being considered by Director Surface Warfare.

3. Mission Package Integrator and Mission System/Sea Frame Interface

PMS-420 coordinates Mission Module integration with Northrop Grumman, the Mission Package Integrator (MPI) and coordinates system interface with PMS-501, which is responsible for the sea frame acquisition. PMS-420 is responsible for the LCS Mission Module development and life cycle support and works with PMS-501 to ensure the mission modules have the proper systems interface with the LCS Sea Frame. Once completed, the mission module will be turned over to the MPI and interfaced with the Sea Frame. In order to complete the systems interface, clear communication must take place between the mission system developers, the sea frame developers and the MPI. This information flows through PMS-420 based on MOAs in place with each organization, but

there is no standardized method by which this communication *must* flow. Additionally, the MOAs do not provide specific authority for PMS-420 to direct the communication structure or method in order to facilitate interagency communication.

4. Modeling the Process: LCS Mission Module (PMS-420)

The business process for PMS-420 functions using a series of MOAs with each resource sponsors. Each resource sponsor is responsible for the acquisition of specific mission systems that are later integrated into a Mine Warfare, Anti-submarine Warfare or Surface Warfare mission module. Because the business process functions using a series of MOAs, the modeled process looks similar to an organizational chart. For example, the Unmanned Surface Vehicle (USV) is an acquisition program for Director Surface Warfare. The USV system is to be integrated into the overall Mine Warfare Mission that is the responsibility of Director Expeditionary Warfare. The mine warfare mission systems are integrated into the Mine warfare mission module which is the responsibility of PMS-420. The certified Mine Warfare Mission Module is delivered to the Mission Package Integrator and later integrated into the LCS Sea Frame. Interviews and archival data indicate that MOAs define roles and responsibility between resource sponsors, but do not necessarily define the end product of the relationship, where the end product is delivered or how it is delivered. The combination of MOA's and other PMS-420 relationships shape the business model in Figure 5.

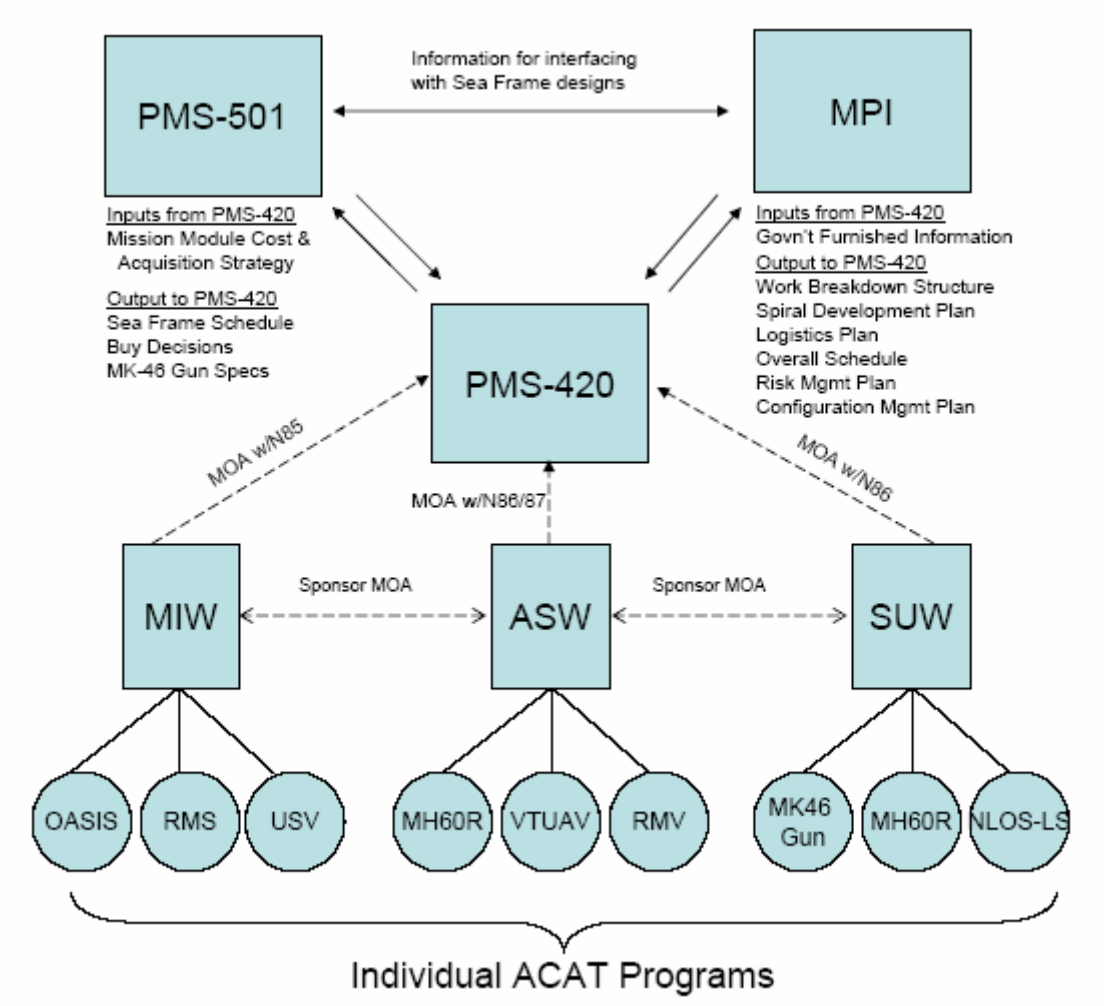

Figure 5. PMS-420 Business Process based on MOA's

V. ANALYSIS OF DATA

A. BUSINESS PROCESS SHOULD SUIT THE ACQUISITION STRATEGY

The Transformation Planning Guidance presents adaptive planning, and accelerated acquisition cycles based on spiral development, as some of the strategies for transforming the way the Department of Defense should conduct business.[45] The acquisition strategy for the Littoral Combat Ship and Mission Modules, rely on a planned accelerated acquisition cycle and spiral development. These strategies require an adaptive business process suited to handle accelerated acquisition with flexible decision making. Although the current MOA business structure used by PMS-420 provides guidance for relationships and resource responsibilities, it lacks adaptability and flexibility. Further, PMS-420 must be able to determine and affect the critical path for all ACAT programs contributing to or supporting the Mission Module Acquisition Plan. Finally, a business process must provide methods of accountability and clear lines of authority between organizations.

1. Flexible Business Process Diagram

The analysis of the business process for PMS-408 revealed an adaptable, flexible, user focused business process similar to the Adaptive Business Process discussed in Chapter II. Chapter IV presented the structural make-up of PMS-408 that facilitates an adaptive business process. The MDA for ACAT IV programs is designated in accordance with service component policy. For the Navy, the MDA is placed at the PEO level. Since some of the programs managed by PMS-408 are Abbreviated Acquisition Programs (AAP), the MDA is at a lower level and thus closer to the system design teams and the customer. By leveraging existing technology, PMS-408 is able to shorten the acquisition cycle. Additionally, through the use of UOES, PMS-408 is able to work closely with system design experts and operational EOD users. Because the adaptive business process is an open loop process, PMS-408 gets real-time operational feed back

[45] Donald Rumsfeld, 6

on preproduction EOD tools. The combination of these attributes gives PMS-408 a distinct advantage in being both flexible and responsive in a changing environment.

A direct comparison of the EOD acquisition strategy with that of the LCS Mission Module strategy is not feasible because of the different program sizes, acquisition strategies and organizational structures. The LCS Mission Modules acquisition is an ACAT I-D program with funding levels in excess of $3 billion.[46] ACAT I-D programs receive the highest level of government oversight and scrutiny. House Appropriations Committee report 109-119 included a request for the Navy to provide a report on the procurement and development plan for the LCS Mission Module. This plan was to be presented to Congress no later than February 1, 2006.[47] Oversight has an acknowledged benefit as well as costs. The time Program Managers spend collecting, organizing and presenting data up the Chain of Command delays the acquisition process because the Program Managers are busy briefing data rather than managing the programs. In addition, the Secretary of the Navy has been directed, in the FY2006 Defense Authorization Act, to submit an annual report to Congress providing current information regarding elements of LCS designated as a mission package.[48] The report is to be submitted to Congress at the same time as the Presidents Budget for the next fiscal year.[49]

The acquisition strategy for LCS and LCS Mission Modules require that both sea frame and Mission Modules be developed concurrently. Mission modules contain several mission systems that must be individually coordinated to meet a predetermined acquisition life cycle delivery schedule. By contrast, EOD acquisition strategies are general focused on one user at a time and development happens sequentially according to

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[46] PEO, "Power Point Brief for Dr. Delores Etter, 6

[47] Program Executive Officer, Littoral Mine Warfare, "Report to Congress: Littoral Combat Mission Packages," Unpublished (Washington DC: Washington Navy Yard, March 2006) 3

[48] PEO/LMW Report to Congress, 3

49 PEO/LMW Report to Congress, 3

the Program Managers schedule. Furthermore, the primary acquisition strategy for the Mission Modules depends upon spiral development vice technology leveraging as with PMS-408.

2. Commitment Management: Identifying the Critical Path

Looking again at Figure 6, it can be seen that PMS-420 does not have direct communication with or oversight of most mission systems being developed. For instance, unlike PMS-408, PMS-420 does not have the same working relationship and physical proximity to both operational end users and systems design teams. When attempting to indirectly coordinate multiple, concurrent acquisition processes, sufficient oversight is essential. For PMS-420 to function as an Adaptive Business Process able to coordinate multiple, concurrent acquisition processes, there needs to be better Coordination of Capabilities or commitment management. In a sense-and-respond organization, a commitment is an agreement between two parties to produce a defined outcome.[50] Commitment Management keeps track of who owes what to whom and enables the adaptive business process to identify the critical path and address commitment break downs. By defining the roles of each mission system acquisition as a commitment, "it helps individuals and organizations understand there relationship to one another and their personal contributions to the organizations reason for being."[51]

B. MEMORANDUM OF AGREEMENT

Coordinating the mission system programs managed directly or indirectly by PMS-420 requires the use of formal authority to facilitate commitment management. The MOA does not give PMS-420 the formal authority needed because it is broadly worded in defining roles and responsibilities, and can vary from agreement to agreement. In addition, the MOA does not empower PMS-420 to direct specific action by a system program office or between system program offices. To effectively run an aggressive,

[50] Haeckel, 142

[51] Haeckel, 147

flexible acquisition program like the LCS Mission Module, PMS-420 requires more formalized authority to direct and request action from resource sponsors. This level of authority is not granted to PMS-420 in the MOA. [52] In an adaptive business process, what is need is a standard universal protocol that describes how commitments between organizations originate and how they should be carried out.[53] A standard contract, detailing who owes what to whom, could serve as a universal protocol. One possible solution is for PMS-420 to adopt a system of commitment management with a Ship Project Directive (SPD). An SDP is "a contractual document between two government programs in acquiring Government Furnished Equipment (GFE), Government Furnished Information (GFI) and services to support a shipbuilding program." Ship Project Directive Systems are reference by a Naval Sea System Command instruction and have been in affect since 1984.[54] An SPD will empower PMS-420 to:

Transmit requirements and management direction from PMS-420 via PEO/LMW to Project Acquisition Resource Managers (PARMs)

Provide funding to procure GFE, GFI, support equipment and services

Provides detailed listing of all GFE and GFI with Required Delivery Dates (RDDs), Shipyard Preferred Dates (SYPDs) and Best Estimated Delivery Dates (BEDDs).[55]

Further details of SDP can be found at NAVSEAINST 5000.5, "Ship Project Directive Systems; implementation of" dated 09 June 1984.

C. REQUIRED CULTURAL CHANGE

The Department of Defense acquisition environment compels PMS-420 to re-engineer its business process. Yet, the functional areas of responsibility remain the same

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[52] Memorandum of Agreement between Warfare Directors, 7

[53] Haeckel, 147

[54] Program Executive Office, Ships, "Ship Project Directive Process and Financial Analysis Process," Power Point Brief (unpublished brief: October 21, 2005) 3

[55] PEO/Ships, 4

as the previous acquisition processes. The unintended consequences of keeping the functional areas the same is the "business as usual" mindset. In order for PMS-420 to experience efficiency from business process re-engineering efforts, the "business as usual" mindset must give way to a culture that promotes expedience and efficiency, even if it means delegating decision authority to offices lower in the chain of command or forgoing the request for additional Department briefings. The PMS-420 business process is obsolete for the adaptive and flexible acquisition strategy being employed in the LCS program, but they will be extremely difficult to re-engineer the process without an associated cultural change in the Department of the Navy (DoN), DoD and Congress.

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VI. RECOMMENDATIONS

A. ADOPT A FLEXIBLE BUSINESS PLAN

In Chapter II, this paper discussed an overview of business process re-engineering. Hammer and Champy's key words in defining business process re-engineering, are very applicable to the needs of PMS-420. These words are, fundamental, radical, dramatic and processes.

The "Fundamental" business process of the acquisition life cycle drives PMS-420. Chapter IV and Appendix B provide a brief description of the acquisition life cycle that is based on the sequential steps of an acquisition strategy. When this fundamental business process is applied to the desire for an aggressive acquisition strategy with concurrent system development, the business process fails to meet expectations. The questions, "Why do we do it the way we do it?" must be answered with respect to the demands of the new acquisition strategy. "Radical" is the re-engineered design concept that must take hold. A flexible business approach must be implemented to manage the concurrent system development strategy which is fueled by an aggressive delivery schedule. "Dramatic" is the type of performance change needed. When dealing with ACAT level I programs, any change in business process must produce dramatic results to satisfy the number of people and agencies that have oversight of the program. And finally, "processes" that place undo delay in the acquisition timeline must be eliminated. The MDA must be kept aware of the myriad of issues surrounding a program. When the MDA is not in contact with the operational users and design teams, keeping the MDA aware requires more specific effort than when the MDA is in contact with operational users and design teams. The process of updating the MDA can add time to the acquisition process. PMS-420 must make fundamental, radical and dramatic change in the business process in order to meet the expectations of the current LCS Mission Module acquisition strategy.

Recommendation: MDA for all or some areas should be lowered to the PEO level to expedite the decision process and reduce time delays in updating each level of the command structure up to the MDA.

B. PROVIDE FORMALIZED AUTHORITY

The MOA framework does not provide the level of commitment between people and organizations needed in this fast moving acquisition process. Formulized authority must be granted to PMS-420 so that clear direction can be given with clear understanding of responsibilities between people and agencies. PMS-420 should investigate alternative government agency-to-agency contracts that can be designed for the LCS Mission Module acquisition.

Recommendation: Implement a standard contract between government agencies that provides clear guidelines on who owes what to whom.

C. GET DEPARTMENT OF THE NAVY BUY-IN

The most difficult part in re-engineering a business process is getting buy-in from senior management. The Navy is supporting an aggressive acquisition strategy with the LCS Mission Module, and it must support an aggressive change in the way PMS-420 does business in order to support the new strategy. Re-engineering the PMS-420 business process to make it adaptive and flexible means changing the "business as usual mindset" throughout the Navy. As mentioned in Chapter IV, the MOA between the Warfare Directors acknowledges that Sea Frame and Mission Modules will be procured and developed separately; and that this unique approach requires a *new* approach to resourcing the Mission Modules. However, the functional areas of responsibility for resourcing the Mission Modules remain the same as previous acquisition processes. In order for there to be real buy-in to a changed process, the "business as usual mindset" must change also. Part of this adaptive process would require MDA to be lowered to the PEO level to expedite the decision process. This goes against the "business-as-usual

mindset" and may prove to be impossible given current fiscal constraints. However, given the efficiencies demonstrated by PMS-408, it should be considered by senior Navy officials.

Recommendation: The Navy must support an aggressive change in the way PMS-420 does business in order for PMS-420 to successfully support the LCS Mission Module acquisition strategy.

D. CONCLUSION

DoD has pioneered the aggressive acquisition strategy for the LCS Mission Module. Although the acquisition strategy for the LCS Mission Modules, concurrent system development, spiral development and modularity design of mission areas is attainable, the current business process does not support the strategy.

Concurrent system development requires an adaptive, flexible business process that is difficult to engineer in a culture where the MDA is not directly in touch with the operational users. Control must be placed at lower levels in order for the adaptive, flexible response to take place. As the MDA for AAPs, PMS-408 is able to streamline the process because of close proximity to operational users and the ability to make quick decisions without briefing higher levels in the command structure. Although this same responsiveness may not be possible with ACAT I-D level programs during times of fiscal constraint, DoD should seek every opportunity to lower the level for MDA so that a responsive business environment can take root.

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APPENDIX A

ACQUISITION CATEGORIES

Major Defense Acquisition Programs	ACAT ID:	• Designated by USD(AT&L) • Defense Acquisition Board Review • Decision by USD(AT&L)	$365M RDT&E or $2.19B Procurement (FY 2000 Constant $)
	ACAT IC:	• Designated by USD(AT&L) • Component-level Review • Decision by Component	
Major Automated Information Systems Acquisition Programs	ACAT IAM:	• Designated by DoD Chief Information Officer • Information Technology Acquisition Board Review • Decision by DoD Chief Information Officer	$378M Life Cycle Cost or $126M Total Prog. Cost or $32M Prog. Cost in any Single Year (FY 2000 Constant $)
	ACAT IAC:	• Designated by DoD Chief Information Officer • Component-level Review • Decision by Component Acquisition Executive	
Major Systems	ACAT II:	• Designated by Component Acquisition Executive • Component-level Review • Decision by Component Acquisition Executive	$140M RDT&E or $660M Procurement (FY 2000 Constant $)
All Other Systems (Except for Army Navy, USMC)	ACAT III:	• Designated IAW Component Policy • Does Not Meet Criteria for ACAT I, IA, II, or III • Review and Decision at Lowest Appropriate Level	No Fiscal Criteria
Army Navy USMC	ACAT IV:	• Designated IAW Component Policy • Does Not Meet Criteria for ACAT I, IA, II, or III • Review and Decision at Lowest Appropriate Level	See AR 70-1 (Army) & SECNAVINST 5000.2C (Navy and Marine Corps)

Source: Introduction to Defense Acquisition Management, p25

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APPENDIX B

A. ACQUISITION PHASE DEFINITIONS

The phase definitions in this appendix are an excerpt from the Introduction to Defense Acquisition Management pages 52-57. [56]

1. Pre-Systems Acquisition

Pre-systems acquisition is composed of activities in development of user needs, in science and technology, and in technology development work specific to the refinement of materiel solution(s) identified in the approved Initial Capabilities Document (ICD). Two *phases* comprise pre-systems acquisition: *Concept Refinement* and *Technology Development*.

Concept Refinement begins with a Concept Decision by the Milestone Decision Authority. During this phase a Technology Development Strategy (TDS) is developed to help guide the efforts during the next phase, Technology Development. Also, a study called an *Analysis of Alternatives* (AoA) is conducted to refine the selected concept documented in the approved ICD. To achieve the best possible system solution, Concept Refinement places emphasis on innovation and competition and on existing commercial off-the-shelf and other solutions drawn from a diversified range of large and small businesses. Concept Refinement ends when the Milestone Decision Authority approves the preferred solution supported by the AoA and approves the associated TDS.

Technology Development begins after a **Milestone A** decision by the Milestone Decision Authority approving the TDS. The ICD and TDS guide the work during Technology Development. A favorable Milestone A decision normally does not mean that a new acquisition program has been initiated. For shipbuilding, however, programs may be initiated at the beginning of Technology Development.

[56] Defense Acquisition University, 52-57

The purpose of this phase is to reduce technology risk and to determine the appropriate set of technologies to be integrated into a full system. During Technology Development a series of technology demonstrations may be conducted to help the user and the developer agree on an affordable, militarily useful solution based on mature technology. The project is ready to leave this phase when the technology for an affordable increment of a militarily useful capability has been demonstrated in a relevant environment

2. Systems Acquisition

Milestone B. Milestone B will normally be *program initiation* for defense acquisition programs. For shipbuilding programs, the lead ship in a class of ships is also approved at Milestone B. Each increment of an evolutionary acquisition (explained later) will have its own Milestone B. Before making a decision, the Milestone Decision Authority will confirm that technology is mature enough for systems-level development to begin, the appropriate document from the Joint Capabilities Integration and Development System (JCIDS—see Chapter 6) has been approved, and funds are in the budget and the out-year program for all current and future efforts necessary to carry out the acquisition strategy. At Milestone B, the Milestone Decision Authority approves the acquisition strategy and the acquisition program baseline and authorizes entry into the *System Development and Demonstration Phase*.

System Development and Demonstration Phase. Entrance criteria for this phase are technology (including software) maturity, funding, and an approved JCIDS document—the Capability Development Document. Programs that enter the acquisition process for the first time at Milestone B must have an Initial Capabilities Document (ICD) and a Capability Development Document. Unless there is some overriding factor, the maturity of the technology will determine the path to be followed by the program. Programs entering at Milestone B must have both a system architecture (defined set of subsystems making up the system) and an operational architecture (description of how this system interacts with other systems to include passing of data). The efforts of this phase are guided by the Key Performance Parameters (KPPs) found in the approved

Capability Development Document and in the Acquisition Program Baseline (APB). The APB establishes program goals, called thresholds and objectives, for cost, schedule, and performance parameters that describe the program over its life cycle. This phase typically contains two efforts: *Systems Integration* and *Systems Demonstration*. A *Design Readiness Review* takes place at the end of Systems Integration.

Systems Integration. A program enters System Integration when the program manager has a technical solution for the system, but the Component subsystems have not yet been integrated into a complete system. This effort typically includes the demonstration of prototype articles or engineering development models (EDM), sometimes in a competitive "fly-off." A program leaves System Integration after prototypes have been demonstrated in a relevant environment (e.g., a first flight or interoperable data flow across system boundaries), the system configuration has been documented, and a successful Design Readiness Review has been completed.

Design Readiness Review. During SDD the Design Readiness Review provides an opportunity for a mid-phase assessment of design maturity as evidenced by measures such as the number of design reviews successfully completed; the percentage of drawings completed; planned corrective actions to hardware/software deficiencies; adequate developmental testing; and an assessment of environment, safety, and occupational health risks; etc. Successful completion of the Design Readiness Review ends System Integration and continues the SDD phase into the System Demonstration effort.

Systems Demonstration. This effort is intended to demonstrate the ability of the system to operate in a useful way consistent with the approved KPPs. The program enters System Demonstration when the PM has demonstrated the system in prototypes or EDMs. This effort ends when the system is demonstrated (using EDMs in its intended environment); measured satisfactorily against the KPPs; and determined to meet or exceed exit criteria and Milestone C entrance requirements. Industrial capabilities must also be reasonably available. Developmental test and evaluation is conducted to assess technical progress against critical technical parameters, and operational assessments are conducted to demonstrate readiness for production. The completion of this phase is

dependent on a Milestone Decision Authority decision to commit the program to production at Milestone C or to end the effort.

Milestone C. The Milestone Decision Authority makes the decision to commit the Department of Defense to production at Milestone C. Milestone C authorizes entry into Low Rate Initial Production (LRIP) or into production or procurement for systems that do not require LRIP. Milestone C authorizes limited deployment in support of operational testing for major automated information systems or software-intensive systems with no production components. If Milestone C is LRIP approval, a subsequent review and decision authorizes full rate production.

Production and Deployment Phase. The purpose of this phase is to achieve an operational capability that satisfies mission needs. Operational test and evaluation determines the effectiveness and suitability of the system. Entrance into this phase depends on acceptable performance in development, test and evaluation, and operational assessment; mature software capability; no significant manufacturing risks; manufacturing processes under control (if Milestone C is full rate production); an approved ICD (if Milestone C is program initiation); an approved Capability Production Document (CPD); acceptable interoperability; acceptable operational supportability; and demonstration that the system is affordable throughout the life cycle, optimally funded, and properly phased for rapid acquisition. For most defense acquisition programs, Production and Deployment has two major efforts: *Low Rate Initial Production* and *Full Rate Production and Deployment*. It also includes a *Full Rate Production Decision Review*.

Low Rate Initial Production. This effort is intended to result in completion of manufacturing development to ensure adequate and efficient manufacturing capability; produce the minimum quantity necessary to provide production or production-representative articles for IOT&E; establish an initial production base for the system; and permit an orderly increase in the production rate sufficient to lead to full rate production upon successful completion of operational and, where applicable, live-fire testing. The Milestone Decision Authority determines the LRIP quantity for ACAT I and II programs at Milestone B. LRIP is not applicable to automated information systems or software-

intensive systems with no developmental hardware; however, a limited deployment phase may be applicable. LRIP for ships and satellites is the production of items at the minimum quantity and rate that is feasible and that preserves the mobilization production base for that system.

Full Rate Production Decision Review. Before granting a favorable Full Rate Production Decision Review, the Milestone Decision Authority considers initial operational test and evaluation and live fire test and evaluation results (if applicable); demonstrated interoperability; supportability; cost and manpower estimates; and command, control, communications, computer, and intelligence supportability and certification (if applicable). A favorable Full Rate Production Decision authorizes the program to proceed into the Full Rate Production and Deployment portion of the Production and Deployment Phase.

Full Rate Production and Deployment. The system is produced and delivered to the field for operational use. During this phase, the program manager must ensure that systems are produced at an economical rate and deployed in accordance with the user's requirement to meet the initial operational capability requirement specified in the Capability Production Document. Follow-on Operational Test and Evaluation may also be conducted, if appropriate, to confirm operational effectiveness and suitability or verify the correction of deficiencies. Operations and support begins as soon as the first systems are fielded/deployed; therefore, the Production and Deployment Phase overlaps the next phase—Operations and Support.

Operations and Support Phase. During this phase full operational capability is achieved, each element of logistics support is evaluated (e.g., supply, maintenance, training, technical data, support equipment), and operational readiness is assessed. Logistics and readiness concerns dominate this phase. The supportability concept may rely on a government activity, a commercial vendor, or a combination of both to provide support over the life of the system. System status is monitored to ensure the system continues to meet the user's needs. The operations and support phase includes *sustainment* and *disposal.*

3. Sustainment and Disposal

Sustainment. Sustainment includes supply, maintenance, transportation, sustaining engineering, data management, configuration management, manpower, personnel, training, habitability, survivability, environment, safety (including explosives safety), occupational health, protection of critical program information, anti-tamper provisions, and information technology (including National Security Systems (NSS) supportability and interoperability functions). Effective sustainment of weapon systems begins with the design and development of reliable and maintainable systems through the continuous application of a robust systems engineering methodology. The program manager works with the users to document performance and support requirements in performance agreements specifying objective outcomes, measures, resource commitments, and stakeholder responsibilities. System modifications are made, as necessary, to improve performance and reduce ownership costs. Product improvement programs or service life extension programs may be initiated as a result of experience with the systems in the field. During deployment and throughout operational support, the potential for modifications to the fielded system continues. Modifications that are of sufficient cost and complexity to qualify as ACAT I or ACAT IA programs are considered as separate acquisition efforts for management purposes. Modifications that do not cross the ACAT I or ACAT IA threshold are considered part of the program being modified.

Disposal of the system occurs at the end of its useful life. The program manager should have planned for disposal early in the system's life cycle and ensured that system disposal minimizes DoD's liability due to environmental safety, security, and health issues. Environmental considerations are particularly critical during disposal as there may be international treaty or other legal considerations requiring intensive management of the system's demilitarization and disposal.

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