NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

A STUDY ON IMPROVING DEFENSE ACQUISITION THROUGH THE APPLICATION OF DEFENSE ACQUISITION WORKFORCE IMPROVEMENT ACT (DAWIA) CONCEPT TO DEFENSE INDUSTRY WORKFORCE

by

Davis I. Choi

September 2009

Thesis Advisor:	Walter Owen
Second Reader:	John A. Sarakatsannis

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 2009	Master's Thesis

4. TITLE AND SUBTITLE A Study on Improving Defense Acquisition through the Application of Defense Acquisition Workforce Improvement Act (DAWIA) Concept to Defense Industry Workforce	5. FUNDING NUMBERS
6. AUTHOR(S) Davis I. Choi	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES: The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Approved for public release; distribution is unlimited	A

13. ABSTRACT (maximum 200 words)

The Department of Defense (DoD) believes that acquisition workforce is the most important asset to assure long-lasting reform of the defense acquisition system, and to optimize the expenditure of ever-decreasing acquisition resources. The Defense Acquisition Workforce Improvement Act (DAWIA) is the basis of defense acquisition workforce policy. As a part of the FY 1991 National Defense Authorization Act, the DAWIA requires the DoD to establish and manage career development through establishment of education and training standards, requirements, and courses for the DoD civilian and military acquisition workforce.

Defense acquisition leadership in general recognizes that cross-organizational collaboration and disciplined communication are pivotal to successful program acquisition. However, they have not yet completely grasped the control and management of defense industry establishments and activities. The DoD and defense industry are yet to recognize how much they know and don't know each other. This thesis evaluates the Defense Acquisition Workforce Improvement Act (DAWIA) principle, investigates the adaptation of DAWIA concept to defense industry establishment, and provides recommendations to the defense acquisition community.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Defense Acquisition, Defense Acquisition Workforce, Defense Acquisition Workforce Improvement Act, Certification, Professionalization, Workforce, Defense Industry Workforce, Program Management, Project Management	121
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UU

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

A STUDY ON IMPROVING DEFENSE ACQUISITION THROUGH THE APPLICATION OF DEFENSE ACQUISITION WORKFORCE IMPROVEMENT ACT (DAWIA) CONCEPT TO DEFENSE INDUSTRY WORKFORCE

Davis I. Choi
Senior Project Engineer, Boeing Integrated Defense Systems
B.S., United States Air Force Academy, 1981
M.S., University of Southern California, 1985
M.S., Troy State University, 1989

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN SYSTEMS ENGINEERING MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
September 2009

Author: Davis I. Choi

Approved by: Walter Owen
Thesis Advisor

John A. Sarakatsannis
Second Reader

David H. Olwell
Chairman, Department of Systems Engineering

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

The Department of Defense (DoD) believes that acquisition workforce is the most important asset to assure long-lasting reform of the defense acquisition system, and to optimize the expenditure of ever-decreasing acquisition resources. The Defense Acquisition Workforce Improvement Act (DAWIA) is the basis of defense acquisition workforce policy. As a part of the FY 1991 National Defense Authorization Act, the DAWIA requires the DoD to establish and manage career development through establishment of education and training standards, requirements, and courses for the DoD civilian and military acquisition workforce.

Defense acquisition leadership in general recognizes that cross-organizational collaboration and disciplined communication are pivotal to successful program acquisition. However, they have not yet completely grasped the control and management of defense industry establishments and activities. The DoD and defense industry are yet to recognize how much they know and don't know each other. This thesis evaluates the Defense Acquisition Workforce Improvement Act (DAWIA) principle, investigates the adaptation of DAWIA concept to defense industry establishment, and provides recommendations to the defense acquisition community.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AFIT	Air Force Institute of Technology
AFSAB	Air Force Scientific Advisory Board
AJAX	Asynchronous JavaScript and XML
ANSI	American National Standards Institute
ASEP	Associate Systems Engineering Professional
ASQ	American Society for Quality
AT&L	Acquisition, Technology and Logistics
AUD	Auditing
BUS-CE	Business – Cost Estimating
BUS-FM	Business – Financial Management
C4ISR	Command, Control, Communications, Computers, Intelligence Surveillance and Reconnaissance
CAE	Component Acquisition Executive
CAIV	Cost As an Independent Variable
CAP	Critical Acquisition Position
CAPM	Certified Associate in Project Management
CCCM	Certified Commercial Contracts Manager
CD	Concept Decision
CDD	Capabilities Development Document
CFCM	Certified Federal Contracts Management
CGAP	Certified Government Auditing Professional
CIA	Certified Internal Auditors
CML	Certified Master Logistician
CON	Contracting
CPCM	Certified Professional Contracts Manager
CPD	Capabilities Production Document
CPFF	Cost Plus Fixed Fee
CPL	Certified Professional Logistician
CQE	Certified Quality Engineer
CR	Concept Refinement
CSDA	Certified Software Development Associate
CSDL	Computer Society Digital Library
CSDP	Certified Software Development Professional
CSEP	Certified Systems Engineering Professional
CSEP-Acq	Certified Systems Engineering Professional with US DoD Acquisition Extensions
CSIS	Center for Strategic and International Studies
CSSBB	Certified Six Sigma Black Belt
CSSGB	Certified Six Sigma Green Belt
DAB	Defense Acquisition Board
DAIP	Defense Acquisition Improvement Program
DAPA	Defense Acquisition Performance Assessment
DAU	Defense Acquisition University
DAWIA	Defense Acquisition Workforce Improvement Act
DCP	Decision Coordinating Paper
DFAR	Defense Federal Acquisition Regulation
DL	Demonstrated Logistician
DML	Demonstrated Master Logistician

Acronym	Definition
DSL	Demonstrated Senior Logistician
DMR	Defense Management Report
DoD	Department of Defense
DoDAF	Department of Defense Architectural Framework
DoDD	DoD Directive
DoDI	DoD Instruction
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities
DSARC	Defense Systems Acquisition Review Council
DSB	Defense Science Board
DSP	Defense Support Program
DUSD(AR)	Deputy Under Secretary for Defense (Acquisition Reform)
DUSD(AT&L)	Deputy Under Secretary of Defense Acquisition, Technology and Logistics
EA	Evolutionary Acquisition
EMD	Engineering & Manufacturing Development
ESEP	Expert Systems Engineering Professional
EVMS	Earned Value Management System
FAR	Federal Acquisition Regulation
FASA	Federal Acquisition Streamlining Act
FE	Facilities Engineering
FFP	Firm Fixed Price
FFRDC	Federally Funded Research and Development Center
FY	Fiscal Year
GAO	Government Accountability Office (Name changed from General Accounting Office effective on 7 July 2004)
GPRA	Government and Performance Results Act
HTTP	Hyper Text Transmit Protocol
JD	Julius Doctor
JMSNS	Justification for a Major Systems New Start
ICD	Initial Capabilities Document
IEEE	Institute of Electrical and Electronic Engineers
IEEE CS	Institute of Electrical and Electronic Engineers Computer Society
IIA	Institute of Internal Auditors
IMP	Integrated Master Plan
INCOSE	International Council on Systems Engineering
IND	Industrial and/or Contract Property Management
IPPD	Integrated Product Process Development
IPT	Integrated Product Teams
IT	Information Technology
ITAR	International Traffic in Arms Regulations
KLP	Key Leadership Position
LCL	Life Cycle Logistics
MBA	Master of Business Administration
MDD	Materiel Development Decision
MENS	Mission Element Need Statement
MILSPECs	Military Specifications
MS	Master of Science
MSA	Materiel Solution Analysis
NCMA	National Contract Management Association
NPR	National Performance Review
NRO	National Reconnaissance Office

Acronym	Definition
NSSA	National Security Space Acquisition Policy
OOA/D	Object Oriented Analysis and Design
OSD	Office of the Secretary of Defense
PAT	Process Action Teams
PDU	Professional Development Unit
PEOs	Program Executive Officer
PgMP	Program Management Professional
PM	Program Management
PMBOK	Project Management Body of Knowledge
PMCD	Project Manager Competency Development
PMI	Project Management Institute
PMI-SP	PMI Scheduling Professional
PMI-RMP	PMI Risk Management Professional
PMP	Project Management Professional
POM	Program Objectives Memorandum
PPBS	Planning, Programming and Budgeting System
PQM-QA	Production, Quality and Manufacturing – Quality Assurance
PQM-PM	Production, Quality and Manufacturing – Production & Manufacturing
PUR	Purchasing
RFP	Request for Proposal
ROE	Rules of Engagement
SAIC	Science Applications International Corporation
SEP	Systems Engineering Plan
SDD	System Development and Demonstration
SOLE	International Society of Logistics
SOW	Statement of Work
SPRDE-S&TM	Systems Planning, Research, Development & Engineering – Science and Technology Manager
SPRDE-SE	Systems Planning, Research, Development & Engineering – Systems Engineering
SPRDE-PSE	Systems Planning, Research, Development & Engineering – Project Systems Engineer
SSB	Senior Steering Board
T&E	Test and Evaluation
T&M	Time and Material
TOC	Total Ownership Costs
TSIR	Total System Integration Responsibility
TSPR	Total System Performance Responsibility
TT&C	Telemetry, Tracking and Commanding
UML	Unified Model Language
USD(A)	Under Secretary of Defense for Acquisition
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology and Logistics
WMG	Workforce Management Group
XML	Extensible Markup Language

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

I would like to thank God, our families and friends for all their support through this journey. Also, I would like to express gratitude to Professor Walter (Wally) Owen and John Sarakasannis (aka, BJ–Big John) for their support, and extensive review and scrutiny of this thesis.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

This chapter presents the purpose, problem statement, and research design for a study on improving defense acquisition through the application of Defense Acquisition Workforce Improvement Act (DAWIA) concept to defense industry. It identifies the research questions to answer and research methods. Finally, the significance, scope, and summary of the study are discussed.

A. BACKGROUND

The Department of Defense (DoD) has a long and inconsistent history of defense acquisition program successes and failures. When the programs and projects fail, causing cost overruns, schedule delays and performance shortfalls both the warfighters and tax payers are at loss. The repeated and growing failures in defense acquisition over the past decades, have been well documented and reported in numerous Government Accountability Office (GAO), Office of the Secretary of Defense (OSD), and various other agency reports, along with Congressional panels and commissions. The recurring and cited causes are: unclearly stated, inaccessible, and changing needs and requirements; unstable year to year funding; congressional and bureaucratic meddling; poorly established and tracked baseline; and insufficient investment in systems engineering and program management. Numerous studies and examinations have also produced similar observations regarding systemic shortfalls and recommended fixes. While the DoD's acquisition policies and directives adopted many of the most substantive findings and recommendations of these reviews, the people managing the process lacked the will to carry through and implement them in program decisions.

DoD leaders are painfully aware of the fiascos that continue to plague the defense acquisition systems. In 2005, then-acting Deputy Secretary of Defense Gordon England authorized an integrated assessment of the defense acquisition process through the Defense Acquisition Performance Assessment (DAPA) project. Citing "many programs continue to increase in cost and schedule even after multiple studies and recommendations that span the past 15 years," he directed a thorough assessment of the

defense acquisition process "to consider every aspect of acquisition, including requirements, organization, legal foundations, decision methodology, oversight, checks and balances—every aspect" (Christie, 2006, p. 30). The DAPA panel, led by retired Air Force Lieutenant General Ronald T. Kadish, reported the findings to the 109th Congress House Armed Services Committee on 29 March 2006. The DAPA panel found that the defense acquisition system's problems "are deeply embedded in many of the acquisition management processes that we use in the Department of Defense and not just the traditional procurement system." The panel proposed an integrated transformation of acquisition to "reduce costs and enhance overall acquisition performance." This assessment found that the defense acquisition process is in need of fundamental reform to more clearly align responsibility, authority, and accountability within six major categories—workforce, acquisition, requirements, budget, industry and organization. Under the significantly different security environment government is facing, the panel pointed out that the defense acquisition processes needed to meet the demands of this environment, requiring flexibility and agility to respond to more dynamic security environments and rapidly changing needs. Furthermore, the panel emphasized that adapting the acquisition system to the realities of a new security environment cannot be considered independently of the organizations charged with its conduct and the system used to recruit, train, develop, and retain its workforce. In the end, the panel recommended rebuilding value and stabilizing the leadership in the acquisition workforce, and enhancing the training, education, certification, and qualifications of the entire acquisition workforce (DoD DAPA, 2006).

One major element of defense acquisition success, as with any other business and enterprise, is the people. The 8 May 1990 U.S. Congress Report, *The Quality and Professionalism of the Acquisition Workforce*, concluded that acquisition is such a complex process that professional skills and attributes are essential for the people performing acquisition functions. Thus, a comprehensive program is needed to ensure required improvement in the quality and professionalism of those individuals working in acquisition positions throughout the DoD. This report focused on four major questions:

1) Are the services appointing program managers, deputy program managers, and contracting officers with the experience, education, and training required by law and regulation, and are program managers being retained in their positions the mandatory four years or until they complete a major milestone?
2) Is there a career program structure to develop qualified and professional acquisition personnel-both military and civilian?
3) Is there an appropriate mix of military and civilian personnel within the work force?
4) What impediments exist that must be overcome to develop a quality, professional work force and how can that be accomplished? (U.S. Congress, 1990, p. 1)

Given the challenges and missions that defense acquisition community will face in the future, building a wide-ranging network of expert resources and robust defense acquisition workforce is critically important. Numerous previous studies and reviews heavily emphasized on the DoD acquisition community and its workforces. However, having robust DoD acquisition workforce may not enough to face the 21st century security challenges.

B. PURPOSE

The purpose of this study is to provide an understanding of underlying frameworks, issues, and lessons associated with the defense acquisition management. Specifically, this study reviews and analyzes the changes to defense acquisition and workforce policies and directives over the years. Additionally, it recommends the tools and methods to improve defense acquisition process, through adaptation of Defense Acquisition Workforce Improvement Act (DAWIA), for defense industry workforce. This research attempts to provide specific recommendations to the DoD leadership and defense acquisition community, for improved collaboration and communication with defense industry community, in support of the defense acquisition process.

C. RESEARCH QUESTIONS

Instituting practices and policies for DoD acquisition workforce to face the 21st century security challenge may not be enough. The DoD must turn its attention to the

entire defense acquisition establishment which includes DoD and its workforce, and defense industry and its workforces. Are they ready to meet such challenges? Answers to the following questions will provide the steps to elaborate specific recommendations:

1. What are the peculiarities and trends of defense acquisition?

2. What are the lessons of past acquisition programs and initiatives?

3. What is the motive behind Defense Acquisition Workforce Improvement Act (DAWIA)?

4. Can the Defense Acquisition Workforce Improvement Act (DAWIA) concept be applied to the defense industry?

5. If yes, how can the DAWIA concept be adapted to the defense industry community?

D. BENEFITS OF STUDY

This study provides specific recommendations to the DoD acquisition community for methods and tools to improve communication and collaborations with the defense industry community.

E. SCOPE

This study pertains to the lessons and issues of various defense acquisition programs, and the analysis of previous and existing acquisition policies, focusing on the applicability of Defense Acquisition Workforce Improvement Act (DAWIA) concept to the defense industry community. Specifically, this study provides the analysis and understanding of the evolution of DAWIA related to DoD workforce education, training, and certification, and investigates, compares, and contrasts DAWIA against selected civilian institutions providing similar services to the defense industry community. Specifically, this research analyzes the similarities and differences between the DAWIA concept and other civilian institutional training, education and certification practices available to the defense industry community, specifically Project Management Institute (PMI), and International Council on Systems Engineering (INCOSE), and provides

methods and tools to help enhance collaboration between the two to improve program management. The importance of collaboration in any business environment is well understood. In the DoD acquisition process, proactive involvement with defense industry early, and even before the initiation of the formal acquisition lifecycle, maximizes collaboration with contractors. This triggers its ability to create innovative design and development techniques. It can establish clear communication channels necessary for effective management and successful problem-solving approaches throughout the process.

F. METHODOLOGY

1. Conduct literature review of various acquisition programs from professional journals, books, government reports, prior theses, and various online sources in order to understand the recurring government acquisition program management issues and results.

2. Define the objective and research questions based on the literature review.

3. Conduct research and review of Defense Acquisition Workforce Improvement Act (DAWIA) concept and applicable civilian institution certifications such as Project Management Institute (PMI) and International Council on Systems Engineering (INCOSE).

4. Investigate and develop analogous application of Defense Acquisition Workforce Improvement Act (DAWIA) concept to defense industry community.

5. Develop recommendations for program acquisition management effectiveness adapting and modeling of Defense Acquisition Workforce Improvement Act (DAWIA) concept to improve collaboration and communication with defense industry community.

G. ORGANIZATION OF STUDY

This research study is broken down into five chapters. A description of each chapter is provided.

1. Chapter I–Introduction

This introductory chapter provides an introduction and overview of this study, the purpose, the research questions, the benefit, the scope, and the methodology of the thesis.

2. Chapter II–Review of Defense Acquisition Program Management

Chapter II reviews, discusses, and analyzes the defense acquisition program management framework. Next, it evaluates the evolution of the defense acquisition policy changes since the 1970s. Finally, this chapter provides the background and foundation to improve the reader's awareness of the DoD's attempt to professionalize the defense acquisition workforce.

3. Chapter III–Review of DAWIA and Civilian Organization Certifications, and Defense Industry Career Web Sites

Chapter III starts with the literature review of defense acquisition and workforce policy evolution, followed by major civilian professional organizations' certification process, and requirements applicable to the Defense Acquisition Workforce Improvement Act (DAWIA) certifications. The selected professional organizations are PMI, INCOSE, IEEE CS, NCMA and SOLE. It also presents a current understanding of the defense industry's effort for improving toward their workforce development trends and needs, along with a review of selected major defense industry career Web sites and associated documentation.

4. Chapter IV–Research Analysis

Chapter IV analyzes the research questions and provides results of the study and other findings.

5. Chapter V–Conclusions

Chapter V, the final chapter, consolidates all concepts presented in the previous four chapters and summarizes the material. Realizing that this project is limited in scope, it also provides opportunities for further study.

II. REVIEW OF DEFENSE ACQUISITION MANAGEMENT

A. INTRODUCTION

This chapter begins with an overview of the defense acquisition program management framework, along with the generally accepted program/project management framework, to provide the nature and status of defense acquisition program management. Next, is a review of the evolution of defense acquisition policy since 1970 as related to the DoD 5000 series documents. Finally, a background showing the evolution of Defense Acquisition Workforce Improvement Act (DAWIA) is provided to address its motives as related to the acquisition policy and process changes implemented.

B. DEFENSE ACQUISITION

1. Program Management Framework

Striving for commonality across diverse business areas and product commodities, the Project Management Institute (PMI) Project Management Body of Knowledge (PMBOK) provides a generic framework structure for understanding project and program management as a discipline. Program and project terminology are often treated as synonyms. Some references associate a project as a subset of program. Projects and programs have a different recognition depending on the industry involved. The DoD prefers the term "program management." Construction, public works, and product industries prefer the term "project management." There is a growing acceptance of the differentiation of "project" from "program," in that a program is usually much larger in scope, is activity oriented, and is not necessarily time limited. A program may encompass a number of projects. Program management is "the integration and management of highly interdependent projects to deliver a product, service, or infrastructure capability that contributes to the achievement of a company's strategic objectives, and desired business results" (Martinelli, 2007, p. 1). The Project Management Institute (PMI) Project Management Body of Knowledge (PMBOK) and

Program Management Professional (PgMP) Credential Handbook defines project management is a subset of program management. The PMBOK defines that "project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements" (PMI PMBOK, 2008, p. 6). On the other hand, the PMBOK defines the term program as "a group of related projects, managed in a coordinated way, to obtain benefits and control not available from managing them individually" (PMI PMBOK, 2008, p. 9). As such, the PgMP Credential Handbook states that "program managers define and initiate projects, assign project managers to manage cost, schedule, and performance of component projects, and oversee multiple projects directed at achieving a strategic goal" (PMI PgMP, 2009, p. 5).

Program management has evolved as an answer to some of the management problems resulting from today's complex system, and the increasingly complex efforts required when solving those problems. It is the discipline that enables today's organizations to produce their products, services and infrastructure within cost, schedule, and technical performance requirements. The overall framework adopted for program management requires sound management discipline guided by fundamental management principles. Program management is the investiture in a single person with the responsibility for success or failure of the program. In *Visualizing Program Management*, the authors state, "there must be one person whose responsibility it is to make a project work—even as we acknowledge the importance of teamwork and worker empowerment in the modern workplace" (Forsberg, Mooz & Cotterman, 2000, p. viii). Program management is about people working together in joint participation and synchrony in order to achieve program goals. Developing effective team requires careful planning and support. This may be the most important action that the program manger takes because the success of the entire program will depend on the hard work and dedication, along with expertise, competency, and training and education of the team. The members of the program team come from different parts of the organization and may work part time or full time on the program. It is the job of the program manager to bond this heterogeneous group into a cohesive team, which can work closely together to meet program goals (Stuckenbruck, 1982).

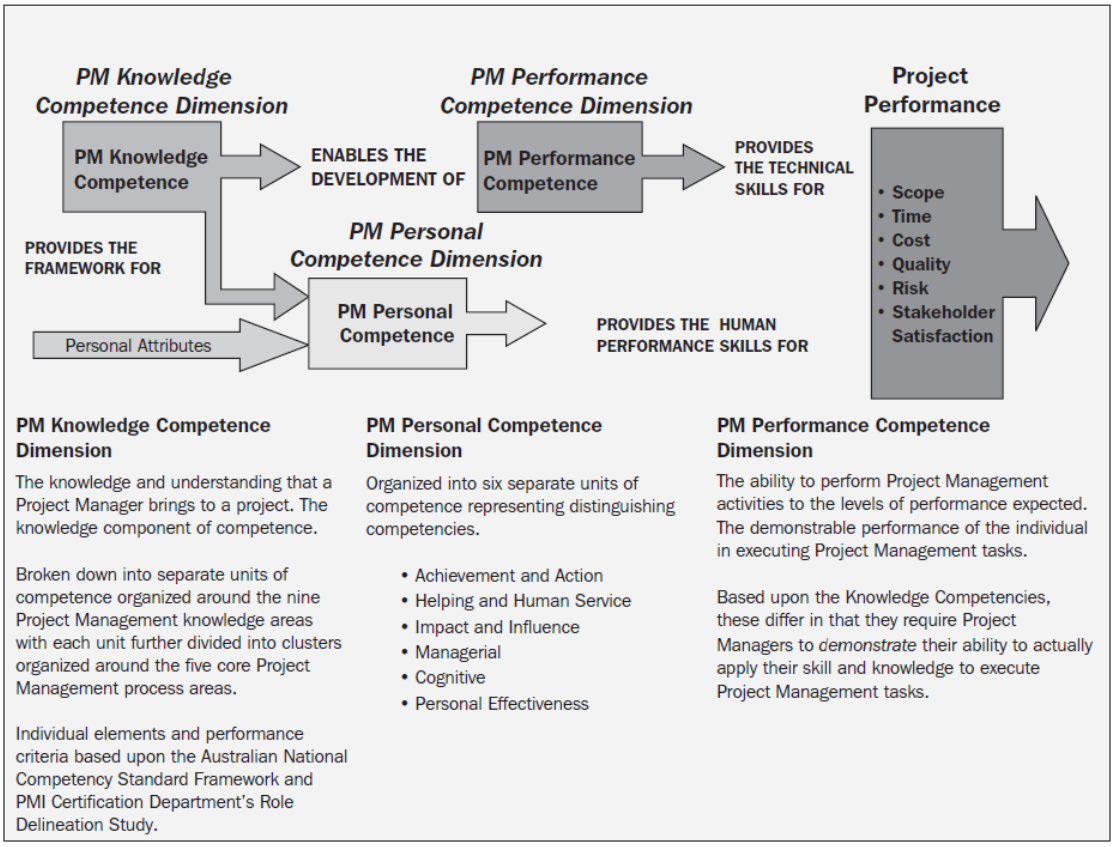

Figure 1. Dimensions of Competency (From PMI PMCD, 2002, p. 3).

Even though the Project Management Institute (PMI) Project Manager Competency Development (PMCD) Framework addresses the key dimensions of project manager competency and the competencies that are most likely to impact project manager performance, the framework also applies to program manager. The PMCD Framework describes competency as three separate dimensions when applied to project management: 1) Project Management Knowledge (i.e., what they know about project management); 2) Project Management Performance (i.e., what they are able to do or accomplish while applying their project management knowledge); and 3) Personal Competency (i.e., how individuals behave when performing the project or activity; what are their attitudes and core personality traits) (PMI PMCD, 2002). This PMCD Framework is illustrated in Figure 1. It shows how the three dimensions of competence come together to help the project manager accomplish the level of project performance desired by the organization. However, the PMCD points out that the program success

depends not only on a competent project manager, but also organizational program management maturity and capability. Many organizational maturity factors and other contingencies will influence the outcome of the program as well. A competent project manager working within an immature organization could result in an unsuccessful project. Of course, an incompetent project manager in a mature organization could also result in an unsuccessful project (PMI PMCD, 2002).

2. Defense Acquisition Program Management

DoD Desk Guide for Acquisition, Technology, and Logistics Workforce Career Management Guide defines acquisition program as "the conceptualization, initiation, design, development, test, contracting, production, deployment, logistics support, modification, and disposal of weapons and other systems, supplies, or services (including construction) to satisfy DoD needs, intended for use in or in support of military missions" (DoD A Desk Guide, 2006, p. 11). In his Defense Acquisition Review Journal article, *Independent Program Oversight: an Answer for Major Weapons Systems' Success?* the author portrays program management as "a mature and proven discipline that represents a long history of business lessons learned" (Miller, 2008, p. 66). The program management best practices are constantly updated to reflect the latest management trends and best tools and procedures. It is valued by both the public and private sectors and widely implemented as a discipline that enhances successes (Miller, 2008). As stated in the previous section, program success depends on selecting the right person as a program manager. The importance of the program manager has long been noted in our nation's military procurement establishment, which is traditionally the job to be among the most important and most difficult assignment.

3. Problems of Defense Acquisition

In early 1993, the General Accounting Office (GAO) published a report on the causes of persistent acquisition problems concluding that performance shortfalls, schedule delays and cost increases are the logical consequences of the acquisition culture (Fox, 1995). DoD investments in major weapons systems are significant: $157 billion in

fiscal year 2006 and a projected estimate of $188 billion in 2011 (Miller, 2008). Obviously, the management of these large investments is critical to the success of the DoD, and the nation as a whole. Yet, the GAO repeatedly describes problems with the development, acquisition, and delivery of major weapons systems. Since 1990, GAO has designated the DoD management of major weapon system acquisitions a high risk area. The DoD has taken actions over the years to improve acquisition outcomes, but its weapon programs continue to take longer, cost more, and deliver fewer capabilities than the originally planned (GAO Testimony, 2008). Critics of acquisition reform often say it is all tied up in politics and there is little hope of change in defense acquisition management. They suggest that with no change in the political process, there is little hope for real change in the acquisition process. Acquisition funds are too susceptible to political influence. However, in the Defense Acquisition Review Journal article, *A Ten-Year Review of the Vision for Transforming the Defense Acquisition System,* the authors point out that, while it is always true in the American model which gives ultimate control of the military to elected officials, it does not preclude the ability of a bureaucracy to change itself over time if driven by clear change visions (Rogers, 2004).

In 2005, the deputy defense secretary authorized an integrated assessment of the defense acquisition process through the Defense Acquisition Performance Assessment (DAPA) project. The DAPA panel found that the defense acquisition system's problems were deeply rooted in many of the acquisition management processes. It proposed an integrated transformation of acquisition to reduce costs and enhance overall acquisition performance. This assessment found that the defense acquisition process was in need of fundamental reform to more clearly align responsibility, authority and accountability within six major categories—workforce, acquisition, requirements, budget, industry and organization (Congressional Testimony, 2006).

C. DEFENSE ACQUISITION POLICY REVIEW

The review of the DoD 5000 series evolution provides an unique opportunity to see both the stability and change evident in defense acquisition policy since 1970. The DoD Directive 5000.01 and the companion document, DoD Instruction 5000.2 describe

how to conduct the defense acquisition process. These have been the foundation of the defense acquisition process for over 30 years. The DoD Directive 5000.01 (Defense Acquisition System) on 20 November 2007 and Instruction 5000.02 (Operation of the Defense Acquisition) on 8 December 2008 are the most recent revision document of acquisition policy. The following paragraphs summarize the evolution of defense acquisition policy. The information in these paragraphs was extracted from U.S. Army Acquisition History Report (USA, 2004), Dr. Joseph Ferrara article in Acquisition Review Quarterly (Ferrara, 1995), and Dr. Edward Rogers and Colonel (Ret) Robert Birmingham article in Defense Acquisition Review Journal (Rogers, 2004).

1. Evolution of 1970s Defense Acquisition Policy

a. 1971–David Packard Initiative

While serving as the Deputy Secretary of Defense from 1969–1971, David Packard, a co-founder of Hewlett-Packard, recognized the need for a formal defense acquisition management system to control cost growth, especially in an environment of fiscal constraint as the Vietnam drawdown began and defense spending declined. In May 1969, Packard formed the Defense Systems Acquisition Review Council (DSARC) to serve as an advisory body to the Secretary of Defense on matters concerning acquisition of major weapon systems. In May 1970, Packard issued a policy memorandum on defense acquisition articulating many of the broad themes that would later become the foundation for the 5000 series, including decentralized execution, streamlined management structures, and use of appropriate contract mechanisms. According to Packard, the primary objective of the DoD oversight is to enable the services to improve the management of their programs. The May 1970 policy memo established broad guidance in five major areas: management, conceptual development, full scale development, production, and contracts. On 13 July 1971, the first DoD Directive 5000.1 was formally issued stating David Packard's management approach to conducting defense acquisition. The 1971 DoD Directive 5000.1 emphasized the importance of competent people, rational priorities, and clearly defined responsibilities as a foundation of successful major defense systems. It paid a special attention to the need for competent

program managers to have sufficient authority to accomplish the program objectives. It also described the method of conducting defense acquisition, which has been articulated and updated in subsequent versions of the directive throughout the following 30 years (DoDD 5000.1, 1971). The intellectual heritage of many of today's statutes, policies, and institutions such as the Defense Acquisition Workforce Improvement Act (DAWIA), the streamlined acquisition chain of command, and the Defense Acquisition University can be traced to the Packard's document (Ferrara, 1996).

b. 1975–Addition of DoDI 5000.2

The first reissuance of 5000 was published in 1975. The big change in 1975 was the issuance of an accompanying instruction, DoD Instruction (DoDI) 5000.2. DoDI 5000.2 provided guidelines for the Decision Coordinating Paper (DCP) and the Defense Systems Acquisition Review Council (DSARC) for major programs clarifying David Packard's concept of DSARC and describing the use of the Decision Coordinating Paper (DCP). The DCP was a summary document that would support the DSARC review and the OSD decision-making process throughout the acquisition of a system program (USA, 2004).

c. 1977–Milestone "Demonstration and Validation"

The major change evident in the Ford administration issuance of a new set of 5000 documents on 18 January 1977 was the addition of a new milestone decision point called Demonstration and Validation between program initiation and full-scale development. Production and deployment were a part of a continuing trend to concentrate management effort on reducing technical risk early in a program's lifecycle before initiation of full-scale development. In addition, the 1977 version replaced the Decision Coordinating Paper (DCP) with Mission Element Need Statement (MENS). The MENS is submitted by the DoD components to the Secretary of Defense prior to program initiation (Milestone 0) to identify and support the need for a new or improved

mission capability of the DoD components, based on the result of a projected deficiency or obsolescence in existing systems, a technological opportunity to seize, or an opportunity to reduce operating cost (USA, 2004).

2. Evolution of 1980s Defense Acquisition Policy

a. 1980–Focusing on Cycle Time and Adding More Detail

The 1980 version of the DoD 5000 documents incorporated a version of several important concepts including acquisition time and interaction between acquisition and budget process. The descriptive nature of the DoD Instruction 5000.2 was expanded with the DoD Directive 5000.23, *System Acquisition Management Careers*, DoD Directive 4105.62, *Selection of Contractual Sources for Major Defense Systems*, and DoD Instruction 7000.11, *Contractor Cost Data Reporting*. It also added Integrate Program Summary (IPS) at major milestone reviews to provide management overview of the entire program. Finally, the Defense Systems Acquisition Review Council (DSARC) Executive Secretary position was created to administer and coordinate the DSARC process (Ferrar, 1996).

b. 1982–Carlucci Initiative

The main impetus driving the issuance of the 1982 revisions was the establishment of the Defense Acquisition Improvement Program (DAIP), better known as the "Carlucci Initiatives." The DAIP was a comprehensive reform effort aimed at improving numerous aspects of the defense acquisition process. The 1982 version made a change in milestone documentation, replacing the Mission Element Need Statement (MENS) with the Justification for a Major Systems New Start (JMSNS) to integrate JMSNS into the DoD Planning, Programming and Budgeting System (PPBS). As Dr. Ferrar pointed out, "the primary objective of this change was to more closely link the mission need determination process with the resource allocation process" (Ferrar, 1996, p. 119).

c. 1985-86–Responding to the "Horror Stories"

In response to widespread criticism of the DoD from media, various interest groups and Congress of high costs and cost overruns in defense acquisition, the 1985 version named the Deputy Secretary of Defense as the Defense Acquisition Executive to demonstrate that the DoD was taking acquisition management seriously (Ferrar, 1996).

d. 1987–Implementing the Packard Commission

In 1985, President Reagan chartered a blue ribbon commission (The Packard Commission) to study the defense acquisition process and to recommend improvements. Almost concurrently with the release of the Packard Commission report, President Reagan signed a directive to implement the recommendations. Congress passed the Goldwater-Nichols Act (1986) and Defense Acquisition Improvement Act (1986) which provided the reorganization within the DoD suggested by the Packard Commission. Reflecting the Packard Commission recommendation, the 1987 version included creation of new full-time Under Secretary of Defense for Acquisition (USD(A)) with broad powers to direct and oversee acquisition throughout DoD, Service Acquisition Executives, and Program Executive Officers (PEOs). It also institutionalized formal decision reviews in the trans- and post-production periods. Milestone IV review is created one to two year after initial deployment to assure operational readiness and support objectives. Also, Milestone V review is created five to ten year after initial deployment to evaluate operational effectiveness and determine the necessity of major upgrades (Ferrar, 1996).

3. Evolution of 1990s Defense Acquisition Policy

The 1991 and 1996 revisions of the 5000 documents are easily the most far-reaching changes enacted since the original 5000 were originally published in 1971. The 1991 documents represented a dramatic centralization of policy control and procedural

specificity. The 1996 version represents an equally dramatic reversal of these elements. Particularly, this era is noted as the birth of the defense acquisition workforce policy through evolutionary Defense Acquisition Workforce Improvement Act (DAWIA).

a. 1991–Policy Overhaul

Prompted by Secretary of Defense Dick Cheney's 1989 Defense Management Report (DMR), the 1991 documents were the most comprehensive in 5000 history in terms of guidance and information provided to the field. The three documents—5000.1, 5000.2 and 5000.2-M Manual—spanned over 900 pages in length providing specific requirements for program documentation to bring discipline to the acquisition process by issuing clear guidelines and consolidating more than 50 Directives, instructions and policy memoranda into a unified set of acquisition guidance (Ferrar, 1996).

b. 1996–Institutionalizing Acquisition Reform

On 7 September 1993, Vice President Al Gore released his landmark report, "Creating a Government that Works Better and Costs Less: The Gore Report on Reinventing Government," as part of the National Performance Review (NPR). For defense acquisition, the Gore report called for the need to change the culture of how the government conducts the business of defense. Following NPR guidance, Secretary of Defense William Perry released a mandate calling for a complete cultural change in how the DoD operates on 9 February 1994. After the Perry Mandate in 1994, a special office of Deputy Under Secretary for Defense (Acquisition Reform) (DUSD(AR)) was established to specifically deal with transformation issues and to ensure that change was made in an effective way. The DUSD(AR) has three specific initiatives—implementation of Process Action Teams (PAT), adoption of Integrated Product Teams (IPT), and efforts to capture lessons learned. A major focus was directed toward rewriting the DoD Directive 5000.1 and the DoD Instruction 5000.2 documents (Rogers, 2004).

The key change was the shift of Program Initiation moving from Milestone 0 to Milestone I after successful Concept Exploration (Phase 0) and before Program Definition and Risk Reduction (Phase I). While the same basic kinds of activities were occurring in each phase of this model, as in its predecessor, major policy thrusts towards reform were Integrated Product Process Development (IPPD), program stability, risk assessment and management, total system approach, total ownership costs (TOC), cost as an independent variable (CAIV), program objectives & thresholds, non-traditional acquisition, tailoring, continuous improvement, performance (versus military) standards and specifications, electronic commerce, environmental management, and a host of others (Dillard, 2003).

4. Evolution of 2000s Defense Acquisition Policy

The events of 11 September 2001 raised dramatically the urgency of solving acquisition problems. Rumsfeld's vision emphasized commercial outsourcing to save money and a renewed emphasis on doing only the functions directly related to warfighting. With respect to technology, he called for new efforts to streamline the development process to catch up with private sector development cycles. Finally, he made a strong case for improving the retention of a quality workforce in the entire military from the uniformed personnel to the acquisition corps. On 30 October 2002, Deputy Under Secretary of Defense Acquisition, Technology and Logistics (DUSD(AT&L)) Paul Wolfowitz issued a memo to cancel all 5000 documents strongly indicating incremental and piecemeal programmatic approaches were not acceptable solutions to the transformation problem (Rogers, 2004).

a. 2000–Last Clinton 5000

The policy of this series emphasized science and technology, interoperability, time-phased requirements for evolutionary acquisition, integrated test and evaluation, logistics, transformation, cost as a military requirement, simulation-based acquisition and other tenets (Dillard, 2003).

b. 2003–Paul Wolfowitz Change

The 2003 version included language on evolutionary acquisition and spiral development taken from the National Defense Authorization Act of 2003 with an initiative to develop joint Integrated Architectures (systems of systems), cancellation of DoD 5000.2-R replaced by Defense Acquisition Guidebook. The entrance and exit criteria for each phase and work effort now incorporated the introduction of new requirements documents from the Joint Capabilities Integration and Development System (which had been evolving parallel to the acquisition system): the Initial Capabilities Document (ICD), the Capabilities Development Document (CDD), and the Capabilities Production Document (CPD) (Dillard, 2003).

c. 2003–2004–National Security Space Acquisition Policy (NSSA)

In October 2001, the Secretary of Defense directed the Office of Secretary of Defense (OSD) and the Air Force to take certain actions to consolidate authorities across the national security space community. In response to that direction, Mr. Peter Teets was delegated authority as the Air Force Acquisition Executive for Space for Air Force space programs and as the DoD Milestone Decision Authority for all DoD space Major Defense Acquisition Programs. He also assumed the role as Director of National Reconnaissance Office (NRO) (Congressional Testimony, 2003). In 2002, facing the national security space environment changes, caused by declining acquisition budgets, significant unintended consequences of acquisition reform, and increased dependence on space by an expanding user base, the DoD chartered the Defense Science Board (DSB)/Air Force Scientific Advisory Board (AF SAB) Joint Task Force (a.k.a. "The Young Panel") to investigate systemic issues related to space systems acquisition and to recommend improvements to the acquisition of space programs (OUSD, 2003).

Implementing the recommendation of The Young Panel, the new National Security Space Acquisition (NSSA) Policy 03-01 dated 6 October 2003 was issued based on National Reconnaissance Office (NRO) Acquisition Management Directive 7 as a best practice. The NSSA Policy 03-01 falls under the authority of DoDD 5000.1 and replaces processes and procedures described in DoDI 5000.2 for space acquisition. The 2003

NSSA Policy 03-01 was replaced by the 27 Dec 2004 version reflecting lessons learned from the Space Based Infrared System and Future Imagery Architecture programs and the Defense Space Acquisition Board process. NSSA Policy 03-01 specifically states that mission success is the overarching principle behind all National Security Space programs and all program activities must be driven by this objective. Mission success must be the first consideration when assessing the risks and trade-offs among cost, schedule, and performance. It also provided the authority and assignment mandates for DoD Space Program Acquisition Execution Chain in accordance with the Defense Acquisition Workforce Improvement Act (NSSA, 2004).

d. 2005–2008–Defense Acquisition Performance Assessment (DAPA)

The Defense Acquisition Performance Assessment (DAPA) initiative was established by Acting Deputy Secretary of Defense Gordon England in a 7 June 2005 memo. He directed "an integrated acquisition assessment to consider every aspect of acquisition, including requirements, organizational, legal foundations (like Goldwater-Nichols, decision methodology, oversight, checks and balances—every aspect" (Spring, 2005, p. 1). In the end, the DAPA Panel proposed sweeping changes to dramatically improve the DoD's ability to stabilize and integrate key elements of the acquisition system—organization, workforce, budget, requirements, acquisition and industry (DoD DAPA, 2006). During the testimony before the 109th Congress House Armed Services Committee on 29 March 2006, the DAPA panel chairman, Lt Gen (USAF Ret.) Ronald T. Kadish testified that "simply focusing on improvements to the 'little a' acquisition portion of this system, instead of the larger acquisition process, can not and will not substantially improve Defense Acquisition Performance" (Congressional Testimony, 2006, p. 5). The DAPA panel recommendations are summarized in Table 1.

Table 1. DAPA Panel Recommendations Overview (After DoD DAPA, 2006).

Key Elements	Recommendations
Organization	▪ Realign authority, accountability and responsibility at the appropriate level and streamline the acquisition oversight process. ▪ Establish dedicated Four-Star Acquisition Systems Commands, at the Service level.
Workforce	▪ Rebuild and value the acquisition workforce, and incentivize leadership.
Budget	▪ Transform the Planning, Programming and Budgeting process and establish a distinct ▪ Stable Program Funding Account.
Requirements	▪ Replace the Joint Capability Integration and Development System with the Joint Capabilities Acquisition and Divestment Plan (a Combatant Commander-led requirements process in which the Services and Defense Agencies compete to provide solutions.) ▪ Establish a two-year recurring process to produce an integrated, time-phased and fiscally-informed Joint Capability Acquisition and Divestment plan and a continuous Materiel Solutions Plan Development Process to identify and initiate development of Materiel Solutions. ▪ Add an "Operationally Acceptable" test evaluation category. ▪ Give program managers explicit authority to defer non-Key Performance Parameter requirements to later spirals or block upgrades.
Acquisition	▪ Adopt a risk-based source selection process. ▪ Shift to time-certain development procedures and make schedule a Key Performance Parameter. ▪ Mandate a time start and end dates that are clearly defined and revamp the acquisition processes to support it.
Industry	▪ Overcome the consequences of reduced demand by sharing long range plans and restructuring competitions for new programs. ▪ Require government insight and favor formal competition for major subsystems when a Lead System Integrator acquisition strategy is pursued.

The DoD Directive 5000.01, certified to be current as of 20 November 2007, along with DoD Instruction 5000.02 dated 8 December is the most recent revision of acquisition policy incorporating the recommendations of Defense Acquisition Performance Assessment (DAPA) panel. The content of the current 5000.2 has grown from 37 to 79 pages since the 2003 version. The major differences between the 2003 and 2008 versions of the DoDI 5000.02 are the following:

- The Materiel Development Decision (MDD) replaces the Concept Decision (CD). A MDD is required regardless of where the program intends to enter the acquisition process.
- The Materiel Solution Analysis Phase (MSA) replaces the Concept Refinement (CR) Phase.

- Technology Development phase now includes a mandatory requirement for competitive prototyping of the system or key-system elements.

- Engineering and Manufacturing Development (EMD) replaces System Development and Demonstration (SDD). There is more emphasis on systems engineering and technical reviews.

- Systems Engineering is much more robust throughout all phases with mandatory technical reviews.

- Evolutionary Acquisition (EA) is now just one process. There is no "spirals." Term "spiral" development is no longer used as an EA strategy term. "Spiral Development" is an engineering term that will continue to be used for software development.

- "Increments" are favored. Each increment is a militarily-useful and supportable operational capability that can be developed, produced, deployed, and sustained. Each increment will have its own set of threshold and objective values set by the user. Block upgrades, pre-planned product improvement, and similar efforts that provide a significant increase in operational capability and meet an acquisition category threshold specified in this document shall be managed as separate increments (Fazio, 2008).

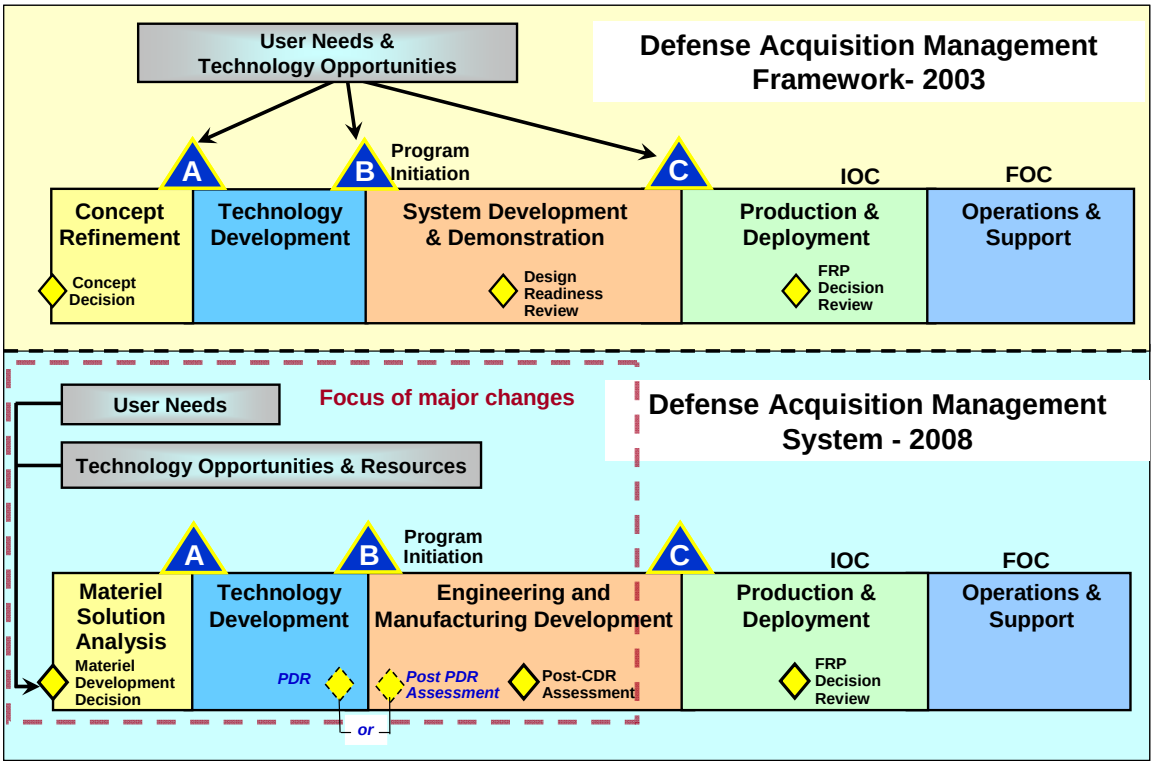

Figure 2. 2003 vs. 2008 Defense Acquisition Management Framework (From Fazio, 2008, p. 7).

D. DEFENSE ACQUISITION WORKFORCE POLICY

The basis of defense acquisition workforce policy is the Defense Acquisition Workforce Improvement Act (DAWIA) of 1990, which was the response to many years of frustration with numerous defense acquisition program failures to meet cost, schedule, and performance goals. In June 1990, legislation was introduced by Congressman Mavroules (D-MA), Chairman of the Subcommittee on Investigations, Committee on Armed Services, and the U.S. House of Representatives. He firmly believed that it was crucial to conduct the in-depth assessment of the qualifications—training, education, and experience—and professionalism of acquisition personnel, as well as a review of the DoD efforts to establish and manage the career development of the acquisition work force.

> These are the highlights of the philosophy that is behind the Acquisition Workforce Improvement Act. It would aim to create a very professional acquisition work force and its leadership corps in each of the military services. We want everyone inside the military, within the business community, and among the public at large to see that Acquisition Work Force and corps as an outstanding group of identifiable professionals who are responsible and able stewards of the public's funds…. No longer would acquisition assignments be made to officers who want to "civilianize" their resumes. No longer would key acquisition assignments, such as program managers, be given to amateurs. Only qualified professionals would be allowed to hold key acquisition jobs. They would be appointed by those responsible for acquisition in the DOD and their performance would be evaluated by these same individuals. (Mavroules, 1991, pp. 22–23)

1. Definition of Defense Acquisition Workforce

Overall, the DoD acquisition mission comprises not only procurement and program management but also many other activities, such as research and development, logistics, maintenance, supply, test and evaluation, quality assurance, civil engineering, and others. They work at program offices, arsenals, and depots. People working in designated acquisition positions in the DoD are doing more specialized acquisition management functions, such as program management, contracting, and systems engineering. This group has been the main focus of all reforms, education and training program enacted by the Congress under Defense Acquisition Workforce Improvement Act (DAWIA) (Congressional Testimony, 1997).

Within the DoD, the term “acquisition workforce” has been replaced by the term “Acquisition, Technology and Logistics (AT&L) Workforce,” to more accurately reflect the breadth of the types of functions and duties performed by employees currently in positions designated as acquisition positions; however, the term “acquisition” is still used when it is part of a title, such as in the “Acquisition Corps,” referring directly to its use in Title 10 (DoD Desk Guide, 2006, p. 1).

2. DAWIA Implementation Guides

Defense acquisitions are complex and controversial. Managing and reforming defense acquisition has historically presented a great challenge for both DOD and Congress. The structure the DoD utilizes to plan, execute and oversee acquisition activities is intricate. It is a multivariable system with many processes. The acquisition system has evolved over time. This evolution will continue because the DoD and Congress are striving for improvement and innovation in the entire defense acquisition system. With each revision and enhancement to DoD acquisitions, the emphasis has been on the improvement of the acquisition systems strategies, management and process along with the professionalization of defense acquisition workforces.

Three major reports—the Center for Strategic and International Studies (CSIS) Beyond Goldwater-Nichols (BGN) Series Volume Two (July 2005), the Defense Acquisition Performance Assessment (DAPA) Report (January 2006), and the Defense Science Board's (DSB) Summer Study on Transformation: A Progress Assessment, Volume One (February 2006) discuss the challenges facing defense acquisitions and make recommendations to mitigate them. The various other reports generally echo similar themes. The 10 July 2009 Congressional Research Service (CRS) Report for Congress (RL34026), emphasized the need to "improve the defense acquisition workforce by (1) recruiting the best leaders and specialists from industry; (2) developing improved personnel developmental opportunities, and establishing clear acquisitions career paths; (3) increasing the number of federal employees in critical skill areas; and (4) establishing a consistent definition of the acquisition workforce" (Schwartz, 2009, p. 15).

The DAWIA was initially implemented through DoD Directive 5000.52, Defense Acquisition Education, Training, and Career Development Program of 25 October 1991, DoD Instruction 5000.58, Defense Acquisition Workforce of 14 January 1992, and DoD 5000.58-R, Acquisition Career Management Program of January 1993. They are now replaced by the following DoD publications:

- DoD Directive 5000.52: Defense Acquisition, Technology, and Logistics Workforce Education, Training, and Career Development Program (12 January 2005).

- DoD Instruction 5000.66: Operation of the Defense Acquisition, Technology, and Logistics Workforce Education, Training, and Career Development Program (21 December 2005).

- DoD, A Desk Guide for Acquisition, Technology, and Logistics Workforce Career Management (10 January 2006).

- DoD AT&L Human Capital Strategic Plan, v 3.0 (2007).

DoD Directive 5000.52 provides policies and responsibilities for an education, training, and career development program for the DoD Acquisition, Technology, and Logistics (AT&L) Workforce, and mandates the establishment of a single Acquisition Corps throughout the DoD (DoDD 5000.52, 2005). DoD Instruction 5000.66 implements the DoD Directive 5000.52 and provides uniform guidance for management and operations of career development of the Acquisition, Technology, and Logistics (AT&L) workforce.

> It is DoD policy that the primary objective of the AT&L Workforce Education, Training, and Career Development Program is to create a professional, agile and motivated workforce that consistently makes smart business decisions, acts in an ethical manner, and delivers timely and affordable capabilities to the warfighter. The AT&L Workforce Education, Training, and Career Development Program improves the capabilities and management of the AT&L Workforce by: developing a highly qualified, diverse workforce capable of performing current and future DoD acquisition, technology, and logistics functions; preparing future key leaders; providing career guidance and opportunities for broadening experiences and progression; managing Key Leadership Positions (KLPs) to enhance program stability and accountability; and ensuring effective use of training and education resources. (DoDI 5000.66, 2005, p. 2)

DoD Instruction 5000.66 further specifies the designation and identification of AT&L positions, specification of position requirements, attainment and maintenance of AT&L competencies through education, training, and experience, AT&L Performance Learning Model, management of the Defense Acquisition Corps, selection and placement of personnel in AT&L positions, and workforce metrics (DoDI 5000.66, 2005). DoD Desk Guide for Acquisition, Technology, and Logistics Workforce Career Management (10 January 2006) supplements DoDD 5000.52 and DoDI 5000.66 by providing more detailed guidance on key aspects of the AT&L Workforce Education, Training, and

Career Development Program, such as AT&L position designation, certification, Acquisition Corps membership, continuous learning, and career development programs (DoD Desk Guide, 2006). The DoD Acquisition, Technology and Logistics (AT&L) Human Capital Strategic Plan has been developed as a part of USD's (AT&L) overarching responsibility and directly supports life-cycle management of the DoD AT&L workforce (DoD AT&L Human Capital, 2007). These publications provide the significant changes in the AT&L Workforce Education, Training, and Career Development Program as summarized below:

Table 2. Current DAWIA Implementation Highlights (After DoDI 5000.66, 2005).

Change Highlights	Description
Establishment of Single Defense Acquisition Corps and Integrated Management Structure	Once four independent Acquisition Corps – Army, Navy, Air Force, and Department of Defense (for other Defense Agencies and organizations) – is now an integrated, single Defense Acquisition Corps. The Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)), through the newly established AT&L Workforce Senior Steering Board (SSB) and the AT&L Workforce Management Group (WMG), sets overarching policies and requirements for Acquisition Corps membership and decision regarding the AT&L Workforce Education, Training, and Career Development Program. Also, to be eligible for Acquisition Corps membership, an individual must be certified at Level II or above in an AT&L Career Field.
Designation of and Criteria for Critical Acquisition Positions (CAPs)	A subset of AT&L positions, designated by the Component Acquisition Executive (CAE) based on the criticality of that position to the acquisition program, effort or function it supports. Now, consistent across DoD Components, all CAPs must be designated at Level III.
Key Leadership Positions (KLPs)	A subset of CAPs to identify very specifically those positions that require special CAE and Defense Acquisition Executive (DAE) attention with regard to qualifications, accountability, and position tenure.
CAP and KLP Tenure Requirements & Agreements	Persons selected for CAPs that are not designated as KLPs must sign an agreement to remain in the position for a minimum of three years. Persons selected for CAPs that have been designated as KLPs must sign an agreement to remain in the position for a period tailored to the unique requirements of the specific program or effort to be performed, such as significant milestones, events, or efforts.
AT&L Career Field Certification Timeframe	AT&L Workforce members must be certified in the AT&L Career Field and at the level required for their AT&L position. Certification should be achieved prior to assignment.
Continuous Learning	A new emphasis has been placed on the need for AT&L Workforce members to maintain currency in their AT&L Career Field by earning continuous learning points (CLPs) for any new competencies that are added to their AT&L Career Field after Level III certification has been achieved.

3. Defense Acquisition University (DAU)

As a part of implementation of the Defense Acquisition Workforce Improvement Act (DAWIA), the DoD has established a Defense Acquisition University (DAU) originally operated as a consortium of 16 existing Army, Navy, Air Force and DoD schools to conduct educational development, training, and research and analysis for acquisition. The DAU was established to accomplish the education and training for members of each acquisition career field within DoD (GAO, 1993). The DAU is developing and updating online courses, implementing knowledge management, emphasizing targeted training, and building partnerships with other colleges and universities such as Johns Hopkins University, University of Maryland, and others to expand the opportunities for continuous learning activities for the defense acquisition workforce (Berta, 2001). The DAU campus is now located in five different regions – Fort Belvoir, Virginia, California, Maryland, Kettering, Ohio, Huntsville, Alabama and San Diego, California.

E. CHAPTER SUMMARY

The nature and complexity of defense acquisition business have been cited numerously as one of the major contributors to performance shortfalls, schedule delays and cost increases. However, it would not prevent finding a better and innovative way to execute the defense acquisition programs. The DoD will continue to investigate and find a way to improve the processes. The success depends on the fundamental principles and discipline in acquisition program management planning and execution. The review of DoD 5000 series documents evolution provides a unique chance to see the changes evident in defense acquisition policy. There are always improvements to be made via revisions in policy and the implementation thereof. Likewise, there is a companion need to strive to improve the defense acquisition workforce through professionalization.

THIS PAGE INTENTIONALLY LEFT BLANK

III. REVIEW OF DAWIA AND CIVILIAN ORGANIZATION CERTIFICATION, AND DEFENSE INDUSTRY CAREER WEB SITES

A. INTRODUCTION

This chapter starts with an overview of Defense Acquisition Workforce Improvement Act (DAWIA) certifications. Similar to the DoD DAWIA certifications, various civilian organizations have their own programs of certification for their own subject matter experts. To provide the understanding of current civilian practices, selected civilian organizations that best exemplify the most relevant use of DAWIA certification, are presented. The selected civilian organizations are the Project Management Institute (PMI), International Counsel on Systems Engineering (INCOSE), Institute of Electrical and Electronic Engineers (IEEE) Computer Society (CS), National Contract Management Association (NCMA), and International Society of Logistics (SOLE). Finally, this chapter then reviews selected major defense industry trends and efforts related to their own workforce professionalization through research of selected defense industry career Web sites.

B. DAWIA CERTIFICATION

The International Council on Systems Engineering (INCOSE) defines certification as an occupational designation providing confirmation of an individual's competency (demonstrated education, experience, and knowledge) in a specified profession or occupational specialty and a formal process issued by an organization (INCOSE, 2009). Certification is voluntary that it is neither a barrier nor a gateway to entering a job, but it may be used as a qualifier in placement. Certification is important for organizations since it formally recognizes the capabilities of the people, can be used as part of the hiring and promotion process, encourages employee participation in continuing education, provides an independent internal and external assessment, and is a tool for promoting professional competence. For the individual, it formally recognizes

one's capabilities, is a discriminator that can aid in obtaining next job, can provide a competitive advantage in a career, provides a portable professional designation that is recognized across industry, and furthers professional development. For a team, it allows the team to level-set on professional concepts and activities and can help establish a common professional language for the team.

The initial AT&L workforce position categories were specified in the November 1995 DoD 5000.52-M (Acquisition Career Development Program) which was issued under the authority of the 25 October 1991 DoD Directive 5000.52 (Defense Acquisition Education, Training, and Career Development Program) (DOD 5000.52-M, 2005). Current AT&L workforce position categories are specified in the DoD Desk Guide for Acquisition, Technology, and Logistics Workforce Career Management (DoD Desk Guide, 2006). All AT&L positions fall under one of the following AT&L position categories. The table below is the comparison of 1995 and current AT&L workforce position categories.

Table 3. Comparison of AT&L Position Categories (After DoD 5000.52-M, 2005 & DAU, 2009).

1995 AT&L Workforce Position Category	Current AT&L Workforce Position Category
Auditing	Auditing (AUD)
Business – Cost Estimating and Financial Management	Business – Cost Estimating (BUS-CE)
	Business – Financial Management (BUS-FM)
Contracting (Including Construction)	Contracting (CON)
	Facilities Engineering (FE)
Industrial and/or Contract Property Management	Industrial and/or Contract Property Management (IND)
Communications-Computer Systems	Information Technology (IT)
Acquisition Logistics	Life Cycle Logistics (LCL)
Manufacturing and Production (Including Quality Assurance)	Production, Quality and Manufacturing – Production & Manufacturing (PQM-PM)
	Production, Quality and Manufacturing – Quality Assurance (PQM-QA)
Program Management	Program Management (PM)
Program Management Oversight	
Purchasing and Procurement Technician	Purchasing (PUR)
Systems Planning, Research, Development and Engineering	Systems Planning, Research, Development, Engineering – Program Systems Engineer (SPRDE-PSE)
	Systems Planning, Research, Development, Engineering – Science and Technology Manager (SPRDE-S&TM)
	Systems Planning, Research, Development, and Engineering – Systems Engineering (SPRDE-SE)
Test and Evaluation	Test and Evaluation (T&E)
Education, Training and Career Development	
Defense Logistics Agency Multifunction Management	

A required certification level must be assigned to each AT&L position. The AT&L workforce has three general certification levels for its own specialty—Basic (Level I), Intermediate (Level II) and Advanced (Level III). The designated level corresponds to the level of responsibility and expertise required by the position, and therefore typically corresponds to the grade of the position. The Basic (Level I) certification standards are designed to establish fundamental qualifications and expertise in the individual's career field. In addition to participating in education and training courses, individuals are expected to develop their required competencies through appropriate on-the-job experience, including rotational assignments. At the Intermediate

levl (Level II), initially individuals need to emphasize functional specialization and also engage in career broadening experiences to provide breadth and depth. These broadening experiences are the foundation of the competencies and skills necessary to assume positions of greater responsibility. This may involve multi-functional experience and development. At the Advanced (Level III) level, individuals need to attain the appropriate functional and core competencies to fill Critical Acquisition Positions (CAPs) comprised of the pool to fill Key Leadership Positions (KLPs) (DoDI 5000.66, 2005). The level designated corresponds to the level of responsibility and expertise required by the position, and therefore typically corresponds to the grade of the position as indicated below:

Table 4. AT&L Workforce Certification Level (After DoD Desk Guide, 2006).

Certification Level	Civilian AT&L Workforce		Military AT&L Workforce	
	All except Purchasing	Purchasing	Officer	Enlisted
Level I	GS-5 thru 8	GS-5	O-1 to O-2/O-3	Per component direction
Level II	GS-9 thru 12	GS-6 thru 8	O-3 and/or O-4	
Level III	GS-13 and above	GS-9	O-5 and above	

To occupy all Critical Acquisition Positions (CAPs), including Key Leadership Positions (KLPs), individuals must attain Level III certification regardless of grade level.

C. PROJECT MANAGEMENT INSTITUTE (PMI)

The following information is compiled from the Project Management Institute (PMI) official Web site (https://www.pmi.org).

1. Introduction to PMI

The Project Management Institute (PMI) is a non-profit professional organization dedicated to advancing the state-of-the-art of project management. The PMI was formed in 1969 as a group of concerned managers and former managers intent on improving the quality of management at all levels. The Project Management Institute (PMI) sets standards, conducts research and provides education and professional exchange opportunities designed to strengthen and further establish the professionalism. This

institute aims to advance the careers of practitioners and enhance the performance of business and other organizations. PMI has been recognized by the American National Standards Institute (ANSI) as an accredited standards developer. Currently, the PMI has 420,000 members and credential holders and 250 chapters in over 70 countries.

2. PMI Certification

Although there are other project management certification programs from various educational institutions, the PMI certifications are widely acknowledged with the project management community including the DoD. Its first certification offered was the Project Management Professional (PMP) certification, which was launched in 1984. Nearly 260,000 people now hold the PMP certification (PMI, 2009). Currently, PMI offers the following five professional certifications:

- Project Management Professional (PMP)
- Certified Associate in Project Management (CAPM)
- Program Management Professional (PgMP)
- PMI Scheduling Professional credential (PMI-SP)
- PMI Risk Management Professional (PMI-RMP)

a. Project Management Professionals (PMP)

The PMP was initiated in 1984 to recognize individuals who demonstrated understanding of the knowledge and skills to lead and direct project teams and to deliver results within the constraints of schedule, budget, and resources. To be eligible for the PMP credential, the following educational and professional experience requirements must be satisfied. All project management experience must have been accrued within the last eight consecutive years prior to the application submission (PMI PMP, 2009).

Table 5. PMP Requirements (After PMI PMP, 2009).

Project Management Professionals (PMP) Requirements			
Educational Background	▪ High School diploma, associate's degree or global equivalent	OR	▪ Bachelor's degree or global equivalent
Related Education	▪ 35 hours project management education		▪ 35 hours project management education
Project Management Experience	▪ Minimum five years/60 moths unique non-overlapping professional project management experience during which at least 7,500 hours were spent leading and directing project tasks		▪ Minimum three years/36 moths unique non-overlapping professional project management experience during which at least 4,500 hours were spent leading and directing
Knowledge Basis	▪ A Guide to the Project Management Body of Knowledge PMBOK Guide		
Examination	▪ 4 hours; 200 questions		
Renewal	▪ 60 PDUs every three years		

b. Certified Associate in Project Management (CAPM)

Certified Associates in Project Management (CAPM) recognizes individual with a demonstrated understanding of the fundamental knowledge, processes, and terminology as defined in A Guide to the Project Management Body of Knowledge (PMI CAPM, 2009). To be eligible for the CAPM credential, the following educational and professional experience requirements must be satisfied.

Table 6. CAPM Requirements (After PMI CAPM, 2009).

Certified Associates in Project Management (CAPM) Requirements			
Educational Background	▪ High School diploma, associate's degree or global equivalent		
Related Education/ Experience	▪ 1,500 hours were spent leading and directing project tasks	OR	▪ 23 contract hours of formal education
Knowledge Basis	▪ A Guide to the Project Management Body of Knowledge PMBOK Guide		
Examination	▪ 3 hours; 150 questions		
Renewal	▪ Exam every five years	OR	▪ If eligible, may apply for any other of PMI's credential

c. Program Management Professional (PgMP)

The Program Management Professionals (PgMP) is a credential that recognizes demonstrated experience, skill and performance in the oversight of multiple, related projects that are aligned with an organizational objective and strategic goal. Program managers define and initiate projects, assign project managers to manage cost, schedule, and performance of component projects and oversee multiple projects directed at achieving strategic goal (PMI PgMP, 2009). To be eligible for the PgMP credential, the following educational and professional experience requirements must be satisfied.

Table 7. PgMP Eligibility Requirements (After PMI PgMP, 2009).

Program Management Professional (PgMP) Requirements			
Educational Background	▪ High School diploma, associate's degree or global equivalent	OR	▪ Bachelor's degree or global equivalent
Related Education	▪ 35 contact hours of formal education		
Project Management Experience	▪ Minimum four years (6,000 hours) of unique non-overlapping professional project management experience ▪ Must have been accrued within the last 15 consecutive years prior to the application submission.		▪ Minimum four years (6,000 hours) of unique non-overlapping professional project management experience ▪ Must have been accrued within the last 15 consecutive years prior to the application submission.
Program Management Experience	▪ Minimum seven years (10,500 hours) of unique non-overlapping professional program management experience ▪ Must have been accrued within the last 15 consecutive years prior to the application submission.		▪ Minimum four years (6,000 hours) of unique non-overlapping professional program management experience ▪ Must have been accrued within the last 15 consecutive years prior to the application submission.
Knowledge Basis	▪ A Guide to the Project Management Body of Knowledge PMBOK Guide		
Examination	▪ 4 hours; 170 questions		
Multi-rater assessment (MRA)	▪ 360-degree review involving performance evaluation by one supervisor, four peers, four direct reports and three professional references		
Renewal	▪ 60 PDUs every three years		

d. PMI Scheduling Professional (PMI-SP)

The PMI Scheduling Professional (PMI-SPSM) recognizes individuals who provide expertise in the specialized area of developing and maintaining project schedule (PMI PMI-SP, 2009). To be eligible for the PMI-SP credential, the following educational and professional experience requirements must be satisfied.

Table 8. PMI-SP Requirements (After PMI PMI-SP, 2009).

PMI Scheduling Professional (PMI-SP) Requirements			
Educational Background	▪ High School diploma, associate's degree or global equivalent ▪ 35 contract hours of formal education	OR	▪ Bachelor's degree or global equivalent
Related Education	▪ 40 contact hours of formal education in the specialized area of project scheduling		▪ 30 contact hours of formal education in the specialized area of project scheduling
Project Scheduling Experience	▪ At least 5,000 hours spent in the specialized area of professional project scheduling within the last five consecutive years		▪ At least 3,500 hours spent in the specialized area of professional project scheduling within the last five consecutive years
Knowledge Basis	▪ A Guide to the Project Management Body of Knowledge PMBOK Guide		
Examination	▪ 3.5 hours; 170 questions		
Renewal	▪ 30 PDUs every three years		

e. PMI Risk Management Professional (PMI-RMP)

The PMI Risk Management Professional (PMI-RMPSM) credential recognizes individuals who provide expertise in the specialized area of assessing and identifying project risks along with preparing plans to mitigate threats and capitalize on opportunities (PMI PMI-RMP, 2009). To be eligible for the PMI-RMP credential, the following educational and professional experience requirements must be satisfied.

Table 9. PMI-RMP Requirements (After PMI PMI-RMP, 2009).

PMI Risk Management Professional (PMI-RMP) Requirements			
Educational Background	▪ High School diploma, associate's degree or global equivalent	OR	▪ Bachelor's degree or global equivalent
Related Education	▪ 40 contact hours of formal education in the specialized area of project risk management		▪ 30 contact hours of formal education in the specialized area of project risk management
Project Scheduling Experience	▪ At least 4,500 hours spent in the specialized area of professional project risk management within the last five consecutive years		▪ At least 3,000 hours spent in the specialized area of professional project risk management within the last five consecutive years
Knowledge Basis	▪ A Guide to the Project Management Body of Knowledge PMBOK® Guide		
Examination	▪ 3.5 hours; 170 questions		
Renewal	▪ 30 PDUs every three years		

3. PMI Global Standards and Publications

PMI's global standards have helped establish the institute as the premier authority in project management globally. The American National Standards Institute has recognized PMI as a standards development organization. PMI Global standards program is to improve the understanding and practice of project management by identifying, defining, documenting and championing generally accepted project management practices and a common project management lexicon. PMI's standard development efforts started with the Project Management Body of Knowledge (PMBOK) Guide—now with over 2 million copies in distribution. PMI standards are grouped according to the projects, programs, people, organizations, and profession (PMI, 2009). The following are the current standards:

Table 10. PMI Global Standards (After PMI, 2009).

Category	Standards
Projects	▪ A Guide to the Project Management Body of Knowledge PMBOK Guide ▪ Construction Extension to the PMBOK Guide Third Edition ▪ Government Extension to the PMBOK Guide Third Edition ▪ DoD Extension to the PMBOK Guide ▪ Practice Standard for Earned Value Management ▪ Practice Standard for Project Configuration Management ▪ Practice Standard for Work Breakdown Structures ▪ Practice Standard for Scheduling
Programs	▪ The Standard for Program Management
People	▪ Project Manager Competency Development Framework
Organizations	▪ Organizational Project Management Maturity Model (OPM3) ▪ The Standard for Portfolio Management
Profession	▪ Project Management Lexicon ▪ Practice Standard for Project Estimation ▪ Practice Standard for Project Risk Management

The DoD Extension to the PMI PMBOK dated June 2003 has been approved as a Project Management Institute (PMI) Standard. It provides supplemental and unique information on the DoD system acquisition processes that are not contained in the PMI PMBOK Guide. Many of those processes are commercial processes that have been embraced by the DoD program management yet were not contained in the PMBOK Guide. The DoD extension is a comprehensive set of DoD practices for each of the knowledge areas of the PMI PMBOK. The DoD Extension contains additional areas of defense acquisition knowledge: 1) Chapter 13–Project Systems Engineering Management; 2) Chapter 14–Project Software Acquisition Management; 3) Chapter 15–Project Logistics Management; 4) Chapter 16–Project Test and Evaluation Management; and 5) Chapter 17–Project Manufacturing Management (DAU, 2003).

D. INTERNATIONAL COUNSEL ON SYSTEMS ENGINEERING (INCOSE)

The following information is extracted from the International Counsel on Systems Engineering (INCOSE) official Web site (https://www.incose.org).

1. Introduction to INCOSE

The International Council on Systems Engineering (INCOSE) is a not-for-profit membership organization founded in 1990. The mission of INCOSE is to advance the state of the art and practice of systems engineering in industry, academia, and government by promoting interdisciplinary, scalable approaches to produce technologically appropriate solutions that meet societal needs. INCOSE has grown significantly since its formation. Today, there are over 6,000 members representing a broad spectrum—from student to senior practitioner, from technical engineer to program and corporate management, from science and engineering to business development (INCOSE, 2009).

2. INCOSE Certification

INCOSE certifies professionals in the discipline of Systems Engineering and has established a multi-level professional certification program to provide a formal method for recognizing the knowledge and experience of systems engineers. INCOSE certification provides formal recognition that a person has achieved. Currently, several notable companies started to post jobs referencing INCOSE certification such as Booz Allen Hamilton, General Motors, Lockheed Martin, Northrop Grumman, SAIC, etc (INCOSE, 2009).

The foundation certification, Certified Systems Engineering Professional (CSEP) was initiated in 2004 targeted towards systems engineers with five or more years work experience. Since then, the INCOSE has instituted multi-Level Certification for every stage of professional career. Currently, INCOSE offers the following four professional certifications:

- Associate Systems Engineering Professional (ASEP)
- Certified Systems Engineering Professional (CSEP)
- Certified Systems Engineering Professional (CSEP) with US DoD Acquisition Extensions
- Expert Systems Engineering Professional (ESEP)

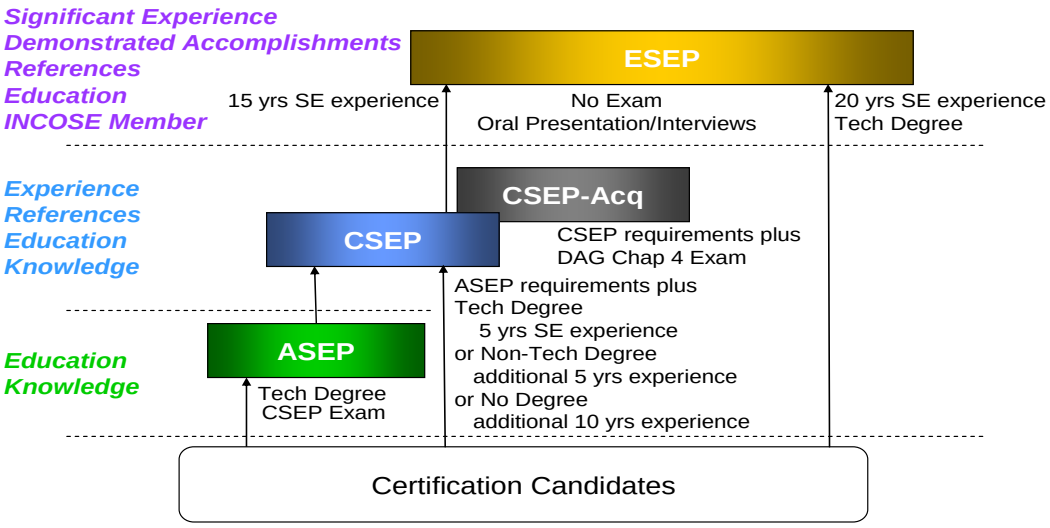

Figure 3. Multi-Level Certification Concept (From INCOSE, 2009).

a. Associate Systems Engineering Professional (ASEP)

ASEP certification is targeted toward systems engineers with limited work experience ideal for junior/emerging Systems Engineers and recent college graduates (INCOSE, 2009). ASEP is certified against education and knowledge requirements and available since July 2008.

Table 11. ASEP Requirements (After INCOSE, 2009).

Associate Systems Engineering Professional (ASEP) Requirements	
Educational Background	▪ Minimum BS (or equivalent) in Technical Field
Experience	▪ None
Knowledge Basis	▪ INCOSE Systems Engineering Handbook
Examination	▪ 120 Questions/2 hours
Renewal	▪ 120 PDUs every Three Years ▪ Must maintain INCOSE membership ▪ Must transition to CSEP within 10 yrs

b. Certified Systems Engineering Professional (CSEP)

CSEP certification is targeted towards Systems Engineers with five or more years work experience. CSEP is certified against experience, education, and knowledge requirements and has been available since 2004. Applications must be substantiated by 3–5 references. The candidates must pass the CSEP examination based

on INCOSE Systems Engineering Handbook Version 3.1. After the attainment of the CSEP credential, the CSEP must participate in the Continuing Certification Requirements (CCR) program to maintain an active certification status. The CSEP certification cycle lasts three years from the examination pass date. To maintain certification, no less than 120 professional development units (PDUs) must be obtained (INCOSE, 2009).

Table 12. CSEP Requirements (After INCOSE, 2009).

Certified Systems Engineering Professional (CSEP) Requirements	
Educational Background	▪ Minimum BS (or equivalent) in Technical Field (can substitute additional experience if non-tech/no degree)
Experience	▪ Minimum 5 yrs systems engineering experience ▪ 5 more years of engineering experience for non-technical Bachelor's (total 10 years) ▪ 10 more years of engineering experience if no Bachelor's degree (total 15 years) ▪ Substantiated by references: ▪ Recommendations from at least 3 colleagues/peers/ managers ▪ Must cover the required period needed by the applicant ▪ References must also be knowledgeable in Systems Engineering
Knowledge Basis	▪ INCOSE SE Handbook
Examination	▪ 120 questions/2 hours
Renewal	▪ 120 PDUs every three years

c. Certified Systems Engineering Professional (CSEP) with U.S. DoD Acquisition Extensions (CSEP-Acq)

CSEP-Acq is targeted towards systems engineers who support or work in a US Department of the Defense acquisition environment requiring same core CSEP experience, education, and knowledge requirements with additional acquisition knowledge items test. CSEP-Acq was available since July 2008 (INCOSE, 2009).

Table 13. CSEP-Acq Requirements (After INCOSE, 2009).

Certified Systems Engineering Professional – DoD Acquisition (CSEP-Asq) Requirements	
Educational Background	▪ Minimum BS (or equivalent) in Technical Field (can substitute additional experience if non-tech/no degree)
Experience	▪ Minimum 5 yrs systems engineering experience ▪ 5 more years of engineering experience for non-technical Bachelor's (total 10 years) ▪ 10 more years of engineering experience if no Bachelor's degree (total 15 years) ▪ Substantiated by references: Recommendations from at least 3 colleagues/peers/ managers covering required period needed by the applicant by references who must also be knowledgeable in Systems Engineering
Knowledge Basis	▪ INCOSE SE Handbook and Defense Acquisition Guide Chapter 4
Examination	▪ 180 questions/3 hours
Renewal	▪ 120 PDUs every three years

d. Expert Systems Engineering Professional (ESEP)

ESEP certification is targeted towards systems engineers with significant work experience and demonstrated systems accomplishments. ESEP is certified against accomplishment, experience, and education requirements. Interviews are used to validate significant systems accomplishments. It was first available in 2009.

3. INCOSE Standards and Publications

INCOSE technical products are formally approved information in accordance with the INCOSE technical product review board and approval process, and are categorized as technical publications, primers and database products. Technical publications are handbooks and guidebooks, formal INCOSE technical information relative to topics within systems engineering providing task guidance, advanced methods, guidance, lessons learned, cookbook techniques, criteria, etc. Primers are formal INCOSE introductory technical information that explains the basic language and approaches of a systems engineering topic. Finally, database products are formal INCOSE-derived technical information, usually capturing data on a variety of topics that can be best presented in data base form (INCOSE, 2009).

Table 14. INCOSE Products (After INCOSE, 2009).

Category	INCOSE Products
Technical Publications	▪ INCOSE Systems Engineering Handbook ▪ Metrics Guidebook ▪ Technical Measurement Guide ▪ Systems Engineering Leading Indicators Guide ▪ Conops of SE Education Community ▪ Systems Engineering Capability Assessment Model (SECAM) Model Description ▪ Systems Engineering Vision 2020
Primers	▪ Systems Engineering Primer ▪ Measurement Primer
Database Products	▪ Tools Database

E. INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) COMPUTER SOCIETY (CS)

The following information was extracted from the Institute of Electrical and Electronic Engineers (IEEE) Computer Society official Web site (https://www.computer.org).

1. Introduction to IEEE Computer Society (CS)

Institute of Electrical and Electronic Engineers (IEEE) Computer Society (CS) is an organizational unit of the IEEE. Founded in 1946, and the largest of the 39 societies of the IEEE, the CS is dedicated to advancing the theory and application of computer and information-processing technology. The IEEE CS serves the information and career-development needs of today's computing researchers and practitioners with technical journals, magazines, conferences, books, conference publications, and online courses. With about 40 percent of its members living and working outside the United States, the CS fosters international communication, cooperation, and information exchange. It monitors and evaluates curriculum accreditation guidelines through its ties with the U.S. Computing Sciences Accreditation Board and the Accreditation Board for Engineering and Technology (IEEE CS, 2009).

2. IEEE Computer Society Certification

IEEE CS offers two certifications: Certified Software Development Professional (CSDP) program for mid-career professionals and Certified Software Development Associate (CSDA) credential for recent college graduates (IEEE CS, 2009).

a. Certified Software Development Associate (CSDA)

Certified Software Development Associate (CSDA) certification is a software development certification intended for beginning software development and software engineering associates. CSDA is the first step towards becoming a Certified Software Development Professional (CSDP).

Table 15. CSDA Requirements (After IEEE CS, 2009).

CSDA Requirements	
Qualifications	▪ Recent software or computer engineering graduates ▪ Under-graduates who are in their final year of a bachelor's degree program in software or computer engineering ▪ Non-degree professionals with more than 2 years of programming experience
Experience	▪ Not required
Knowledge Basis	▪ Guide to the Software Engineering Body of Knowledge (SWEBOK) ▪ Industry accepted, systematic procedure for identifying/validating the performance domain of a job and the knowledge and skills that are necessary to perform the job
Examination	▪ CSDA exams via computer-based testing (CBT)

b. Certified Software Development Professional (CSDP)

Certified Software Development Professional (CSDP) certification is intended for experienced software development and software engineering professionals (IEEE CS, 2009).

Table 16. CSEP Requirements (After IEEE CS, 2009).

Certified Software Development Professional (CSDP) Requirements	
Qualifications	▪ Bachelor's degree or ▪ CSDA certificate holder or ▪ Educator at the post-baccalaureate level or ▪ Full member of the IEEE
Experience	▪ Advanced degree in software engineering and at least two years (about 3,500 hrs) of experience in software engineering/ development or ▪ At least four years (about 7,000 hrs) experience in software engineering/development
Knowledge Basis	▪ Guide to the Software Engineering Body of Knowledge (SWEBOK) ▪ Industry accepted, systematic procedure for identifying/validating the performance domain of a job and the knowledge and skills that are necessary to perform the job
Examination	▪ CSDA exams via computer-based testing (CBT)
Recertification	▪ Retake the CSDP examination or ▪ 30 PDUs every three years

3. IEEE Computer Society Standards and Publications

The IEEE Computer Society Digital Library (CSDL) provides access to more than 250,000 articles and papers from 1,600 conference proceedings and to all available issues of 26 CS periodicals. The CS Conference Publishing Services division produces more than 250 conference publications, authored books, online tutorials, CD-ROMs, multimedia, and additional electronic products each year. CS Press Books also publishes full-length technical books on cutting-edge topics through a partnership with John Wiley and Sons (IEEE CS, 2009).

F. NATIONAL CONTRACT MANAGEMENT ASSOCIATION (NCMA)

The following information is extracted from the National Contract Management Association (NCMA) official Web site (http://www.ncmahq.org).

1. Introduction to National Contract Management Association (NCMA)

National Contract Management Association (NCMA) was formed in 1959 to foster the professional growth and educational advancement of contracting professional to improve organizational performance through effective contract management (NCMA, 2009).

2. NCMA Certification

NCMA offers three certification programs: Certified Federal Contracts Manager (CFCM), Certified Commercial Contracts Manager (CCCM), and Certified Professional Contracts Manager (CPCM).

a. Certified Federal Contracts Manager (CFCM)

Certified Federal Contracts Management (CFCM) certification shows that you are knowledgeable about the practice of contracts management in the federal environment.

Table 17. CFCM Requirements (After NCMA, 2009).

Certified Federal Contracts Management (CFCM) Requirements	
Educational Background	▪ Degree from a regionally accredited institution at the bachelor's level ▪ 80 hours of continuing professional education of contract management
Experience	▪ One year of contract management (or related career field) experience
Knowledge Basis	▪ Contract Management Body of Knowledge (CMBOK)
Examination	▪ Federal knowledge module exam

Candidates lacking only the experiential and continuing education requirements may apply for the designation and take the examinations. Upon successful completion of the examinations, the candidate will be awarded the designation when both experiential and continuing education requirements are met.

b. Certified Commercial Contracts Manager (CCCM)

Certified Commercial Contracts Manager (CCCM) certification shows that you are knowledgeable about the practice of contracts management in the commercial environment (NCMA, 2009).

Table 18. CCCM Requirements (After NCMA, 2009).

Certified Commercial Contracts Manager (CCCM) Requirements	
Educational Background	▪ Degree from a regionally accredited institution at the bachelor's level ▪ 80 hours of continuing professional education of contract management
Experience	▪ One year of contract management (or related career field) experience
Knowledge Basis	▪ Contract Management Body of Knowledge (CMBOK)
Examination	▪ Commercial knowledge module exam

Candidates lacking only the experiential and continuing education requirements may apply for the designation and take the examinations. Upon successful completion of the examinations, the candidate will be awarded the designation when both experiential and continuing education requirements are met.

c. Certified Professional Contracts Manager (CPCM)

Certified Professional Contracts Manager (CPCM) certification shows that one is knowledgeable about all facets of contracts management, both within the government and the commercial arenas.

Table 19. CPCM Requirements (After NCMA, 2009).

Certified Professional Contracts Manager (CPCM) Requirements	
Educational Background	▪ Degree from a regionally accredited institution at the bachelor's level ▪ 120 hours of continuing professional education of contract management
Experience	▪ Five years of contract management (or related career field) experience
Knowledge Basis	▪ Contract Management Body of Knowledge (CMBOK)
Examination	▪ Certified professional contracts manager module exam

Also, NCMA offers a certificate program based on completion of a specified course curriculum designed to improve individual performance in the subject matter area. The certificate program for Certified Schedules Contracts Managers (CSCM) shows that you are knowledgeable in Federal Supply and Multiple Award Schedule contracting. This certificate program is in partnership with The Federal Contracting Institute (FCI). The Federal Contracting Institute (FCI), the provider of

training to both government contractors and government agency personnel has recently joined the NCMA to develop and administer a new certificate program for Certified Schedules Contracts Managers (CSCM). This certificate program requires the completion of five required courses, two required audio seminars and two electives, as well as a passing grade on a standardized test conducted by NCMA (NCMA, 2009).

3. NCMA Standards and Publications

The following are the major list of NCMA publications.

Table 20. NCMA Products (After NCMA, 2009).

NCMA Products
▪ Annotated Guide to the Contract Management Body of Knowledge (CMBOK)
▪ Contract Management Organizational Assessment Tools
▪ Desktop Guide to Basic Contracting Terms
▪ Federal Knowledge Module
▪ General Business Knowledge Module
▪ Solicitations, Bids, Proposals and Source Selection

G. INTERNATIONAL SOCIETY OF LOGISTICS (SOLE)

The following information was extracted from the International Society of Logistics (SOLE) official Web site (http://www.sole.org).

1. Introduction to International Society of Logistics (SOLE)

The International Society of Logistics (SOLE) is a non-profit international professional society composed of individuals organized to enhance the art and science of logistics technology, education and management. SOLE was founded in 1966 as the Society of Logistics Engineers "to engage in educational, scientific, and literary endeavors to advance the art of logistics technology and management" (SOLE, 2009, No Page #). There are over 90 SOLE chapters in more than 50 countries throughout the world.

2. International Society of Logistics (SOLE) Certification

a. SOLE Certification and Recognition Programs

The SOLE instituted a certification program in October 1972 to accredit professionals in the logistics field. This certification program was expanded in 2005 to include recognition of accomplishments for individual prior to certification in their profession. The certification program was further expanded in 2006 to recognize professionals in the sub-discipline of Logistics Chain Management. The expanded certification program recognizes the functional interrelationships within the professional responsibilities of logisticians regardless of their occupational roles (SOLE, 2009).

Starting early in the logistician's career, he/she begins by earning the recognition as a Demonstrated Logistician, then Demonstrated Senior Logistician and finally Demonstrated Master Logistician. These recognitions are provided based on continuous experience and professional development. The next step in the process provides for certification in Logistics Chain Management as a Certified Master Logistician (CML). The ultimate recognition in the profession is attained through the achievement of certification as a Certified Professional Logistician (CPL). This certification covers the entire scope of practice that the logistics professional will engage in during his/her career (SOLE, 2009).

b. Demonstrated Logistician Program

Recognizing the continuing nature of education and development of the professional logistician, in 2005, the Society implemented the Demonstrated Logistician Program. This program provides intermediate recognition of professional performance and continuing education in the individual fields of practice within the profession. This program is implemented in the DoD, military services and industry as an intermediate recognition program as logisticians hone their skills and work toward full professional certification from SOLE either as a Certified Master Logistician (CML) or a Certified Professional Logistician (CPL); or other professional certification in the areas of program management, quality or reliability (SOLE, 2009).

There are three levels of designation in the Demonstrated Logistician Program. The first is the Demonstrated Logistician (DL), next is the Demonstrated Senior Logistician (DSL) and the highest level is the Demonstrated Master Logistician (DML).

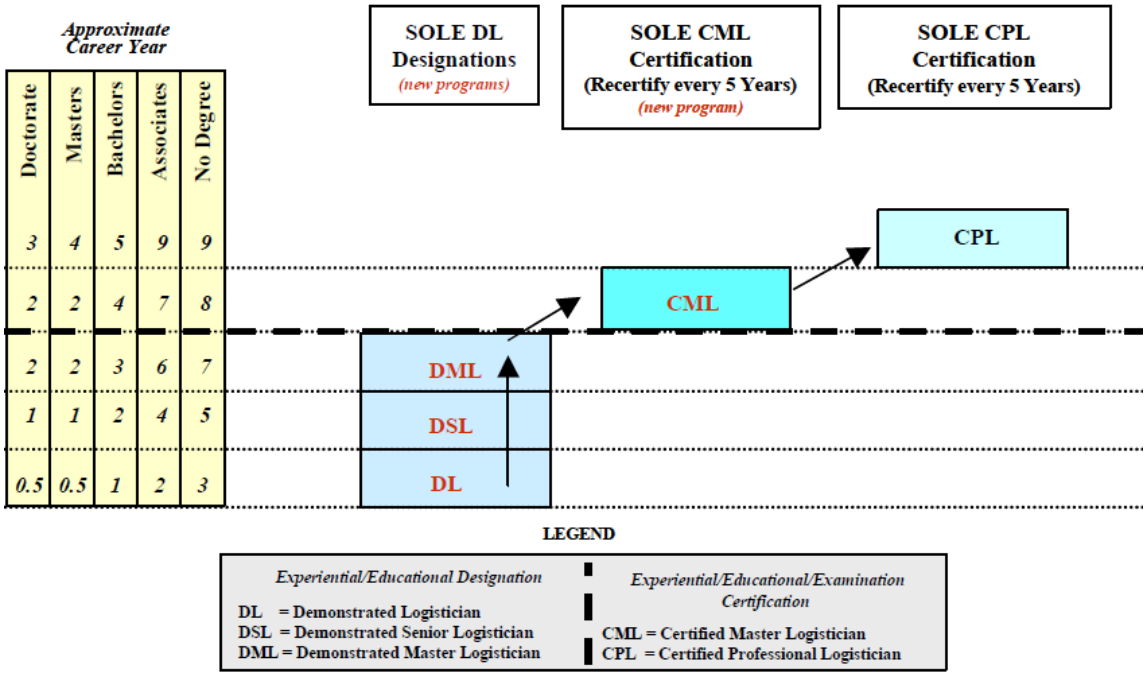

Figure 4. Professional Growth Path of Logistician (From SOLE, 2009).

All levels require that the individual continue his/her professional education through college credit or CEU equivalent credit courses, coupled with technical training in his/her field and enabler training in areas associated with the integrated functions of business or government. In addition, there are requirements for continued demonstrated professional performance in the practice of logistics (SOLE, 2009).

Table 21. DLP Requirements (After SOLE, 2009).

Demonstrated Logistician Program (DLP) Requirements				
		Demonstrated Logistician (DL)	Demonstrated Senior Logistician (DSL)	Demonstrated Master Logistician (DML)
No. of Years Satisfactory Performance Evaluation	High School	3	5	7
	Associate	2	4	6
	Bachelors	1	2	3
	Maters	0.5	1	2
	Doctors	0.5	1	2
CEU Credits	High School	12	24	36
	Associate	9	18	30
	Bachelors	6	12	24
	Maters	0	0	0
	Doctors	0	0	0
No. of Functional Course		12	18	24
No. of Enabler Course		10	15	20

c. Certified Master Logistician (CML)

The adoption of a certification program in October 1972 was a major step by SOLE to further the accreditation of professionals in the logistics field. This certification program was further expanded in 2005 to include the Certified Master Logistician (CML), recognizing the professions in Logistics Chain Management. This CML certification recognizes the functional interrelationships within the professional responsibilities of logisticians regardless of their occupational roles (SOLE, 2009).

Table 22. CML Requirements (After SOLE, 2009).

Certified Master Logistician (CML) Requirements	
Experience	▪ Eight years experience in practicing or teaching logistics chain management ▪ Or Bachelor's degree in logistics fields plus four years experience ▪ Or Master's degree in logistic fields plus three years experience ▪ Or Doctoral degree in logistics fields plus two years experience ▪ Experience must be in two fields (systems management, and distribution and customer support) of logistics with a minimum of two years experience in each field. Individuals with doctoral degree need only have three years experience in one logistics field.
Knowledge Basis	▪ Body of Knowledge for the Logistics Profession
Examination	▪ Test broad knowledge of the broad application of logistics chain management activities
Recertification	▪ Every five years requiring 50 certification points as defined by SOLE

d. Certified Professional Logistician (CPL)

Certified Professional Logistician (CPL) is awarded to individuals of proven competence in logistics who pass an examination designed to test their broad knowledge of the entire logistics spectrum (SOLE, 2009).

Table 23. CPL Requirements (After SOLE, 2009).

Certified Professional Logistician (CPL) Requirements	
Experience	▪ Nine years experience in practicing or teaching logistics chain management ▪ Or Bachelor's degree in logistics fields plus five years experience ▪ Or Master's degree in logistic fields plus four years experience ▪ Or Doctoral degree in logistics fields plus three years experience ▪ Experience must be in at least two fields (systems management, systems design and development, acquisition and production support, and distribution and customer support) of logistics with a minimum of two years experience in each field. Individuals with doctoral degree need only have three years experience in one logistics field.
Knowledge Basis	▪ Body of Knowledge for the Logistics Profession
Examination	▪ Test broad knowledge of the broad application of logistics chain management activities
Recertification	▪ Every five years requiring 50 certification points as defined by SOLE

3. SOLE Standards and Publications

The Logistics Spectrum, the official publication of SOLE, promotes professional development and advances in logistics through examination and discussion of the latest technology, techniques and professional issues in the field. The Spectrum has a worldwide distribution of over 4,000 copies (SOLE, 2009).

H. REVIEW OF SELECTED DEFENSE INDUSTRY CAREER WEB SITES

This section provides the review of selected defense industry career Web sites. The Web sites provides the insight into their experience, training, education and certification requirements for their own workforces. The companies selected here are two well known Federally Funded Research and Development Centers (FFRDCs)—Aerospace and MITRE cooperation, and seven well-known defense systems development, and systems engineering and technical assistance (SETA) contractors—

BAE, Boeing, General Dynamics, Lockheed Martin, Northrop Grumman, Raytheon and Science Application International Corporation (SAIC). The review is concentrated primarily on the senior or leadership positions.

1. Selected Defense Industry Position Requirements by Company

a. Aerospace Corporation

Headquartered in El Segundo, CA, Aerospace Corporation is one of the Federally Funded Research and Development Centers (FFRDCs), unique independent nonprofit entities sponsored and funded by the U.S. government to meet specific long-term technical needs that cannot be met by any other single organization. The Aerospace Corporation's FFRDC is sponsored by the U.S. Air Force, and chartered to provide objective technical analyses and assessments for space programs that serve the national interest. As the FFRDC for national-security space, Aerospace supports long-term planning and the immediate needs of our nation's military and reconnaissance space programs. The primary customers are the Space and Missile Systems Center of Air Force Space Command and the National Reconnaissance Office, although work is performed for civil agencies as well as international organizations and governments in the national interest (Aerospace, 2009).

Table 24. Aerospace Corporation Position Description (After Aerospace, 2009).

Position	Job Title and Requirements
Project Management	▪ Senior Project Engineer ▪ BS or advanced degree in engineering and at least 12 years experience ▪ Experience with Systems Engineering processes is required ▪ Demonstrated experience with the acquisition life cycle is required
Systems Engineering	▪ Senior Systems Engineer ▪ BS or higher degree in engineering, mathematics, or related field ▪ Minimum of 12 years experience in developing architectures and requirements to define satellite command and control, TT&C, and/or space to ground data routing systems ▪ Program management experience.
Software Engineering	▪ DSP Implementation Lead ▪ B.S. degree and an M.S. degree in EE or a related field ▪ Prior experience in hardware system software and/or algorithm development of receiver subsystems ▪ Proficiency with UNIX, Windows, and C/C++ are desired ▪ A background in software-defined radio technology is preferred ▪ Experience using Matlab or similar simulation environments is preferred
Contract Management	▪ Not Available
Logistics	▪ Not Available

b. BAE

Headquartered in London, UK, BAE had major global presences in Australia, Saudi Arabia, South Africa, Sweden, UK and US employing 106,000 people. BAE has 13 major business divisions: BAE Systems Australia; BAE Systems Products Group; CS&S International; Customer Solutions; Detica Information Intelligence; Electronics & Integrated Solutions; Electronics, Intelligence & Support; Integrated System Technologies (INSYTE), Land & Armaments; Military Air Solutions, Regional Aircraft; Shared Services; and Submarine Solutions (BAE, 2009).

Table 25. BAE Position Description (After BAE, 2009).

Position	Job Title and Requirements
Project Management	▪ Program Manager ▪ 3-5 years of hands-on program management experience ▪ BS with 4-6 years of experience or a MS with 1-3 years of experience ▪ 3-5 years experience managing an Enterprise Service ▪ Required to certify as Program Management Professional (PMP) within 6 months of accepting the position
Systems Engineering	▪ Senior Systems Engineer ▪ BS in engineering or scientific field with a minimum of 16 years experience. ▪ Broad systems engineering experience. Experience working within an integrated development team ▪ Responsibilities will include leading and participating in systems requirement development, high level system design activities, integration and test, and other critical program tasks
Software Engineering	▪ Senor Software Engineer ▪ Minimum BS in Computer Engineering, EE, Computer Science ▪ Working experience with Real Time Operating Systems such as VxWorks, LynxOS, QNX, etc. ▪ Direct working experience with Object Oriented Analysis and Design (OOA/D) methods and use of tools such as Rational Rose. ▪ Use of Software CM and Change control tools such as Rational ClearCase and ClearQuest
Contract Management	▪ Contract Administrator III ▪ BS degree in a related field w/4 years of negotiation and contract administration experience ▪ Knowledge of FAR/DFAR, CPFF, CPAF, T&M and FFP contracts ▪ Proposal preparation and price and cost analysis experience
Logistics	▪ Senor Logistics Manager ▪ Leads/directs efforts to ensure that integrated logistics support (ILS) objectives are considered and introduced ▪ Fifteen (15) years of logistics experience, five (5) of which were directly involved in aeronautical weapon systems acquisition logistics ▪ At least one year of defense acquisition management experience must have been obtained within the last 5 years prior to selection for employment under this contract. ▪ Operational Logistics experience from a maintenance, munitions

c. Boeing

Boeing is one of the world's leading aerospace companies and the largest manufacturer of commercial jetliners and military aircraft combined. Headquartered in Chicago, IL, Boeing employs more than 160,000 people across the United States and in 70 countries, and has four major business units—Commercial Airplanes, Integrated Defense Systems, Boeing Capital Corporation and Shared Services Group (Boeing, 2009).

Table 26. Boeing Position Description (After Boeing, 2009).

Position	Job Title and Requirements
Project Management	▪ Project Management Manager ▪ Master degree in one or more of the following disciplines or closely related field: Business Administration, Systems Management, Systems Engineering, Electrical Engineering, Computer Science ▪ Minimum of 20 years experience in combined program management, technical leadership positions
Systems Engineering	▪ Systems Engineer 6 ▪ Bachelor's and 20 or more years' experience; Master's with 18 or more year's experience; Master's with 18 or more years' experience; or PhD with 15 or more years' experience. ▪ Experienced in leading teams creating systems architecture views of complex intersegment space systems for various stakeholders.
Software Engineering	▪ Software/Systems Engineer Tech Lead ▪ Bachelor's and 20 or more years' experience; Master's with 18 or more year's experience; Master's with 18 or more years' experience; or PhD with 15 or more years' experience. ▪ Experience with software or system architecture/specification development ▪ Knowledge of object oriented analysis and design methods using Unified Model Language
Contract Management	▪ Contract & Pricing Administrator 4 ▪ Bachelor's degree with 10 or more years related work experience; or Master's degree with 8 or more years work experience or an equivalent combination of education and experience
Logistics	▪ Not Available

d. General Dynamics

Headquartered in Falls Church, VA, General Dynamics employs approximately 92,900 people worldwide with four business groups—Aerospace, Combat Systems, Marine Systems and Information Systems and Technology (GD, 2009).

Table 27. General Dynamics Position Description (After GD, 2009).

Position	Job Title and Requirements
Project Management	▪ Manager, Program ▪ Requires BS/BA degree ▪ Experience equivalent to that of twenty (20) years experience in Navy shipboard engineering systems ▪ Experience in defining project objectives and requirements, directing, coordinating and completing project efforts, interfacing with government personnel, and providing progress reports
Systems Engineering	▪ Systems Engineer Senior ▪ BS Degree in a technical field related to electrical or systems engineering ▪ +8 years demonstrated results, or equivalent experience. ▪ Specific experience with satellite signal processing, including phased array beam forming and demodulation, desirable. ▪ Experience with the large scale satellite communications systems is required. Experience with the Space Network/TDRSS system and its customers are desired.
Software Engineering	▪ Engineer Staff - Software ▪ BS in CSE/CS/CE and minimum 4 year of software design/development experience ▪ Experience in OOD, UML, XML, Eclipse and software programming languages such as C/C++/Java preferred
Contract Management	▪ Senior Contract Manager ▪ Bachelor's Degree preferred plus 10 years Contracts experience. In lieu of a degree and associated experience, 14 years related experience. This may include professional certifications. ▪ Extensive knowledge in US Government contracting, International Contracting and Export Regulations (ITAR and EAR), and understanding of subcontracting to aid in flow-down of prime contract requirements
Logistics	▪ Senior Principle Engineer, Logistics ▪ Requires BS/BA degree. Requires 10-15 years experience. ▪ DAWIA Level II or III in logistics equivalent experience required ▪ Experience with USMC Acquisition processes ▪ Experience with Joint or USAF acquisition program

e. Lockheed Martin

Headquartered in Bethesda, MD, Lockheed Martin's business units are Aeronautics, Electronic Systems, Information Systems & Global Services, and Space Systems. Lockheed Martin employs about 146,000 people worldwide (LM, 2009).

Table 28. Lockheed Martin Position Description (After LM, 2009).

Position	Job Title and Requirements
Project Management	▪ Program Management Director ▪ Appropriate degree form an accredited college, or equivalent experience/ combined education, with professional experience and specialized training. ▪ Minimum of 15 years of USAF strategic missile program/project management leadership experience. ▪ Familiarity with USAF strategic missile mission and USAF customer knowledge and experience. ▪ Washington Operations and Congressional support experience/knowledge. ▪ Green Belt certification.
Systems Engineering	▪ Systems Engineer Senior ▪ Bachelor's degrees from an accredited college in a related discipline, or equivalent experience/combined education, with 5 years experience; or 3 years experience with a related Masters degree. ▪ Experience in the architecture design and development, configuration control and management, requirements traceability & documentation, test planning for verification of functionality and requirements
Software Engineering	▪ Software Engineer Senior ▪ Bachelor's degree from an accredited college in a related discipline, or equivalent experience/combined education, with 5 years experience; or 3 years experience with a related Masters degree. ▪ Understanding of software engineering principles, C/C++ programming languages, a working knowledge of various operating systems (i.e. Linux, Windows, etc), and be familiar with Internet protocols.
Contract Management	▪ Contract Negotiation Senior Manager ▪ Appropriate degree from an accredited college, or equivalent experience/combined education, with professional experience and specialized training commensurate with assignment ▪ Experience and knowledge in the creation and management of cost reimbursable and firm fixed price contracts. ▪ Previous lead, management, or supervisory experience. ▪ NCMA Certification ▪ J.D. or M.B.A. degree
Logistics	▪ Logistics Engineer Staff ▪ Bachelors degree from an accredited college in a related discipline, or equivalent experience/combined education, with 9 years experience; or 7 years experience with a related Masters degree ▪ Spacelift Range Systems (SLRS) experience ▪ Logistics engineering experience

f. MITRE Corporation

Located in Bedford, MA, and McLean, VA, MITRE corporation manages four Federally Funded Research and Development Centers (FFRDCs): one for the Department of Defense (known as the DoD Command, Control, Communications and Intelligence FFRDC), one for the Federal Aviation Administration (the Center for

Advanced Aviation System Development), one for the Internal Revenue Service and U.S. Department of Veterans Affairs (the Center for Enterprise Modernization), and one for the Department of Homeland Security (the Homeland Security Systems Engineering and Development Institute). MITRE also has its own independent research and development program that explores new technologies and new uses of technologies to solve sponsors' problems in the near-term and in the future. MITRE employs 7,000 scientists, engineers and support specialists (MITRE, 2009).

Table 29. MITRE Corporation Position Description (After MITRE, 2009).

Position	Job Title and Requirements
Project Management	▪ Lead Acquisition Professional ▪ BS or equivalent and 5 years of related experience or MS or equivalent and 3 years of related experience or PhD and 1 year of related experience ▪ 10 years experience in Program Management/System Engineering ▪ Level III DAWIA Certified Program Manager or equivalent (i.e. PMI) ▪ Level III DAWIA Certified Contracting Officer or equivalent ▪ Level III DAWIA Certified Systems Planning, Research, Development & Engineering (SPRDE) or equivalent (e.g. INCOSE) ▪ Experienced with the content and utilization of the FAR, Defense Acquisition System, and the PPBS
Systems Engineering	▪ Senior Systems Engineer supporting Intel Community ▪ BS or equivalent and 1 year experience or MS or equivalent ▪ Current experience working with both DoD and other U.S. Government Agencies as well as experience with collateral organizations. ▪ Working knowledge of Web servers, portals, directory and proxy servers, PKI infrastructure and requirements are a must, as well as firewalls and routers, including encrypted routers are a must. ▪ Current experience in troubleshooting, scripting in Perl, Python, and/or other scripting languages, and basic knowledge of Solaris, SunOS, HPUX, Windows XP and Windows 2003
Software Engineering	▪ Senior Software Systems Engineer - Defense Programs ▪ BSCS, BSCE or equivalent and 1 year experience or MS or equivalent ▪ Expertise in principles of object-oriented software design/programming ▪ Experience with Java, C/C++, Perl, and/or others ▪ Knowledge of hands-on experience w/internet technologies such as HTTP, AJAX, XML, Web services, and emerging Web standards & technologies
Contract Management	▪ Contracts Manager – Federal Programs ▪ Bachelor's degree in Business Administration, Finance, Accounting or related field, plus 6 years experience or the equivalent in job-relevant work experience ▪ Excellent understanding of government contracts laws and regulations ▪ Working knowledge of Microsoft office applications in a Windows environment
Logistics	▪ Not Available

g. Northrop Grumman

Headquartered in Century City, CA, Northrop Grumman Corporation employs 120,000 people and organized into five business sectors—Aerospace Systems, Electronic Systems, Information Systems, Shipbuilding, and Technical Services (NG, 2009).

Table 30. Northrop Grumman Position Description (After NG, 2009).

Position	Job Title and Requirements
Project Management	▪ Program Manager ▪ BS in Management or Engineering; MBA preferred. Proficiency in program management and financial concepts, EVMS, planning and scheduling (MS Project), Word, Excel and PowerPoint ▪ Minimum three years program management experience required
Systems Engineering	▪ Director C4ISR Systems Engineering ▪ BS or MS in an engineering or management discipline (MS preferred), with 10+ years of technical project lead experience ▪ Experience in functional and/or program / engineering management is required. ▪ 10+ years of experience in end-to-end military system development process.
Software Engineering	▪ Senior Software Engineer ▪ Bachelor's Degree in Computer Science or a related technical field 5 years of experience developing applications with Java JDK 1.5 or higher ▪ MS degree in engineering or computer science may be substituted for an additional 2 years of experience ▪ Experience developing Java applications on both Windows and Sun Solaris platforms.
Contract Management	▪ Lead Contract Administrator 5/6 ▪ Bachelor's degree with 8-11 years of experience in Contract administration or related field ▪ Knowledge of pricing principles and FAR/DFARS and associated Federal Contracting regulations a must
Logistics	▪ Acquisition Logistician 6 ▪ Bachelors Degree with 11-14 years work experience is required. Additional 4-6 years work experience may be substituted for degree ▪ Degree in a logistics field, professional or advanced certification is desired ▪ Knowledge of DoD acquisition

h. Raytheon

Headquartered in Waltham, MD, Raytheon employs over 73,000 people worldwide and has six business units—Integrated Defense Systems, Intelligence and Information Systems, Missile Systems, Network Centric Systems, Raytheon Technical Services Company LLC, and Space and Airborne Systems (Raytheon, 2009).

Table 31. Raytheon Position Description (After Raytheon, 2009).

Position	Job Title and Requirements
Project Management	▪ Director I Program Management ▪ Bachelors degree in a related subject (advanced degree is preferred) plus a minimum of 14-16 years of experience managing complex programs worth $100M plus and experienced managing approximately 300 employees in a matrix environment. ▪ Manage a full range of program management best practices
Systems Engineering	▪ Chief Technology Manager ▪ Bachelor's degree (or equivalent experience) in Computer Science, Business Administration or a related field and a minimum 10+ years experience supporting information systems and information technology in a strategic role ▪ Experience in design, acquisition and deployment of information technology infrastructure to encompass management of infrastructure, database, communication, security and networks.
Software Engineering	▪ Senior Software Engineer II ▪ B.S. or M.S. in Computer Engineering, Computer Science, Electrical Engineering, Software Engineering, Systems Engineering, Physics, Mathematics ▪ Knowledge of Missile Guidance, Navigation, and Discrimination systems and associated algorithms is highly desired. ▪ Knowledge of radar based missile systems.
Contract Management	▪ Manager, Program Contracts ▪ Bachelor's degree and 10+ years of contracts and/or finance experience or Master's degree and 8+ years ▪ Experience in preparing proposals, negotiating complex contractual terms with various customers, and executing contracts in accordance with company policies, legal requirements, the FAR and other government and customer provisions
Logistics	▪ Manager II Logistics ▪ Bachelor's Degree in Engineering, Business or Management ▪ 8+ years hands on work experience in the maintenance & deployment of the Patriot Air Defense System. ▪ Level I certified by the Defense Acquisition University in Logistics

i. Science Application International Corporation (SAIC)

Headquartered in San Diego, CA, Science Applications International Corporation (SAIC) has approximately 45,000 employees with offices in more than 150 cities worldwide. SAIC provides a wide array of technical services and solutions, primarily to U.S. federal, state and local government agencies and foreign governments (SAIC, 2009).

Table 32. SAIC Position Description (After SAIC, 2009).

Position	Job Title and Requirements
Project Management	▪ Program Manager ▪ Bachelor's degree in Engineering, Science, or Engineering Management w/18 years of experience or Master's w/15 years of experience ▪ At least ten of these years shall be managing projects/programs in a Federal Government environment. ▪ DAWIA Level II certification as a Program Manager or certification under the commercial Program Management Training program. ▪ Project Management Professional (PMP) certification is a plus
Systems Engineering	▪ Senior Systems Engineer ▪ Bachelor's degree from an accredited institution in Electrical or Electronics Engineering ▪ Seven (7) years of engineering experience in system concept formulation, system design analysis, subsystem design analysis, interface design analysis, network design, modeling, simulation, and communication information systems concepts ▪ Understanding of requirements and generation of DoDAF products
Software Engineering	▪ Senior Software Engineer ▪ Bachelor's degree from an accredited college/university ▪ Minimum 10 years experience, or 8 years with software engineering degree or certification. ▪ Minimum 15 years general engineering experience in at least 2 domains, 13 years with Masters, 11 years with PhD. Strong programming skills in C, C++, and/or Java for software application development are a must.
Contract Management	▪ Senior Contracts Representative III ▪ Bachelors in Business Administration (or related field) and 4+ years of experience in supporting various DoD and commercial contracts ▪ Additional work experience may be substituted for a degree. Master's degree in related field or Contracts Certification may be substituted for two years of experience. ▪ Knowledge of all contract types and a working knowledge of FAR/DFARS ▪ NCMA certification is a plus.
Logistics	▪ Logistics Engineer ▪ Bachelor's degree from an accredited institution in Electrical or Electronics Engineering ▪ Seven (7) years of engineering experience in system concept formulation, system design analysis, subsystem design analysis, interface design analysis, network design, modeling, simulation, and communication information systems concepts are required. ▪ Three (3) years of specialized experience in the design, development, testing, and analysis of Joint Warfighter Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems

2. Comparison between the Companies for Selected Positions

This section reorganized the information in the previous section by each job category—Program/Project Management/Engineering, Systems Engineering, Software Engineering, Contract Management, and Logistics—to compare the job requirements among the aerospace companies.

a. Program/Project Management/Engineering

Table 33. Program/Project Management/Engineering Function Requirements.

Company	Program/Project Management/Engineering Function Requirements
Aerospace Corporation	▪ Senior Project Engineer ▪ BS or advanced degree in engineering and at least 12 years experience ▪ Experience with Systems Engineering processes is required ▪ Demonstrated experience with the acquisition life cycle is required
BAE	▪ Program Manager ▪ 3-5 years of hands-on program management experience ▪ BS with 4-6 years of experience or a MS with 1-3 years of experience ▪ 3-5 years experience managing an Enterprise Service ▪ Required to certify as Program Management Professional (PMP) within 6 months of accepting the position
Boeing	▪ Project Management Manager ▪ Master degree in one or more of the following disciplines or closely related field: Business Administration, Systems Management, Systems Engineering, Electrical Engineering, Computer Science ▪ Minimum of 20 years experience in combined program management, technical leadership positions
General Dynamics	▪ Manager, Program ▪ Requires BS/BA degree ▪ Experience equivalent to that of twenty (20) years experience in Navy shipboard engineering systems ▪ Experience in defining project objectives and requirements, directing, coordinating and completing project efforts, interfacing with government personnel, and providing progress reports
Lockheed Martin	▪ Program Management Director ▪ Appropriate degree form an accredited college, or equivalent experience/ combined education, with professional experience and specialized training. ▪ Minimum of 15 years of USAF strategic missile program/project management leadership experience. ▪ Familiarity with USAF strategic missile mission and USAF customer knowledge and experience. ▪ Washington Operations and Congressional support experience/knowledge. ▪ Green Belt certification.
MITRE Corporation	▪ Lead Acquisition Professional ▪ BS or equivalent and 5 years of related experience or MS or equivalent and 3 years of related experience or PhD and 1 year of related experience ▪ 10 years experience in Program Management/System Engineering

Company	Program/Project Management/Engineering Function Requirements
	▪ Level III DAWIA Certified Program Manager or equivalent (i.e. PMI) ▪ Level III DAWIA Certified Contracting Officer or equivalent ▪ Level III DAWIA Certified Systems Planning, Research, Development & Engineering (SPRDE) or equivalent (e.g. INCOSE) ▪ Experienced with the content and utilization of the FAR, Defense Acquisition System, and the PPBS
Northrop Grumman	▪ Program Manager ▪ BS in Management or Engineering; MBA preferred. Proficiency in program management and financial concepts, EVMS, planning and scheduling (MS Project), Word, Excel and PowerPoint ▪ Minimum three years program management experience required
Raytheon	▪ Director I Program Management ▪ Bachelors degree in a related subject (advanced degree is preferred) plus a minimum of 14-16 years of experience managing complex programs worth $100M plus and experienced managing approximately 300 employees in a matrix environment. ▪ Manage a full range of program management best practices
SAIC	▪ Program Manager ▪ Bachelor's degree in Engineering, Science, or Engineering Management w/18 years of experience or Master's w/15 years of experience ▪ At least ten of these years shall be managing projects/programs in a Federal Government environment. ▪ DAWIA Level II certification as a Program Manager or certification under the commercial Program Management Training program. ▪ Project Management Professional (PMP) certification is a plus

b. Systems Engineering

Table 34. Systems Engineering Function Requirements.

Company	Systems Engineering Function Requirements
Aerospace Corporation	▪ Senior Systems Engineer ▪ BS or higher degree in engineering, mathematics, or related field ▪ Minimum of 12 years experience in developing architectures and requirements to define satellite command and control, TT&C, and/or space to ground data routing systems ▪ Program management experience.
BAE	▪ Senior Systems Engineer ▪ BS in engineering or scientific field with a minimum of 16 years experience. ▪ Broad systems engineering experience. Experience working within an integrated development team ▪ Responsibilities will include leading and participating in systems requirement development, high level system design activities, integration and test, and other critical program tasks
Boeing	▪ Systems Engineer 6 ▪ Bachelor's and 20 or more years' experience; Master’s with 18 or more year’s experience; Master’s with 18 or more years' experience; or PhD with 15 or more years' experience. ▪ Experienced in leading teams creating systems architecture views of complex intersegment space systems for various stakeholders.

Company	Systems Engineering Function Requirements
General Dynamics	▪ Systems Engineer Senior ▪ BS Degree in a technical field related to electrical or systems engineering ▪ +8 years demonstrated results, or equivalent experience. ▪ Specific experience with satellite signal processing, including phased array beam forming and demodulation, desirable. ▪ Experience with the large scale satellite communications systems is required. Experience with the Space Network/TDRSS system and its customers are desired.
Lockheed Martin	▪ Systems Engineer Senior ▪ Bachelor's degrees from an accredited college in a related discipline, or equivalent experience/combined education, with 5 years experience; or 3 years experience with a related Masters degree. ▪ Experience in the architecture design and development, configuration control and management, requirements traceability & documentation, test planning for verification of functionality and requirements
MITRE Corporation	▪ Senior Systems Engineer supporting Intel Community ▪ BS or equivalent and 1 year experience or MS or equivalent ▪ Current experience working with both DoD and other U.S. Government Agencies as well as experience with collateral organizations. ▪ Working knowledge of Web servers, portals, directory and proxy servers, PKI infrastructure and requirements are a must, as well as firewalls and routers, including encrypted routers are a must. ▪ Current experience in troubleshooting, scripting in Perl, Python, and/or other scripting languages, and basic knowledge of Solaris, SunOS, HPUX, Windows XP and Windows 2003
Northrop Grumman	▪ Director C4ISR Systems Engineering ▪ BS or MS in an engineering or management discipline (MS preferred), with 10+ years of technical project lead experience ▪ Experience in functional and/or program / engineering management is required. ▪ 10+ years of experience in end-to-end military system development process.
Raytheon	▪ Chief Technology Manager ▪ Bachelor's degree (or equivalent experience) in Computer Science, Business Administration or a related field and a minimum 10+ years experience supporting information systems and information technology in a strategic role ▪ Experience in design, acquisition and deployment of information technology infrastructure to encompass management of infrastructure, database, communication, security and networks.
SAIC	▪ Senior Systems Engineer ▪ Bachelor's degree from an accredited institution in Electrical or Electronics Engineering ▪ Seven (7) years of engineering experience in system concept formulation, system design analysis, subsystem design analysis, interface design analysis, network design, modeling, simulation, and communication information systems concepts ▪ Understanding of requirements and generation of DoDAF products

c. Software Engineering

Table 35. Software Engineering Function Requirements.

Company	Software Engineering Function Requirements
Aerospace Corporation	▪ DSP Implementation Lead ▪ B.S. degree and an M.S. degree in EE or a related field ▪ Prior experience in hardware system software and/or algorithm development of receiver subsystems ▪ Proficiency with UNIX, Windows, and C/C++ are desired ▪ A background in software-defined radio technology is preferred ▪ Experience using Matlab or similar simulation environments is preferred
BAE	▪ Senor Software Engineer ▪ Minimum BS in Computer Engineering, EE, Computer Science ▪ Working experience with Real Time Operating Systems such as VxWorks, LynxOS, QNX, etc. ▪ Direct working experience with Object Oriented Analysis and Design (OOA/D) methods and use of tools such as Rational Rose. ▪ Use of Software CM and Change control tools such as Rational ClearCase and ClearQuest
Boeing	▪ Software/Systems Engineer Tech Lead ▪ Bachelor's and 20 or more years' experience; Master's with 18 or more year's experience; Master's with 18 or more years' experience; or PhD with 15 or more years' experience. ▪ Experience with software or system architecture/specification development ▪ Knowledge of object oriented analysis and design methods using Unified Model Language
General Dynamics	▪ Engineer Staff - Software ▪ BS in CSE/CS/CE and minimum 4 year of software design/development experience ▪ Experience in OOD, UML, XML, Eclipse and software programming languages such as C/C++/Java preferred
Lockheed Martin	▪ Software Engineer Senior ▪ Bachelor's degree from an accredited college in a related discipline, or equivalent experience/combined education, with 5 years experience; or 3 years experience with a related Masters degree. ▪ Understanding of software engineering principles, C/C++ programming languages, a working knowledge of various operating systems (i.e. Linux, Windows, etc), and be familiar with Internet protocols.
MITRE Corporation	▪ Senior Software Systems Engineer - Defense Programs ▪ BSCS, BSCE or equivalent and 1 year experience or MS or equivalent ▪ Expertise in principles of object-oriented software design/programming ▪ Experience with Java, C/C++, Perl, and/or others ▪ Knowledge of hands-on experience w/internet technologies such as HTTP, AJAX, XML, Web services, and emerging Web standards & technologies
Northrop Grumman	▪ Senior Software Engineer ▪ Bachelor's Degree in Computer Science or a related technical field 5 years of experience developing applications with Java JDK 1.5 or higher ▪ MS degree in engineering or computer science may be substituted for an additional 2 years of experience ▪ Experience developing Java applications on both Windows and Sun Solaris platforms.

Company	Software Engineering Function Requirements
Raytheon	▪ Senior Software Engineer II ▪ B.S. or M.S. in Computer Engineering, Computer Science, Electrical Engineering, Software Engineering, Systems Engineering, Physics, Mathematics ▪ Knowledge of Missile Guidance, Navigation, and Discrimination systems and associated algorithms is highly desired. ▪ Knowledge of radar based missile systems.
SAIC	▪ Senior Software Engineer ▪ Bachelor's degree from an accredited college/university ▪ Minimum 10 years experience, or 8 years with software engineering degree or certification. ▪ Minimum 15 years general engineering experience in at least 2 domains, 13 years with Masters, 11 years with PhD. Strong programming skills in C, C++, and/or Java for software application development are a must.

d. Contract Management

Table 36. Contract Management Function Requirements.

Company	Contract Management Function Requirements
Aerospace Corporation	▪ Not available
BAE	▪ Contract Administrator III ▪ BS degree in a related field w/4 years of negotiation and contract administration experience ▪ Knowledge of FAR/DFAR, CPFF, CPAF, T&M and FFP contracts ▪ Proposal preparation and price and cost analysis experience
Boeing	▪ Contract & Pricing Administrator 4 ▪ Bachelor’s degree with 10 or more years related work experience; or Master’s degree with 8 or more years work experience or an equivalent combination of education and experience
General Dynamics	▪ Senior Contract Manager ▪ Bachelor's Degree preferred plus 10 years Contracts experience. In lieu of a degree and associated experience, 14 years related experience. This may include professional certifications. ▪ Extensive knowledge in US Government contracting, International Contracting and Export Regulations (ITAR and EAR), and understanding of subcontracting to aid in flow-down of prime contract requirements
Lockheed Martin	▪ Contract Negotiation Senior Manager ▪ Appropriate degree from an accredited college, or equivalent experience/combined education, with professional experience and specialized training commensurate with assignment ▪ Experience and knowledge in the creation and management of cost reimbursable and firm fixed price contracts. ▪ Previous lead, management, or supervisory experience. ▪ NCMA Certification ▪ J.D. or M.B.A. degree
MITRE Corporation	▪ Contracts Manager – Federal Programs ▪ Bachelor's degree in Business Administration, Finance, Accounting or related field, plus 6 years experience or the equivalent in job-relevant work

Company	Contract Management Function Requirements
	experience ▪ Excellent understanding of government contracts laws and regulations ▪ Working knowledge of Microsoft office applications in a Windows environment
Northrop Grumman	▪ Lead Contract Administrator 5/6 ▪ Bachelor's degree with 8-11 years of experience in Contract administration or related field ▪ Knowledge of pricing principles and FAR/DFARS and associated Federal Contracting regulations a must
Raytheon	▪ Manager, Program Contracts ▪ Bachelor's degree and 10+ years of contracts and/or finance experience or Master's degree and 8+ years ▪ Experience in preparing proposals, negotiating complex contractual terms with various customers, and executing contracts in accordance with company policies, legal requirements, the FAR and other government and customer provisions
SAIC	▪ Senior Contracts Representative III ▪ Bachelors in Business Administration (or related field) and 4+ years of experience in supporting various DoD and commercial contracts ▪ Additional work experience may be substituted for a degree. Master's degree in related field or Contracts Certification may be substituted for two years of experience. ▪ Knowledge of all contract types and a working knowledge of FAR/DFARS ▪ NCMA certification is a plus.

e. Logistics

Table 37. Logistics Function Requirements.

Company	Logistics Function Requirements
Aerospace Corporation	▪ Not Available.
BAE	▪ Senor Logistics Manager ▪ Leads/directs efforts to ensure that integrated logistics support (ILS) objectives are considered and introduced ▪ Fifteen (15) years of logistics experience, five (5) of which were directly involved in aeronautical weapon systems acquisition logistics ▪ At least one year of defense acquisition management experience must have been obtained within the last 5 years prior to selection for employment under this contract. ▪ Operational Logistics experience from a maintenance, munitions
Boeing	▪ Not Available
General Dynamics	▪ Senior Principle Engineer, Logistics ▪ Requires BS/BA degree. Requires 10-15 years experience. ▪ DAWIA Level II or III in logistics equivalent experience required ▪ Experience with USMC Acquisition processes ▪ Experience with Joint or USAF acquisition program
Lockheed Martin	▪ Logistics Engineer Staff ▪ Bachelors degree from an accredited college in a related discipline, or

Company	Logistics Function Requirements
	equivalent experience/combined education, with 9 years experience; or 7 years experience with a related Masters degree ▪ Spacelift Range Systems (SLRS) experience ▪ Logistics engineering experience
MITRE Corporation	▪ Not Available
Northrop Grumman	▪ Acquisition Logistician 6 ▪ Bachelors Degree with 11-14 years work experience is required. Additional 4-6 years work experience may be substituted for degree ▪ Degree in a logistics field, professional or advanced certification is desired ▪ Knowledge of DoD acquisition
Raytheon	▪ Manager II Logistics ▪ Bachelor's Degree in Engineering, Business or Management ▪ 8+ years hands on work experience in the maintenance & deployment of the Patriot Air Defense System. ▪ Level I certified by the Defense Acquisition University in Logistics
SAIC	▪ Logistics Engineer ▪ Bachelor's degree from an accredited institution in Electrical or Electronics Engineering ▪ Seven (7) years of engineering experience in system concept formulation, system design analysis, subsystem design analysis, interface design analysis, network design, modeling, simulation, and communication information systems concepts are required. ▪ Three (3) years of specialized experience in the design, development, testing, and analysis of Joint Warfighter Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems

I. CHAPTER SUMMARY

This chapter described the Defense Acquisition Workforce Improvement Act (DAWIA) certification and professionalization of defense acquisition workforces. Selected civilian institutions offering similar certifications are researched and reviewed as related to the class, levels, education, training, experience, and other qualification requirements to compare with DAWIA certification. Then, to understand the current status of defense industry trends in their workforce development, selected defense industry establishment career Web sites were reviewed and presented.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. RESEARCH ANALYSIS

A. INTRODUCTION

Most of the DoD, GAO, and Congressional reviews on the DoD acquisition were mainly concentrated on the changes, improvements, and innovation in defense acquisition policy and framework, as related to how the DoD will manage defense acquisition programs. There is a growing interest in pushing industrial base related policies into its acquisition regulations and in utilizing strategies to promote competition and innovation (Gansler, 2008). The review of defense acquisition policy and Defense Acquisition Workforce Improvement Act (DAWIA), selected civilian organization certifications, and defense industry career research call for another approach to improve the performance of defense acquisition programs. This chapter answers and analyzes the research question proposed in the Chapter I and presents the results of the study and other research findings.

B. RESEARCH QUESTION ANALYSIS

1. Peculiarities and Trends of Defense Acquisition

By any measure, the defense acquisition is an undeniably complex and big business. Hundreds of thousands of employees work in the DoD acquisition organizations, which execute millions of contract actions for research, development, procurement and support of weapon systems every year. Defense acquisition reform initiatives, commercialization of business processes, and a decade-long streamlining of the acquisition workforce have all been aimed at fundamentally improving the defense acquisition system. In his Naval Postgraduate School (NPS) acquisition paper, Elliott Yoder stressed that “the impetus for reforms and streamlining the acquisition workforce stems as much from a move towards greater efficiency as from the reality of adapting business practices to meet an ever-shrinking acquisition workforce” (Yoder, 2004, p. 1).

During the 1990s, Congress required the DOD to reduce the size of its acquisition workforce as a result of a perceived peace dividend from the 1991 Gulf War. By 2000, the acquisition workforce reduced by almost 50%. Despite significant increases in defense spending over the last decade, the acquisition workforce has remained relatively stable, resulting in fewer people managing ever greater workloads at a time when many contracts are becoming more complex. Due to the reduced number of defense acquisition workforces, the DoD structured contracts to reduce government oversight and shift key decision-making responsibility to contractors. This approach is known as Total System Performance Responsibility (TSPR). The TSPR could mitigate the impact of losing a large number of acquisition workers by transferring responsibilities to the contractor. According to the 20 May 2009 GAO report on Space Acquisition, "TSPR was intended to facilitate acquisition reform and enable DOD to streamline its acquisition process leveraging innovation and management expertise from the private sector. Specifically, TSPR gave a contractor total responsibility for the integration of an entire weapon system and for meeting DoD's requirements" (GAO, 2009 May, p. 9). TSPR allows the contractor greater freedom to be innovative in its management practices without the traditional level of government oversight under the assumption that this would save money. Under the reduced government oversight, the contractor did not even require formal deliverable document such as earned value management reports to assess the status and performance of the contractor (Rostker, 2009). TSPR seems to work well for sustaining type programs where the contractor is essentially just maintaining that which has been well-defined and maintaining it to a specified standard. The TSPR development programs falter when the government is not fully engaged, or does not do the jobs it was planning to do, assuming that the contractor would take on that responsibility (Gill, 2002).

Several of high-risk space programs under TSPR were intended to facilitate acquisition reform, streamline acquisition process, and leverage presumed innovation and management expertise from the industry, but those programs are in trouble (GAO, 2009 May). In early 2000, the trend reversed to fix the TSPR fiasco. There has been a great deal of turbulence in defense acquisition policy. This has led to confusion within the

acquisition workforce over the major policy thrusts, terminology, and unobvious implications of the changes. In his NPS acquisition report, John Dillard stated, “The new acquisition framework has added complexity, with more phases and delineations of activity and both the number and level of decision reviews have been increased” (Dillard, 2003).

2. Lessons of Defense Acquisition Program

Performance shortfalls, schedule delays and cost increases may be the logical consequences of the acquisition culture (Fox, 1995). There are many historical data of defense acquisition program lessons learned. The lessons repeatedly point out that the program management is not a spectator sport, and the program management team must be willing to make decision even it means the program cancellation. The program is doomed to failure if it starts out underfunded and without a clear and understandable program baseline, and has insufficient resources for the systems engineering jobs at hand. Below table summarizes the collective lessons of past defense acquisition programs.

Table 38. Lessons of Past Defense Acquisition Programs.

Categories	Description
Critical Role of Program Manager	A program manger is paid to make tough decision, not to continue unneeded efforts.
Program Plan	Ensure that the program is structured from the start to contain the required activities such as system engineering, early interface testing, verification and validation plans, engineering development units, mission assurance, etc.,
Early Engagement	Pre-source selection interchange with contractor is a must. One benefit is increased understanding of requirements and get the contractor familiar with government process.
Request for Proposal (RFP)	An overly constrained RFP can and will force the contractor to bid to an unachievable baseline.
Statement of Work (SOW)	Use a detailed SOW clearly defining the needs. The government needs to know what it wants, needs to state it clearly, and needs to evaluate against those needs.
Cost Realism	Do not assume that the contractor will provide an accurate bid. Use cost realism as compared to the Independent Cost Estimate (ICE) as a component of understanding the program.
Systems Engineering	System engineering and control especially prime integrator are critical for program execution. Systems engineering is the basis upon which the system is built.
Mil-Std	Use Mil-Stds and Specs especially in establishing requirements for "soft" products. It is very critical to establish and monitor the baseline review for program success.
Award Fee	Award fee plans should be simple, fair and clearly tied to the objectives. An award fee plan cannot substitute for good management.
Engagement	The government needs and the contractor's incentives are not 100% same. The best defense against program issue is a fully involved, actively managed government team.
Independent Review	Objective outside observers provide important checks and balances to the contractor who may be too close to the problem
Cost Performance Report (CPR)	Make sure your people know how to use a CPR as an element of total program oversight, and spend time to ensure a good initial baseline review.
Trade-offs	Requirements trade-offs are critical as the program matures. Even KPPs should be reevaluated if they impede the overall effort. If a program cannot meet its requirements for the cost agreed to, it is not wrong to reexamine its need.

There should be no surprise that many of these lessons have been repeated program after program. The former Aerospace CEO Dr. William Ballhaus likes to say, "We aren't making any new mistakes—we keep making the old mistakes over and over again" (Shere, 2003).

3. Motive behind Defense Acquisition Workforce Improvement Act (DAWIA)

In 1986, the Packard Commission described the condition of the DoD acquisition workforce compared to its industry counterparts.

> The defense acquisition work force mingles civilian and military expertise in numerous disciplines for management and staffing of the world's largest procurement organization. Each year billions of dollars are spent more or less efficiently, based on the competence and experience of these personnel. Yet, compared to its industry counterparts, this workforce is undertrained, underpaid, and inexperienced. Whatever other changes may be made, it is vitally important to enhance the quality of the defense acquisition workforce-both by attracting qualified new personnel and by improving the training and motivation of current personnel. (Packard, 1986, p. 66)

The 1989 DoD Defense Management Review (DMR) found many of the same problems as the Packard Commission and recommended a series actions to improve the acquisition process and more effectively manage the DoD's resources.

> While small improvements have been made in the nearly three years since the Commission completed work, its major recommendations have yet to be implemented. Identifying steps to accomplish the Commission's broad objectives accordingly has been a major focus of the Defense Management Review. (DoD Report, 1989, p. 13)

The 8 May 1990 U.S. Congress Report, "The Quality and Professionalism of the Acquisition Workforce," recognized professional skills and attributes are essential for the people performing acquisition functions and emphasized the need for a comprehensive program to ensure required improvement in the quality and professionalism of those individuals working in acquisition positions throughout the DoD (US Congress Report, 1990).

When introducing the Defense Acquisition Workforce Improvement Act (DAWIA) in 1990, Congressman Mavroules made it very clear that the key acquisition assignments, such as program mangers, should be given only to qualified professional defense acquisition professionals appointed by those responsible for acquisition in the DoD and their performance to be evaluated by same individuals (Mavroules, 1991). The

message was clear that the disciplined management accountability is paramount importance in the DoD acquisition program success. Addressing the goal to establish the framework for a defense acquisition career program, the 1991 Defense Acquisition Workforce Improvement Act (DAWIA) has made substantial contributions to the improvement of the defense acquisition workforce. The main goal of DAWIA was to improve the quality and professionalism of the acquisition workforce by establishing a systematic career development program for the DoD personnel serving in designated acquisition positions.

The study results of various acquisition and workforce reform initiatives are mixed and still inconclusive. The 2008 GAO reported that despite the recent changes and initiatives to improve the DOD's overall investment strategy and the soundness of the programs, it is still too early to determine the impact those changes have had on programs (GAO, 2008). In the acquisition study report, *Acquisition Reform in the Department of Defense: Has DoD Broken Through the Reform Barrier?*, Professors Carl Templin and Davis Christensen concluded that there is evidence that acquisition reforms are starting to make a difference in contract cost performance, although the evidence is not conclusive (Templin, 2009).

4. Application of DAWIA Concept to Defense Industry

The 2006 Defense Acquisition Performance Assessment (DAPA) report recognizes defense industry as the key enabler of the DoD's efforts to maintain military superiority, and calls for a close partnership between the DoD and defense industry to ensure that the DoD remains able to obtain dominant warfighting capabilities. Furthermore, the DAPA report points out that despite frequent reform and some isolated successes, the overall performance of the DoD acquisition system remains problematic, and proposes sweeping changes to dramatically improve the DoD's ability to stabilize and integrate key elements of the acquisition system–organization, workforce, budget, requirements, acquisition, and industry (DoD DAPA, 2006). The 2007 Defense Acquisition Transformation Report also calls out for creating an environment that encourages industry to create and sustain reliable and cost-effective industrial capabilities

sufficient to meet the strategic DoD objectives. The DoD considers that one of the key points for industrial capabilities is long-term contractor workforce improvements, and is defining and evaluating key contractor workforce capabilities with industry (DoDR, 2007). The 2008 GAO Congressional testimonial report on defense acquisitions states that better weapon program outcomes require discipline, accountability, and fundamental changes in the acquisition environment. Furthermore, it suggested that meaningful and lasting reform will not be achieved until the DOD changes the acquisition environment and the incentives that drive the behavior of the DdD decision-makers, the military services, program managers, and the defense industry (GAO, 2008).

The 2008 RAND Corporation technical report, *The Defense Acquisition Workforce: An Analysis of Personnel Trends Relevant to Policy, 1993*-2006, indicated there is a lack of information on area of specialization and certification levels of contractor workforce employed in acquisition functions and recommends to have better information on the contractor workforces (Gates, 2008). To create an environment of true partnership with the defense industry and induce innovation and effectiveness, the DoD should look for a way to promote the cross-organizational collaboration with industry. As a part of fostering partnership environment with industry, the author believes that the defense industry, along with the DoD, should consider the adaptation and application of Defense Acquisition Workforce Improvement Act (DAWIA) concept to defense industry acquisition workforce. This would enhance cross-organizational communications and understanding, sharing of common acquisition tools and knowledge. It would also improve industry acquisition workforce competency and capabilities to face the 21st century ever-changing security environment. Especially, the defense industry program leadership personnel such as program manger, chief engineer, and major IPT leads should have comparable experience, qualification, education, and training as their counterparts in the DoD.

5. Approach for Adaptation of DAWIA Concept to Defense Industry

The purpose of Defense Acquisition Workforce Improvement Act (DAWIA) and DAWIA implementation concept is to enhance the professional knowledge and

capabilities of the DoD Acquisition, Technology and Logistics (AT&L) workforce through systematic education, training, and career development program (DoD Desk Guide, 2006). The approach for DAWIA concept application to the defense industry acquisition workforce should start with the implementation of transfer and sharing of knowledge between the DoD and defense industry to enhance the communications and increase understanding of each other (King, 2007). Also, there should be a concerted effort to coordinate and organize the training, educations and qualifications of the defense industry acquisition workforce through implementation of DAWIA equivalent certification process, especially for those workforces occupying key leadership positions. The certification process is to improve workforce competencies to deal with changing demands of acquisition, increase career opportunities, standardize education, training, and experience requirements for acquisition professionals (Dawn, 2008). DAWIA equivalent certification may be instituted for the industry acquisition workforce either through opening the DAWIA certification opportunity for defense industry with expansion of Defense Acquisition University (DAU) program, and/or collaboration with civilian organizations such as Project Management Institute (PMI) and International Council on Systems Engineering (INCOSE) to develop DAWIA equivalent certification program.

C. OTHER RESEARCH FINDINGS

1. Acquisition Reform

Acquisition management framework models reflect both explicit and implicit aspects of acquisition policy. The models demonstrate that changes to the DoD acquisition system have been evolutionary. The success in defense acquisition reform requires broader and more uniform awareness, understanding, and acceptance of acquisition reform initiatives across multiple communities including defense industries before real progress can be made (Hanks, 2005).

2. Defense Industry Workforce

Review of the selected defense industry career Web sites in Chapter III, Section H reveals that there are wide varieties and disparities in the job qualification requirements for similar positions in defense industry, even within the same company, in professional certification requirements. There is no evidence of a coherent system or effort for industry acquisition workforce career development, training, and education. Only a handful of MITRE Corporation and SAIC positions, limited to program management positions are asking for Defense Acquisition Workforce Improvement Act (DAWIA) certification. Other defense industry companies are sporadically asking for certification in Project Management Professional (PMP) and National Contract Management Association (NCMA) certifications.

D. CHAPTER SUMMARY

Reductions in the DoD acquisition workforce in the 1990s, due to perceived fewer threats, made acquisition reform and transformation a difficult task, as the skills and people required were not available. At the same time, the defense industry workforce underwent a similar process of fluctuation. The stability of defense industry workforces is completely dependent upon the contract from the DoD. As such, the defense contractor workforce is not a stable workforce since the needs and capabilities of defense industry workforce are very heavily dependent upon satisfying the DoD contract compared to the relatively stable DoD acquisition workforce, despite their own difficulties. The current defense industry workforce planning and disposition are in such disarray. This requires stability and discipline to maintain the professionalization mandating a robust senior leadership. Concentrating on the emphasis on defense industry workforce, this study proposes a new idea of implementing the disciplined acquisition management of DAWIA to the defense industry workforce.

THIS PAGE INTENTIONALLY LEFT BLANK

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

Great strides have been made in improving and innovating acquisition of defense systems over the past four decades. At the same time, the world events changed from Cold War to the breakdown of the Soviet Union, collapse of communism in Eastern Europe, the Gulf War, and then countering rogue nations such as Iran and North Korea and terrorist and drug non-state actors such as Al-Qaeda and Columbian and Mexican Drug Cartels. The accelerated change in these first years of the 21st century is notable for its emphasis on combating global terrorism and drug cartels, and insuring homeland security. The magnitude of changes in threat environments and turbulence in policies can easily lead to confusion in the defense acquisition community, and at the same time, provide an opportunity for innovations and new ideas. There are always improvements to be made as the defense acquisition environments evolve. Under the premise of applying Defense Acquisition Workforce Improvement Act (DAWIA) concept to defense industry acquisition workforce, this chapter summarizes the study with a list of recommendations for application of the DAWIA concept to the defense industry workforce and proposes suggested areas for further research.

B. SPECIFIC LIST OF RECOMMENDATIONS

The purpose of the Defense Acquisition Workforce Improvement Act (DAWIA) is to enhance the professional knowledge and capabilities of defense acquisition workforce through systematic education, training, and career development program. As called out in the 2006 Defense Acquisition Performance Assessment (DAPA) report, a close partnership between the DoD and defense industry are key to ensure obtaining dominant warfighting capabilities (DoD DAPA, 2006). The application and adaptation of DAWIA concept to the defense industry workforce is the topic and motivation of this study. The defense industry along with the DoD must take the initiative to transform

defense industry workforce in line with the DoD acquisition workforce professionalization standards to improve the acquisition practices and face the new challenges ahead.

1. Study on Defense Industry Workforce Development

A study should be conducted to examine the current defense industry workforce development efforts and program management practices to develop approaches and innovations to enhance defense industry workforce development consistent with the concept of Defense Acquisition Workforce Improvement Act (DAWIA). When conducting such a study, DoD must not only examine the competency, capabilities and experience of key industry leaderships in programs, but also review the defense industry workforce and work environments beneath the industry program manager and IPT lead to have complete understanding of the structure, culture, management discipline and operational concept of defense industry organizations.

2. New Policy Guidance on Defense Industry Workforce Development

The defense industry must be restructured to allow for greater responsiveness, improved efficiency and increased innovation. Based on study and review, the DoD and defense industry must collaborate on development of solid policy and guidance for defense industry workforce development analogous to the Defense Acquisition Workforce Improvement Act (DAWIA). When developing such policy, the DoD should be cognizant of its scope and applicability along with careful analysis and understanding of the rules of engagements (ROEs) for its use. This will require a major cultural change in the way that the DoD and defense industry manage the defense acquisition programs, and alter the training, education, and certification standards and processes of defense industry workforce with added emphasis on industry program management leadership. Making such significant changes will prove to be an extremely challenging endeavor and will require strong leadership and commitment with a clear vision and continuous strive to achieve the objectives. This will be the most significant cultural shift. Both the DoD

and defense industry leadership must take a proactive role in identifying and clearly articulating the desired structure and outcomes followed by continuous and sustained communication and education (Gansler, 2008).

The major DoD policy change should be the establishment of DAWIA equivalent certifications for defense industry workforce. The certification will improve workforce competencies and motivations, enhance career opportunities, and standardize education, training, and experience requirements for defense industry workforce. Specifically, DAWIA equivalent certification should be mandatory for key leadership positions such as program manager, chief engineer, IPT/sub-IPT lead. This may be accomplished either through expansion of DAWIA certification opportunity to the defense industry acquisition workforce, or establishment of DAWIA equivalent certifications in collaboration with civilian organizations, such as Project Management Institute (PMI) and International Council on Systems Engineering (INCOSE). The table below is a comparative analysis between selected DAWIA certifications and civilian organization certifications.

Table 39. Equivalency Comparison between Selected DAWIA Certifications and Civilian Organization Certifications.

DAWIA Certification	Civilian Certification
Auditing (AUD)	Institute of Internal Auditors (IIA) ▪ Certified Government Auditing Professional (CGAP) ▪ Certified Internal Auditors (CIA)
Business – Cost Estimating (BUS-CE)	
Business – Financial Management (BUS-FM)	
Contracting (CON)	National Contract Management Association (NCMA) ▪ Certified Federal Contracts Manager (CFCM) ▪ Certified Professional Contracts Manager (DPCM)
Facilities Engineering (FE)	
Industrial and/or Contract Property Management (IND)	
Information Technology (IT)	
Life Cycle Logistics (LCL)	International Society of Logistics (SOLE) ▪ Demonstrated Logistician (DL) ▪ Demonstrated Senior Logistician (DSL) ▪ Demonstrated Master Logistician (DML) ▪ Certified Professional Contracts Manager (DPCM)

DAWIA Certification	Civilian Certification
	▪ Certified Master Logistician (CML) ▪ Certified Professional Logistician (CPL)
Production, Quality and Manufacturing – Production & Manufacturing (PQM-PM)	
Production, Quality and Manufacturing – Quality Assurance (PQM-QA)	American Society for Quality (ASQ) ▪ Certified Quality Engineer (CQE) ▪ Certified Six Sigma Black Belt (CSSBB) ▪ Certified Six Sigma Green Belt (CSSGB)
Program Management (PM)	Project Management Institute (PMI): ▪ Project Management Professional (PMP) ▪ Program Management Professional (PgMP)
Purchasing (PUR)	
Systems Planning, Research, Development, Engineering – Program Systems Engineer (SPRDE-PSE)	International Council on Systems Engineering (INCOSE): ▪ Certified Systems Engineering Professional (CSEP) ▪ Certified Systems Engineering Professional (CSEP) with US DoD Acquisition Extensions (CSEP-Acq) ▪ Expert Systems Engineering Professional (ESEP) Project Management Institute (PMI): ▪ Project Management Professional (PMP)
Systems Planning, Research, Development, Engineering – Science and Technology Manager (SPRDE-S&TM)	International Council on Systems Engineering (INCOSE): ▪ Certified Systems Engineering Professional (CSEP) ▪ Certified Systems Engineering Professional (CSEP) with US DoD Acquisition Extensions (CSEP-Acq) ▪ Expert Systems Engineering Professional (ESEP)
Systems Planning, Research, Development, and Engineering – Systems Engineering (SPRDE-SE)	International Council on Systems Engineering (INCOSE): ▪ Certified Systems Engineering Professional (CSEP) ▪ Certified Systems Engineering Professional (CSEP) with US DoD Acquisition Extensions (CSEP-Acq) ▪ Expert Systems Engineering Professional (ESEP)
Test and Evaluation (T&E)	

DAWIA emphasizes not only technical and managerial competencies, but also the leadership competency for defense industry workforce. Therefore, the DAWIA equivalent certification for the defense industry workforce should emphasize the leadership and leadership education for defense industry workforce. Leadership should be distinguished from the managerial capability. The leadership presents the ability to inspire and ensure team motivation on both individual and team levels. For the sake of program performance effectiveness and success, the defense industry acquisition leadership must learn to understand the differences between doing things right (management) and doing the right things (leadership).

3. Education and Training

The defense industry in general has limited knowledge of defense acquisition training and education opportunities available through several DoD educational establishments. This study recommends not only expanding the DoD training and educational opportunities for the defense industry but also advises communicating the availability of the DoD establishment training opportunities to the defense industry. The primary training and education for defense acquisition workforce for certification is through Defense Acquisition University (DAU). The Naval Postgraduate School (NPS) also has a multitude of educational opportunities for the defense industry workforce and is expanding the educational opportunities for the industry. The Air Force Institute of Technology (AFIT) should expand more educational opportunities for defense industry workforce.

Another recommendation for education and training is to expand DAU equivalency program. The DAU provides the opportunity for other organizations such as colleges and universities, the DoD schools, other federal agencies, commercial vendors, and professional societies to offer courses, programs or certifications, which DAU will accept as equivalent to one or more DAU courses (DAU Equivalency Program, No Date).

4. Knowledge Sharing

To enhance communications and increase understanding of each other, this study recommends the transferring and sharing of acquisition management knowledge, especially in program management, systems engineering, contract management, and cost estimation and analysis between the DoD and defense industry. The DoD should also encourage industry-to-government and government-to-industry rotations to help maintain program management, technical and systems engineering skills, and investigate the methods of increasing the understanding between the DoD and defense industry acquisition workforce (Gansler, 2008).

C. SUGGESTED AREAS FOR FURTHER RESEARCH

There are several lessons to be learned from this research study; hopefully, much more detailed follow up research will be conducted to investigate new ideas and areas

that would contribute to the continued improvement in defense acquisition program execution and performance. Continued strong leadership, communication and exchange will hopefully bring about deep and substantial progress in the years ahead. The following are the list of suggested areas for further study.

1. Defense Industry Workforce Competency and Management

As recommended in Chapter V, Section B.1, a comprehensive study should be conducted to examine and review the defense industry workforce competency level and management practice status. This study will provide the insights into the industry program office operations such as the extent and adequacy of technical and management discipline and competency, collaboration and cooperation, and organization. This study will provide the basis of establishing new policy guidance, or improving existing policy guidance. This study may reveal the need for restructuring the defense industry to allow for increased responsiveness and management attention and discipline and may even recommend very provocative initiatives for both DoD and industry to embrace.

2. Integrated Combined Joint Program Office between DoD and Defense Industry

The investigation of the approach and method to have combined DoD-defense industry program management organizations and organizational relationship is another recommended topic for future study which should encompass the feasibility, practicality and organizational approach. Classic organization theory holds that organizational structures must change in response to contingencies of size, technology, environment and other factors. In his book, *Command in War*, Van Creveld applies this same principle to command and control of combat elements in war. He argues that the command structure must either create a greater demand for information (vertically, horizontally, or both) and increase the size and complexity of the directing organization, or be able to deal and adapt semi-independently with the situations (Van Creveld, 1985). Over the years, the DoD has established multitudes of integrated program offices, or joint program offices under the guidance of Goldwater-Nichols DoD Reorganization Act of 1986. This type of program offices have been established only within government agencies either within

military services, DoD agencies, other government agencies, and/or foreign military services/agencies. Another alternative for government/industry collaboration should be considered—Integrated Combined Joint Program Office with defense industry. There can be various alternative forms and arrangements of such organization. Depending on the specific acquisition arrangement, it may be necessary to integrate significant elements of leadership and management responsibilities and authority to enable a closer relationship between the DoD program office and defense contractor program office and also allow a closer DoD oversight of defense acquisition programs.

3. Directed Telescope

A 2009 GAO report criticized the inadequate DoD control and management of contractor performance and activities.

> Managing and assessing post-award performance entails various activities to ensure that the delivery of services meets the terms of the contract and requires adequate surveillance resources, proper incentives, and a capable workforce for overseeing contracting activities. If surveillance is not conducted, not sufficient, or not well documented, DoD is at risk of being unable to identify and correct poor contractor performance in a timely manner and potentially pay too much for the services it receives. (GAO, 2009 April, Defense, p. 8)

The use of disciplined application of control and management for defense acquisition program draws similarities with disciplined application of military command and control concept along with clear communication of commander's intent. In his article, *The Directed Telescope: A Traditional Element of Effective Command*, Army Lieutenant Colonel Griffin examined the use of the directed telescope.

> The directed telescope or, more specifically, the use of specially selected, highly qualified, and trusted young officers as special agents or observers for the commander has been a fundamental method of responding to this persistent challenge. These young officers are the “eyes” of the commander. Throughout military history, the use of officers in this capacity has been critical in obtaining battlefield command information for the commander. The utility of these special agents, whether they are aides, liaison personnel, or special staff officers, has been proven in war after war for thousands of years and have played an extremely important role in successful command and control at the tactical, operational, and

> strategic levels of warfare. The directed telescope has survived despite successive waves of information-gathering communications technology. (Griffin, 1991, pp. 1–2)

The need for using adequate surveillance resources and capable defense acquisition workforce for overseeing contractor performance and activities is analogous to the military use of directed telescope in battlefield and campaign, with emphasis on current information need and communication. This is another suggested study to apply the directed telescope concept to the defense acquisition program management for contract performance management and surveillance.

D. SUMMARY

Defense acquisition has a highly interdisciplinary enterprise character, in that it entails the integration of a broad range of technical and management skills, including contracting, system engineering, and finance (Fox, 1988). The DoD applies program management principles and lessons learned, but still struggles to deliver successful programs. Despite great strides to improve the DoD acquisition practices and processes over the years, there will always be room for improvements and innovations. The DoD must be more aggressive in pushing industrial base-related policies into its acquisition regulations, and in utilizing strategies to promote competition and innovation. The DoD and the defense industry must focus on cross-organizational collaboration to achieve a better way to manage defense acquisition program. The DoD and Congress have been concentrating on improving and professionalizing the defense acquisition workforce, and now should pay more attention to improving the performance of the defense industry workforce in defense acquisition.

LIST OF REFERENCES

Aerospace Corporation Career Web site. Retrieved on 11 May 2009, from http://www.aero.org/careers/jobs/index.html

Aerospace Industry Association (AIA) (2008 November). *U.S. Defense Acquisition: An Agenda for Positive Reform.* Retrieved on 1 May 2009, from http://www.aia-aerospace.org/assets/report_acquisition-reform-09.pdf

American Society for Quality (ASQ) Web site. Retrieved on 13 July 2009, from http://www.asq.org

BAE System Career Web site. Retrieved on 11 May 2009, from http://www.baesystems.com/Careers/

Berta, K. (2001 May-June). The Defense Acquisition University From Consortium to Consolidation. *Program Manager.* Defense Acquisition University. Retrieved on 16 May 2009, from http://www.dau.mil/pubs/pm/pmpdf01/ma-ju.pdf

Boeing Career Web site. Retrieved on 11 May 2009, from https://jobs.boeing.com/index.jsp

Builder, C. H., Banks, S. C., & Nordin, R. (1999). *Command Concept – A Theory Derived from the Practice of Command and Control*. RAND.

Christie, T. (2006 February). What has 35 Years of Acquisition Reform Accomplished? *Proceedings*, U.S. Naval Institute. Retrieved on 1 May 2009, from http://www.cdi.org/pdfs/Christie%20in%20Proceedings.pdf

Congressional Testimony by General (Ret) Ronald T. Kadish (2006 March 29). *The Defense Acquisition Performance Review Project.* Retrieved on 14 May 2006, from http://www.globalsecurity.org/military/library/congress/2006_hr/060329-kadish.pdf

Congressional Testimony by Principle Deputy Under Secretary of Defense for Acquisition and Technology, R. Noel Longuemare (1997). *Department of Defense (DoD) Acquisition Workforce.* Retrieved on 16 May 2009, from http://www.dod.mil/dodgc/olc/docs/test97-4-8Longuemare.htm

Congressional Testimony by Under Secretary of the Air Force, Peter B. Teets (2003 March). *National Security Space Management.* Retrieved on 14 May 2009, from http://www.nro.gov/speeches/fy04nss_posture_statement.pdf

Dawn, K. C. (2008 April 16). Presentation at National Contract Management Association (NCMA) World Congress Presentation. *Program Management and Acquisition Professionals: The Evolving Certifications*. Retrieved on 15 May 2009, from http://209.85.173.132/search?q=cache:Z7a1MFgS1HIJ:www.ncmahq.org/files/presentations/2210.ppt+Defense+Acquisition+Workforce+Improvement+Act+(DAWIA)&cd=98&hl=en&ct=clnk&gl=us

Defense Acquisition University (DAU) (2009 July 28). *Acquisition, Technology & Logistics Workforce Position Category Descriptions (PCDs)*. Retrieved on 17 August 2009, from http://www.dau.mil/workforce/pcds.asp

Defense Acquisition University (DAU) (2006 November). *Defense Acquisition Guidebook (DAG)*. Retrieved on 15 May 2009, from https://akss.dau.mil/dag/GuideBook/PDFs/GBNov2006.pdf

Defense Acquisition University (DAU) Equivalency Program. Retrieved on 29 April 2009, from http://www.dau.mil/learning/appg.aspx

Defense Acquisition University (DAU) (2003 June). *U.S. Department of Defense Extension to: A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. Retrieved on 8 May 2009, from http://www.dau.mil/pubs/gdbks/DoDExtPMBOK--June%2003.pdf

Department of Defense (DoD) 5000.52-M (1995 November). *Acquisition Career Development Program*. Retrieved on 17 August 2009, from http://biotech.law.lsu.edu/blaw/dodd/corres/pdf/500052mwch1_1195/p500052m.pdf

Department of Defense (DoD) (2006 January). *Defense Acquisition Performance Assessment (DAPA) Report*. Retrieved on 13 August 2009, from http://www.frontline-canada.com/Defence/pdfs/DAPA-Report-web.pdf

Department of Defense (DoD) (2006 January 10). *A Desk Guide for Acquisition, Technology, and Logistics Workforce Career Management*. Retrieved on 23 May 2009, from http://www.dau.mil/workforce/01-10-06%20ATL%20Workforce%20Desk%20Guide%20Issued%20Version%20with%20Forms.pdf

Department of Defense (DoD) (2007 July). *Defense Acquisition Transformation. Report to Congress*. Retrieved on 13 August 2009, from http://www.acq.osd.mil/at/docs/804_defense_acquisition_transformation_report_mar_2008.pdf

Department of Defense (DoD) (2008 December 2). *DoD Announces Major Revision to Acquisition Policy*. Retrieved on 1 May 2009, from http://www.dau.mil/spotlight/DoDI_5000_02_Public_Release_12-2-2008.pdf

Department of Defense Acquisition, Technology and Logistics (DoD AT&L). (2007). *AT&L Human capital strategic plan v 3.0*. Retrieved on 23 May 2009, from http://www.dau.mil/workforce/hcsp.pdf

Department of Defense Directive (DoDD) 5000.1 (1971 July 13). *Acquisition of Major Defense Systems*.

Department of Defense Directive (DoDD) 5000.1 (2007 November 20). *The Defense Acquisition System*.

Department of Defense Directive (DoDD) 5000.52 (1991 October 25). *Defense Acquisition Education, Training, and Career Development Program*. Retrieved on 21 May 2009, from http://biotech.law.lsu.edu/blaw/dodd/corres/pdf2/d500052p.pdf

Department of Defense Directive (DoDD) 5000.52 (2005 January 12). *Defense Acquisition, Technology, and Logistics Workforce Education, Training, and Career Development Program*. Retrieved on 23 May 2009 from http://www.dtic.mil/whs/directives/corres/pdf/500052p.pdf

Department of Defense Instruction (DoDI) 5000.66 (2005 December 21). *Operation of the Defense Acquisition, Technology, and Logistics Workforece Education, Training, and Career Development Progam.* Retrieved on 21 May 2009, from http://biotech.law.lsu.edu/blaw/dodd/corres/pdf/i500058wch3_011492/i500058p.pdf

Department of Defense Instruction (DoDI) 5000.2 (2008 December 8). *Operation of the Defense Acquisition System*. Retrieved on 17 August 2008, from http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf

Department of Defense Report (DoDR) (1989 July 12). *Defense Management Report to the President*. Washington DC. Retrieved on 16 May 2009, from http://www.history.army.mil/acquisition/research/pdf_materials/report_cheny.pdf

Department of Defense (DoD) Report to Congress (2007 February). *Defense Acquisition Transformation Report to Congress – John Warner National Defense Authorization Act Fiscal Year 2007*. Washington DC. Retrieved on 1 May 2009, from http://www.acq.osd.mil/at/docs/804_Defense_Acquisition_Transformation_Report_Feb_2007.pdf

Department of Defense (DoD) Report to Congress (2007 July). *Defense Acquisition Transformation Report to Congress – John Warner National Defense Authorization Act Fiscal Year 2007*. Washington DC. Retrieved on 15 May 2009, from http://www.acq.osd.mil/at/docs/804_Defense_Acquisition_Transformation_Report_Jul_2007.pdf

Department of Defense (DoD) Report to Congress (2008 March). *Defense Acquisition Transformation Report to Congress – John Warner National Defense Authorization Act Fiscal Year 2007*. Washington DC. Retrieved on 15 May 2009, from http://www.acq.osd.mil/at/docs/804_defense_acquisition_transformation_report_mar_2008.pdf

Department of Defense (DoD) The Acquisition 2005 Task Force Final Report (2000 October). *Shaping the Civilian Acquisition Workforce of the Future*. Washington DC. Retrieved on 16 May 2009, from http://www.history.army.mil/acquisition/research/pdf_materials/report_acq_2005.pdf

Dobriansky, J. (2009 April). Acquisition Workforce Challenge – Motivation for Government vs. Industry Employment. *Defense Acquisition Review Journal*. Defense Acquisition University. Retrieved on 13 August 2009, from http://www.dau.mil/pubs/arq/2009arq/ARJ50Web/Dobriansky.pdf

Dillard, J. (2003). *Centralized Control of Defense Acquisition Programs: A Comparative Review of the Framework from 1987–2003 (NPS-AM-03-003)*. Naval Postgraduate School, Monterey, CA.

Dillard, J., & Nissen, M. (2005). Determining the Best Loci of Knowledge, Responsibilities and Decision Rights in Major Acquisition Organizations, *Excerpt from the Proceedings of the Second Annual Acquisition Research Symposium*. Naval Postgraduate School, Monterey, California.

Fazio, S. (2008 December 11). *Defense Acquisition University Briefing – Operation of the Defense Acquisition System Statutory and Regulatory Changes*. Defense Acquisition University. Retrieved on 1 May 2009, from http://www.dau.mil/regions/.../pdf/DoDI_5000.02_Revision_Delivered_on_11-Dec.ppt

Forsberg, K. & Mooz, H. & Cotterman, H. (2005). *Visualizing Project Management: Modeling and Frameworks for Mastering Complex Systems*. Hoboken: John Wiley & Sons, Inc.

Ferrara, J. (1996 Fall). DoD's 5000 Documents: Evolution and Change in Defense Acquisition Policy. *Acquisition Review Quarterly*. Defense Acquisition University. Retrieved on 13 August 2009, from http://www1.dau.mil/pubscats/PubsCats/acker/ferrar.pdf

Fox, J. R., Hirsh, E. & Krikorian, G. (1995 July-August). Unreasonable Pressures on Defense Program Managers - A Candid Look at Conflicts Inherent in Program Manager Roles and Incentives. *Program Manager*. Defense Acquisition University. Retrieved on 13 August 2009, from http://www.dau.mil/pubs/pm/pmpdf95/krikoria.pdf

Gansler, J. S., Lucyshyn, W. & Michael, A. (2008). *Achieving the Desired Structure of the Defense Industry in the 21st Century (UMD-AM-08-125),* University of Maryland.

Gates, S. M., Keating, E. G., Jewell, A. D., Daugherty, L., Tysinger, B., Robbert, A. A., & Masi, R. (2008). *The Defense Acquisition Workforce: An Analysis of Personnel Trends Relevant to Policy, 1993–2006.* RAND Corporation, Santa Monica. Retrieved on 16 May 2009, from http://www.rand.org/pubs/technical_reports/2008/RAND_TR572.pdf

General Dynamics (GD) Career Web site. Retrieved on 11 May 2009, from http://www.gdcareers.com/gdchq_jobs/main.cfm

Gill, J. H. (2002 August). TSPR not for Developing System. *Contract Management*. Retrieved on 12 June 2009, from http://www.ncmahq.org/files/Articles/62D5E_08_02_p26.pdf

General Accounting Office (GAO) (1992 January). *Defense Management Implementation of the Defense Acquisition Workforce Improvement Act (GAO/NSIAD-92-97).* Washington, DC. Retrieved on 13 August 2009, from http://www.dau.mil/workforce/pdf/DAWIA_Implementation_Report_92-97.pdf

General Accounting Office (GAO) (1993 April). *Implementation of the Defense Acquisition Workforce Improvement Act (GAO/NSIAD-93-129).* Washington, DC. Retrieved on 17 August 2009, from http://archive.gao.gov/d44t15/148920.pdf

General Accounting Office (GAO) (2001 January). *Major Management Challenges and Program Risks (GAO-01-244)*. Washington, DC. Retrieved on 13 August 2009, from http://www.gao.gov/pas/2001/d01244.pdf

Government Accountability Office (GAO) (2008). *Better Weapon Program Outcomes Require Discipline, Accountability, and Fundamental Changes in the Acquisition Environment (GAO-08-782T).* Retrieved on 13 August 2009, from http://www.gao.gov/new.items/d08782t.pdf

Government Accountability Office (GAO). (2009 April 29). *Defense Acquisitions: Actions Needed to Ensure Value for Service (GAO-09-643T).* Retrieved on 14 August 2009, from http://armedservices.house.gov/pdfs/DAR042309/GAO_Testimony042309.pdf

Government Accountability Office (GAO). (2009 May 20). *Space Acquisitions: DOD Faces Substantial Challenges in Developing New Space Systems (GAO-09-705T).* Retrieved on 13 August 2009, from http://www.gao.gov/new.items/d09705t.pdf

Griffin, G. B. (1991 July), *The Directed Telescope: A Traditional Element of Effective Command,* Combat Studies Institute. Retrieved on 14 August 2009 from http://www-cgsc.army.mil/carl/resources/csi/Griffin/GRIFFIN.asp#Tables

Hanks, C. H., Axelband, E. I., Lindsay, S., Malik, M. R., & Steele, B. D. (2005). *Reexamining Military Acquisition Reform*. RAND Corporation, Santa Monica. Retrieved on 7 July 2009, from http://www.rand.org/pubs/monographs/2005/RAND_MG291.pdf

Institute of Electrical and Electronics Engineers (IEEE) Computer Society (CS). Retrieved on 9 May 2009, from http://www.computer.org

Institute of Internal Auditors (IIA). Retrieved on 13 July 2009, from http://www.itaudit.org

International Counsel on Systems Engineering (INCOSE). Retrieved on 8 May 2009 from http://www.incose.org

International Society of Logistics (SOLE). Retrieved on 9 May 2009, from http://www.sole.org

King, D. R. (2006 December – 2007 March). Balanced Innovation Management, *Defense Acquisition Review Journal.* Defense Acquisition University. Retrieved on 13 August 2009, from http://www.dau.mil/pubs/arq/2007arq/King%205-06.pdf

Kirschman, J. N. & LaPorte, M. M. (2008), *An Assessment of Collaborative Capacity of Three Organizations within Defense Acquisition (NPS-AM-08-119),* Naval Postgraduate School, Monterey, California.

Lockheed Martin (LM) Career Web site. Retrieved on 11 May 2009, from http://www.lockheedjobs.com/

Martinelli, R. & Waddell, J. (2007 January). Program Management: It's About the Business!, *PM World Today*, Retrieved on 13 August 2009 from http://www.pmforum.org/library/papers/2007/PDFs/Martinelli-Waddell1.pdf

Mavroules, N. (1991). Creating A Professional Acquisition Work Force. National Contract Management Journal. Retrieved on 29 April 2009, from http://library.dau.mil/CreatProfAcqWorkForce_NMavroules.pdf

Miller, E. (2008 April), Independent Program Oversight: An Answer for Major Weapons Systems' Success? *Defense Acquisition Review Journal*, Defense Acquisition University. Retrieved on 13 August 2009, from http://www.dau.mil/pubs/arq/2008arq/ARJ47Web/ARJ47_Miller.pdf

MITRE Corporation Career Web site. Retrieved on 11 May 09 from https://jobs.brassring.com/en/asp/tg/cim_home.asp?sec=1&partnerid=119&siteid=69

National Contract Management Association (NCMA). Retrieved on 9 May 2009, from http://www.ncmahq.org/

National Security Space Acquisition (NSSA) Policy 03-01 (2004 December 27). *Guidance for DoD Space System Acquisition Process*. Retrieved on 13 August 2009, from https://dap.dau.mil/policy/Documents/Policy/Space%20Acquisition%20NSSAcqPol0301_signed_%2027Dec04%20(GN).pdf

Northrop Grumman (NG) Career Web site. Retrieved on 11 May 2009, from http://careers.northropgrumman.com/ExternalHorizonsWeb/getCareerHome.do

Office of the Under Secretary of Defense (OUSD) for Acquisition, Technology, and Logistics (2003 May). *Report of the Defense Science Board/Air Force Scientific Advisory Board Joint Task Force on Acquisition of National Security Space Programs*. Retrieved on 14 May 2009, from http://www.acq.osd.mil/dsb/reports/space.pdf

Packard Commission (1986 June). *Final Report to the President by the President's Blue Ribbon Commission on Defense Management*. Retrieved on 15 May 2009, from http://www.ndu.edu/library/pbrc/36ex2.pdf

Project Management Institute (PMI). *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 4th Edition (2008), Pennsylvania.

Project Management Institute (PMI). *Certified Associate in Project Management (CAPM)* Credential Handbook (2009), Pennsylvania. Retrieved on 8 May 2009, from http://www.pmi.org/PDF/pdc_capmhandbook.pdf

Project Management Institute (PMI). *PMI Scheduling Professional (PMI-SP)* Credential Handbook (2009), Pennsylvania. Retrieved on 8 May 2009, from http://www.pmi.org/PDF/pdc_pmgphandbook.pdf

Project Management Institute (PMI). *PMI Risk management Professional (PMI-RMP)* Credential Handbook (2009), Pennsylvania. Retrieved on 8 May 2009, from http://www.pmi.org/PDF/PMI-RMP_Handbook.pdf

Project Management Institute (PMI). *Program Management Professional (PgMP)* Credential Handbook (2009), Pennsylvania. Retrieved on 8 May 2009 from http://www.pmi.org/PDF/PMI-SP_Hanbook.pdf

Project Management Institute (PMI). *Project Management Professional (PMP)* Credential Handbook (2009), Pennsylvania. Retrieved on 8 May 2009, from http://www.pmi.org/PDF/pdc_pmphandbook.pdf

Project Management Institute (PMI). *Project Manager Competency Development (PMCD) Framework* (2002), Pennsylvania.

Project Management Institute (PMI). Retrieved on 8 May 2009, from http://www.pmi.org

Raytheon Career Web site. Retrieved on 11 May 09 from http://www.rayjobs.com/

Rogers, E. & Birmingham R. P. (2004 January-April). A Ten-Year Review of the Vision for Transforming the Defense Acquisition System. *Defense Acquisition Review Journal.* Defense Acquisition University. Retrieved on 13 August 2009, from http://www.dau.mil/pubs/arq/2004arq/Rogers.pdf

Rostker, B. D., Leonard, R. S., Younossi O., Arena, M. V. & Riposo, J. (2009 Spring). Cost Controls: How Government Can Get More Bang for Its Buck. *Rand Review.* RAND Corporation.. Retrieved on 17 August 2009, from http://www.rc.rand.org/pubs/corporate_pubs/2009/RAND_CP22-2009-04.pdf

Science Application International Corporation (SAIC) Career Web site. Retrieved on 11 May 2009 from http://www.saic.com/career/

Schwartz, M. (2009 July 10). Defense Acquisitions: How DOD Acquires Weapon Systems and Recent Efforts to Reform the Process. *CRS Report for Congress*. Retrieved on 13 August 2009 from http://fas.org/sgp/crs/natsec/RL34026.pdf

Shere, K. D. & Turner S. R., (2003 May-June), Vision and Cultural Change in Government Satellite Programs - Three Most Important Approaches to Changing Culture: Communication, Communication, Communication, *Program Management*, Defense Acquisition University. Retrieved on 13 August 2009, from http://www.dau.mil/pubs/pm/pmpdf03/may/she-m-j03.pdf

Spring, B. (2005 October 19). Congressional Restraint Is Key to Successful Defense Acquisition Reform. *Backgrounder.* The Heritage Foundation. Retrieved on 11 May 2009, from http://www.heritage.org/Research/NationalSecurity/upload/84045_1.pdf

Stuckenbruck, L. C. (Ed.). (1982). *The Implementation of Project Management: The Professional's Handbook.* Project Management Institute. Addison-Wesley Publishing Company, Inc.

Templin, C. R., & Christensen, D. S. (No Date). *Acquisition Reform in the Department of Defense: Has DoD Broken Through the Reform Barrier?* Southern Utah University. Retrieved on 26 May 2009, from http://marriottschool.byu.edu/emp/BMS/Website%20Archive/Documents/Acquisition%20Reform%20Final.doc

U.S. Army (USA) (2004 March 10). *Acquisition History Project Working Paper #3: The Evolution of DoD Directive 5000.1 Acquisition Management Policy 1971 to 2003*. Center of Military History. Retrieved on 12 May 2009, from http://www.history.army.mil/acquisition/research/working3.html

U.S. Congress (1990 May 8). The Quality and Professionalism of the Acquisition Workforce. *Report of the Investigations Subcommittee of the Committee on Armed Services House of Representatives.*

Van Creveld, M. (1985), *Command in War*, London: Harvard University Press.

Van Gemert, D. K. & Wartenberg, M. (2007 September), Lessons Learned in Acquisition Management, *Defense Acquisition Review Journal, Vol 14, No. 2, pp 384-395,* Defense Acquisition University. Retrieved on 19 August 2009, from http://www1.dau.mil/pubscats/PubsCats/ARJ45_VanGemert.pdf

Yoder, E. C. (2004 November), *Engagement versus Disengagement: How Structural & Commercially-based Regulatory Changes Have Increased Government Risks in Federal Acquisitions (NPS-AM-05-001),* Naval Postgraduate School, Monterey, CA.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California

3. Dr. Thomas Huynh
   Naval Postgraduate School
   Monterey, California

4. Dr. Walter Owen
   Naval Postgraduate School
   Monterey, California

5. John A. Sarakatsannis
   Raytheon Space and Airborne System
   El Segundo, California

6. Dr. Art Pyster
   Stevens Institute of Technology
   Hoboken, New Jersey