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Establishing a Foundation to Capture the Cost of Oversight for a Major Defense Program within the Information Technology (IT) Acquisition Community

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ESTABLISHING A FOUNDATION TO CAPTURE THE COST OF OVERSIGHT FOR A MAJOR DEFENSE PROGRAM WITHIN THE INFORMATION TECHNOLOGY (IT) ACQUISITION COMMUNITY

THESIS

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Abstract

In 1970 the Department of Defense introduced the Department of Defense Directive 5000 to standardize the acquisition process; the directive created oversight forums to ensure the policies and procedures created were followed, track program progress, and identify programs in trouble. Although oversight was essentially created to help reduce the cost of acquisitions, there is reason to believe that it may increase the costs; however, because there has only been a few studies conducted that estimated the cost of oversight no one knows how much "oversight" costs individual programs. Numerous oversight processes are being used today, but no research shows one process is any different from the other. Nor have studies been done to determine the cost drivers for oversight.

This thesis will provide a foundation and potential cost saving recommendations that would benefit the Department of Defense in most of the acquisition programs it monitors. An estimated cost of oversight will be calculated for programs following three different oversight processes using the Delphi Methodology. The estimates will be compared to determine if there are any statistical differences between them. A future track for the next generation of oversight processes will develop from the recommendations.

To my Father

Acknowledgements

First, I'd like to thank my mom and dad. Thank you for providing me with a solid foundation for life's challenges. Thanks for teaching me how to work and the value of hard work. I would like to thank Maj Greiner and Lt Col Thal for believing in me when things did not look good and for being great leaders. You both will be rewarded. I'd also like to thank my committee members Lt Col Driessnack and Maj King for helping to guide me through this journey. Last, but not least, I'd like to thank the Defense Acquisitions University for sponsoring my research. I hope that the government will gain much from it.

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Monroe Neal, Jr.

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ESTABLISHING A FOUNDATION TO CAPTURE THE COST OF OVERSIGHT FOR A MAJOR DEFENSE PROGRAM WITHIN THE INFORMATION TECHNOLOGY (IT) ACQUISITION COMMUNITY

1.0 Introduction

1.1 Overview

War preparation has been one constant throughout the history of the United States (U.S.). Today the U.S. spends billions of dollars on research and development and procurement of weapon systems and other major defense acquisition programs annually. For the purpose of this thesis, the definition of major defense acquisition programs (MDAP) will be taken from the February 23, 1991 version of the Department of Defense (DoD) Instruction 5000.2, *Defense Acquisition Management Policies and Procedure.* That version of the DoD Instruction 5000.2 defined an MDAP, as "a directed, funded effort that is designed to provide a new or improved materiel capability in response to a validated need. MDAPs must have an eventual cost of $200 million in research, development, test and evaluation (RDT&E) cost, and at least an eventual $1 billion cost in procurement expenditures both of which are in fiscal year (FY) 1980 constant year dollars" (14:1).

The acquisition cost for an MDAP can reach astounding numbers. Therefore, it is imperative that the stakeholders in the process be prudent and efficient when dealing with these programs because all funding for these programs are appropriated funds from Congress. Both Congress and the DoD have a responsibility to the taxpayers to ensure the funds entrusted in them are not caught up in some type of fraud, waste, or abuse. Over the years, US government agencies have tried to reduce the amount of inefficiencies

within the acquisitions process by developing and implementing policies and procedures for the acquisitions community. Official guidelines implemented to regulate the acquisition process date back to the late 1960s, and the regulations have been changed and reformed continuously.

Some of the more recent changes to the policies and procedures can be attributed to the fall of the Soviet Union, and that is when the U.S.'s approach to national defense had to change. After the fall of the Soviet Union, many Americans believed that the U.S. could reduce spending on its national defense programs because the number one enemy was no longer a viable threat. With a decrease in support for defense spending, mainly production dollars came budget cuts and a major transformation of the DoD. Major advancements in technology also helped transform the acquisition process. Since the defense budget shrank over the next 10 years, the way the DoD acquired its weapon systems and other defense programs had to be streamlined to get the most "bang for the buck." The government could no longer afford to overrun budgets or delay schedules without being accountable for each schedule delay or budget increase. Because the dollar amounts spent on acquiring MDAPs is a significant part of the nation's defense spending, there have been many studies conducted to ensure the acquisitions process is both efficient and effective, although little, if any, research has examined the cost of oversight. While several initiatives have been put in place to reduce the cost of acquisitions, there has been minimal work done on how to capture the actual cost of oversight for MDAPs. Some programs have been given the freedom to develop their own policies and procedures, some have received waivers from the policies and procedures altogether, and some have been given the authority to use non-traditional methods when going through

the approval process, but the programs must use the guidance set by the DoD 5000 series which has been put in place to govern the acquisition process.

This thesis will estimate the actual cost of oversight of a MDAP that used non-traditional methods for obtaining approval using the DoD 5000 series as its governing regulations. This chapter will cover the background and the problem, provide some assumptions, set the scope and outline the methodology.

1.2 Background

Acquisition oversight as we know it today began in the late 1960s. "The Defense Systems Acquisitions Review Council (DSARC) was created to advise then Deputy of Secretary of Defense (SecDef), David Packard, on the status and readiness of each major defense system to proceed from one phase to the next" (1:20). The DSARC was used to monitor the progress of major acquisitions programs, and would allow the DoD to regulate the acquisition process and ensure that the program was moving along according to schedule. After the creation of DSARC, Packard authored two memorandums. One requested input on ways to improve the acquisitions process and the other cited ways the acquisitions process could be improved (1:21). Packard believed that there had to be guidelines put in place for all members of the acquisition workforce to follow. In 1971 the first set of regulations was released and implemented DoD wide. According to Ferrara, the first copy of the DoD 5000.1 and DoD Instruction 5000.2, better known as the DoD 5000 Series was issued in July 1971 (21:111). It would be one of the first attempts to regulate the acquisition process. However, it would only be the beginning of a string of changes and reiterations of the same document. To date, every presidential

administration since Nixon's administration has made some type of change to the series (21:115). The latest update to the series was released in May 2003.

1.3 Problem

During the 1990s, acquisition reform was a major priority for the Clinton administration as major problems with the acquisition process were brought to public attention. Many Americans felt the government was abusing its power and taking advantage of the tax dollars appropriated for acquisitions. According to Gregory, "in the minds of much of the citizenry, the Pentagon procurement system is scandalous and the defense industry is manned by fast-buck artists, incompetents, or deranged Dr. Strangeloves who, when they lack weapons of mass destruction to tinker with, design $600 hammers or $5,000 coffeepots" (24:1).

Since most Americans believed paying $600 for hammers or $5,000 for coffeepots was excessive, DoD looked at the way they acquired items. The coffeepot and hammer cost were both exaggerated examples of the public perception; however, these incidents were "wake up" calls to the government along with the acquisitions community. Because the government's acquisition process is subject to public scrutiny, Congress and DoD must ensure that the policies and procedures put in place to regulate the process are flexible yet stringent enough to react to the forever changing needs of the government. Although oversight is needed within the process, it must be tailored to the situation in order to eliminate non-value-added processes that only add to the increasingly high cost of acquisitions.

1.4 Assumptions

For the purpose of producing results that can be compared to the results gathered from other MDAP programs within traditional and space environment, some assumptions had to be made. The following assumptions were used for the purpose of conducting this research:

1. Assume that the program has stable requirements and a stable budget
2. Assume that the studies performed on the oversight process accurately depict the normal process as defined in the DoD 5000 series
3. Assume the exterior agencies or services do not adversely affect the measures of performance used by the programs being studied
4. Assume the cost are associated only with parameters above the Program Executive Officer (PEO) level
5. Assume that the oversight cost collected occurs post Milestone A approval

The assumptions will help increase the interpretability of the data observed. By narrowing the scope of the study, the results of this research can be compared to the research being conducted for oversight cost in Space and normal DoD 5000 Series programs.

1.5 Scope

"In 2001, the Undersecretary of Acquisition Technology and Logistics [USD (AT&L)], along with the Assistant Secretary of Defense (Communications, Command, Control, and Intelligence) [ASD (C3I)], tasked a Rapid Improvement Team (RIT) to address reducing the time it took to deliver mission effective Information Technology (IT) capabilities within 18 months or less to the warfighter" (29: slide 2). According to the briefing, MDAP programs from the Army, Navy, and the Air Force participated in the RIT pilot study (29: slide 5); however, this thesis focuses on Air Force test programs

completed the pilot study. The RIT pilot study was an attempt to reduce acquisition cycle time by using computer technology and other innovative ideas throughout the approval process. Although the policies and procedures set by the DoD 5000 series were used, the RIT established a virtual process that helped reduce the amount of non value added meetings required throughout the process by putting all available data at each participants fingertips. The RIT also focused on creating a risk-based approach to oversight that allows the amount of oversight for a particular program be tailored to fit the need based on the risk levels of that particular program (29: slide 9). The results of the pilot study may eventually lead to changes in the way oversight of MDAPs are implemented. The results of this research will provide senior leaders a first look at just how much oversight of this type of program cost, and it will help them make better decisions on just how much oversight is necessary for each individual program.

1.6 Methodology

The first step in conducting this research was to select an MDAP that was a part of the RIT pilot study, and gain support from individuals within the IT community. By receiving the support from these individuals early, it ensures that the data required to conduct this study is available to obtain and analyze. No particular program will be studied; however, individuals who are experts in the field will be utilized to gain enough insight to answer the following questions.

1. How many meetings were there?
2. Who attended those meetings?
3. How long did they last?
4. Were the meetings local or was there temporary duty (TDY) involved?
5. How much time was used in preparation of the meeting?

The Delphi method will be used to generate the overall program oversight cost estimate. A series of questions will be formulated and distributed to a panel of experts within the Information Technology (IT) acquisitions community. The expert panel will be asked to answer the questions and return them to be analyzed. After validation of the data is complete, cost per hour rates will be calculated for each individual within the process how has vital role in getting a program approved through the acquisitions process. Some of the individuals included would be the members of the integrated program team (IPT) associated with IT programs that took part in the RIT pilot study. Members will be recommended by their peers and colleagues but will remain anonymous to one another. In the final stage, the total cost for TDYs, meetings, and personnel will be added together to calculate the total cost of oversight for a MDAP for one Milestone Decision Point (MDP). One important thing to remember is that this research focuses on Air Force programs only.

1.7 Research Objectives and Questions

There have been many reforms initiated to help reduce the cost of oversight within the information technology, missile defense, and the space and missile acquisition communities. However, no one has done any research to determine if these reforms were more effective. Therefore, the main objective of this research is to determine the cost of oversight within the information technology community after using a new "virtual" approval process to help reduce the amount of time to obtain Milestone Decision Authority (MDA) approval. The second objective is to compare the results with other MDAPs (Normal DoD 5000 series rules and regulations and Space and Missiles) using different processes to obtain MDA approval. This

comparison will help determine if there is a superior process or it will show there are no real differences between the different processes. The research will also determine if there are specific cost drivers for oversight. If the cost drivers are determined, it will help members of the acquisition community better focus their efforts to make the process more efficient.

1.8 Summary

This chapter introduced the reason for this research. It also outlined the scope and gave a brief introduction to the methodology that will be followed for this research. Chapter 2 of the thesis will give provide information related to the research from other sources and will give a historical picture of how acquisition has evolved over the years, and it will also trace the reforms of the DoD 5000 series. More information on the Delphi Method will be revealed in Chapter 3. Chapter 3 defines a specific course of action to be followed throughout the research process. In Chapter 4, the results of the research will be given in detail. It will analyze the data collected using the procedures set in Chapter 3. Conclusions, recommendations, and potential follow up research will be covered in the final chapter of this research.

2.0 Literature Review

2.1 Overview

Over the years, many studies have been conducted on the Department of Defense (DoD) acquisition process. After all, the United States (U.S) government spends billions of dollars on weapon systems, information technology, and space programs annually. According to an audit report filed by the Air Force Inspector General's office numbered 92-047, "as of March 1991, DoD had approximately 100 active major acquisition programs with a total value of $838 billion" (14:1). In another report authored by Czelusniak and Rodgers, they reported that "of the billions of dollars spent on the nation's defense, DoD loses approximately $5 billion per year in investment funds due to cost growth" (10:16). Because appropriated funds are used for the acquisition process, it is imperative for the DoD to utilize these funds effectively and efficiently. Although DoD has continued to transform the acquisition process to meet the needs of our government, there is still room for improvement.

In an attempt to keep cost growth from becoming too expensive, our leaders continuously monitor cost growth within our acquisition programs and in the early 1970s, the government released formal policies and procedures for the acquisition process. According to Ferrara, "the first versions of DoD Directive 5000.1(DoDD 5000.1) and DoD Instruction 5000.2 (DoDI 5000.2), which are also known as the DoD 5000 series, were released in mid 1970 and 1971" (21:109). The creation of the DoD 5000 series was the first step by the government to stabilize the acquisitions process. Along with the DoD 5000 series, oversight groups and forums were also created to help oversee the programs going through the acquisitions process. In a report to the Secretary of Defense (SecDef)

in 1994, it stated that "oversight verifies, on a continuing basis, that the program is proceeding according to expectations" (5:15). The DoD 5000 series can be considered the "bible" for the acquisition process; however, it is a bible that constantly changes. Over the last 20 years, there have been many revisions and editions of the DoD 5000 series, and the oversight groups and forums have come and gone. One thing has remained constant throughout the years and that is change. However, changes to the groups and forums as well as the 5000 series will continue as DoD and our federal government tries to find a balance between the flexibility within a program office and control of cost overruns.

The first section of this chapter will identify and define the key terms used in throughout this thesis. This chapter will also briefly discuss how typical MDAP operates as outlined in the DoD 5000 series. An evolution of the DoD 5000 series and the importance of it will follow that section to give a better understanding of why changes are ongoing. Presidential administration influences will be discussed, and the final section of the chapter will discuss previous research in the area of cost oversight.

2.2 Definitions

In order to lay a framework for discussion some key terms must be identified and defined. To begin, for the purpose of this thesis oversight is defined as "the cost associated with the approval process of an acquisition program for each Milestone Decision Authority (MDA) above the Program Manager (PM) level." According to the DoDI 5000.2, "a PM is designated for each acquisition program no later than program initiation" (15:35). The PM normally reports to a Program Executive Officer (PEO). The DoD 5000 series says that "unless a waiver is granted, a PEO has to be assigned to

all Acquisition Category I (ACAT I), Acquisition Category IA (ACAT IA), and sensitive classified programs, or for any other program determined by the Component Acquisition Executive (CAE) to require dedicated executive management" (15:35). The PEO is the executive manager over the PM or PMs they are assigned and report to the Defense Acquisitions Board (DAB). The DAB is the final formal member of the vertical chain of command. And the MDA is the final approval authority in determining whether a program moves horizontally from one milestone to the next. For the purpose of this thesis, only the vertical levels of approval above the PM will be considered when determining the cost of oversight. In figure 2.1 below, the vertical levels of approval are shown in yellow.

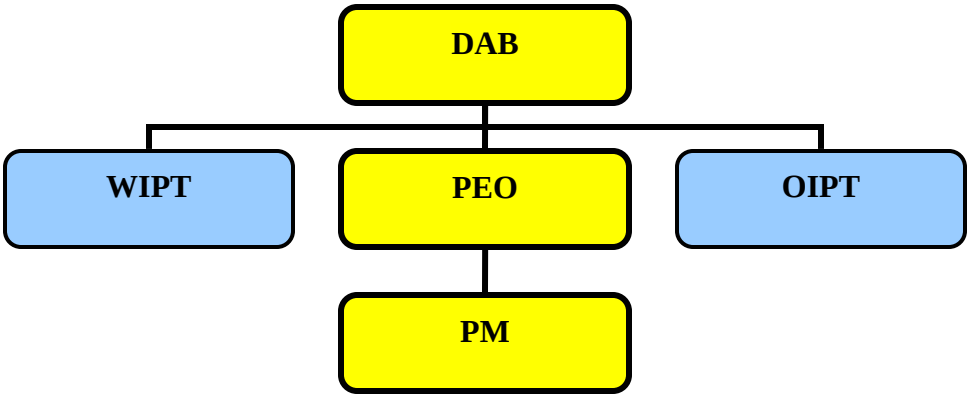

Figure 2.1: Oversight Approval Levels

The vertical levels of hierarchy in figure 2.1 appear to be streamlined. However, outside influences are not accounted for in this diagram. Although the graph doesn't show it, the Working Integrated Product Team (WIPT) works under the Overarching Integrated Product Team (OIPT) and neither one is a member of the formal chain of command for the program approval process, they can have a major impact on a

program's progress. An Integrated Product Team (IPT) is a group of functional experts that has a stake in the operation and success of their assigned program. By using this type of collaboration method, programs hope to eliminate "stovepipe" holdups within a program. Since teams are made up of functional experts, they are able to identify and solve problems quickly to keep their program on schedule. According to Engel, IPTs were formally codified in the March 1996 version of the DoD 5000 series (19:25). In chapter 4, these levels will be dissected further to capture the number meetings necessary before a program is ready to go to the DAB to be reviewed for milestone approval. It will also place a cost of oversight required to obtain an MDA approval.

2.3 MDAP Operation

Since the early 1970s, the MDAP process has been governed by the DoD 5000 series. Lead by then SecDef David Packard, DoD set out to create some boundaries for acquisition officials that would lead to a reduction in the cost of acquisitions. And over the last 20 years the ideas set by Packard have not changed, but the acquisition's process has changed numerous times since the creation of the DoD 5000 series. This research will evaluate how a waiver of procedures to the DoD 5000 series has impacted the cost of oversight for the IT community. Although the IT community must abide by the rules and regulations of the DoD 5000 series, it has been given a waiver on the "process". This thesis will determine if the changes made to the process increases or decreases the cost of oversight compared to that of a program not granted a waiver.

2.3.1 Development Stages

Other than making progress through the vertical chain of command, a program must also make progress through a horizontal development cycle. Although this research

focuses on a specific section of the development cycle, figure 2.2 shows the horizontal steps a MDAP must progress through for the normal DoD 5000 series process.

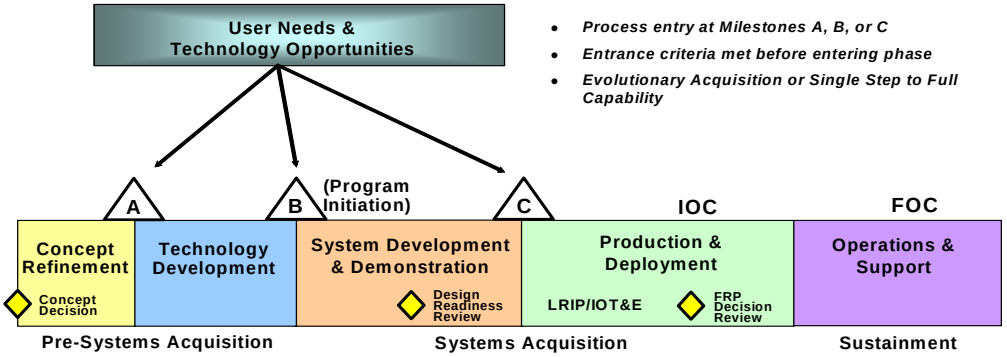

Figure 2.2: Forward Progress (15:2)

The systems acquisition process is composed of all the steps included within Milestone B and Milestone C. There are steps under Milestone C that continue on after a LRIP decision, but these are outside the scope of this research. It focuses on getting approval to progress from Milestone B, the System Development and Demonstration (SDD) stage, and enter Milestone C, the Production and Deployment (PD) stage. "The purpose of the SDD stage is to develop a system or an increment, capability; reduce integration and manufacturing risk…" (15:6). During Milestone A, ideas and needs are refined, but the program does not enter Milestone B (program initiation) until it has been approved. And at that point, the program is officially established.

Once the program enters the SDD stage, "the PM must prepare an acquisition strategy to guide the activities during this stage and it must be approved by the MDA" (15:7). There are two parts to the SDD: System Integration and System Demonstration. The DoDI 5000.2 says that "there will be a Design Readiness Review to provide a mid-phase assessment of design maturity as evidenced by the number of subsystems and

design reviews completed successfully" (15: 8). In order to exit the SDD stage, Systems Integration and Demonstration have to be proven, and the MDA must approve each before the program can progress to the following stage. At the end of the SDD a decision will be made to either end the program or approve the program for Milestone C and authorizes it to begin Low-Rate Initial Production (LRIP).

The purpose of LRIP is to "result in completion of manufacturing development in order to ensure adequate and efficient manufacturing capability and to produce the minimum quantity necessary to provide production or production representative articles for …<testing>" (15:9). During LRIP production quantities are limited in order to provide enough units to ensure testing and producibility yet limit the taxpayer expense before fully approving production. According to DoDI 5000.2, the quantity is normally limited to, "10 percent of the total production quantity documented in the acquisition strategy" (15:9). Once LRIP has proven to be successful, the MDA can approve the program for Full-Rate Production (FRIP) and delivery of the systems to the field. These systems must attain Initial Operational Capability. The statutory and regulatory requirements are found in tables at Enclosure 3 of the DoDI 5000.2 (15:10). Once the systems are fielded to the war fighters the program progresses to the Operations and Support stage and after the system is relieved of duty it moves into the Disposal phase which officially ends the program.

2.3.2 Differences in IT Development

Although the cycles for the IT community resemble the normal DoD 5000 series development cycles, they have created their own process. The IT community needed to focus on reducing the time needed to field a system. Therefore, the RIT began to assign

oversight based on risk. The needs of the IT community were different from that of the Space and normal DoD 5000 Series programs because they each had different life cycles. These life cycles made it difficult to have just one way of doing acquisition. The different life cycles are illustrated below in Figure 2.3.

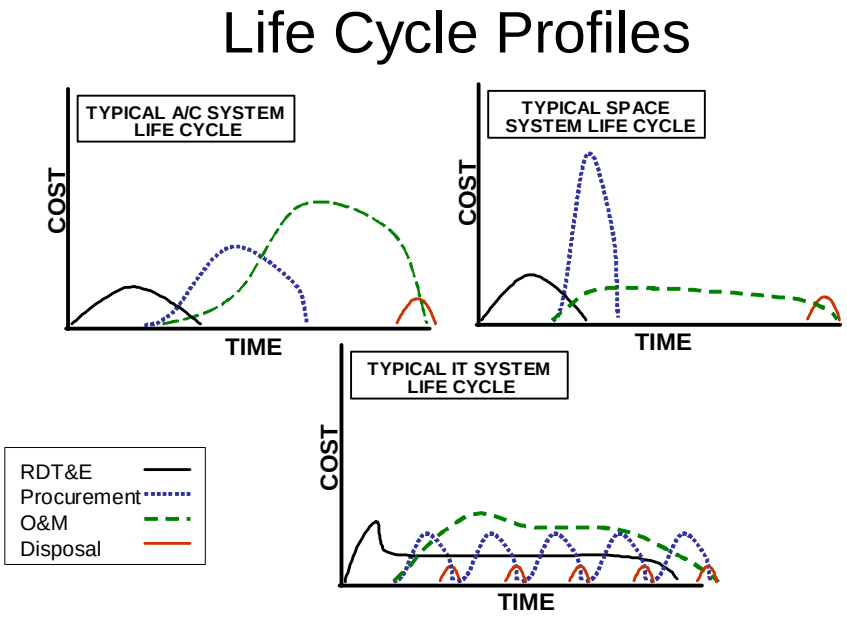

Figure 2.3: Life Cycle Profiles (2: slide 5)

The typical DoD 5000 Series, IT and Space programs require efficient acquisition processes and the government is trying to adapt to the different situations its faced with over time. More on the evolution of the DoD 5000 Series and the acquisition process will be discussed in the following section.

2.4 Evolution of the DoD 5000 Series of Instructions

Now that the acquisition processes for both the normal DoD 5000 series program and that of the IT community have been described, the next step is to discuss the evolution of the DoD 5000 series. Since its inception in the early 1970s, the DoD 5000

series has served as guidance for the acquisition community. Joe Ferrara said in a 1996 article that, the "DoDD 5000.1 and DoDI 5000.2 have been the foundation for the defense acquisition process for over 20 years" (21:109). Since the issuance of the first versions of the series, the DoD 5000 series has been rewritten over 10 times, with the first nine issuances between 1971 and 1993 according to Ferrara (21:109). If studied, each update to the series provides a bit of historical evidence of the political and economical climate. The DoD 5000 series was usually updated as a reaction to either the changing of presidential administrations or changes within the economy. Ferrara points out that the reason it is important to study the evolution of the DoD 5000 series is that, "the 5000 documents offer a unique window on the evolution of policy in a major government department" (21:109). Because the DoD 5000 series is the "bible" for the acquisition process, any revisions to it served as an effort to reform the acquisition process to better suit the needs of the government and the way it conducted business.

2.4.1 Secretary Packard Leads the Way

Deputy Secretary of Defense, David Packard, in the late 1960s began to feel uneasy about the direction of the acquisition of defense programs. He believed that the defense acquisition process could use some improvements (21:111). Packard also recognized that DoD needed to more effectively manage acquisition and control cost growth (21:110). Deputy Secretary Packard headed a defense acquisition review council charged to examine the defense acquisition process to discover opportunities to improve the process. In May 1970, Packard issued a memorandum in which the DoD 5000 series was conceived (21:111). This memorandum outlined the ideas that would later form the basis for the first issuance of DoD Directive 5000.1. Some of Packard's ideas listed

included, “decentralized execution, streamlined management structures, and use of appropriate contract mechanisms” (21:111). The first edition of the Department of Defense Instruction 5000.1 (DoDI 5000.1) was issued in July 1971 and it was filled with the original ideas of Packard (21:111). Ferrara suggests the original guidelines for the operation of a defense acquisition program as outlined in the 5000.1 (as envisioned by Deputy Secretary Packard) have been the driving force behind every acquisition reform effort and DoD 5000 revision ever since (21:111). There will be changes made by each presidential administration to the original instructions. Although the first edition stated that “Layers of authority between the program manager and his Component Head shall be kept to a minimum” (21:111), senior leaders continue to struggle with that objective. Advances in technology have forced DoD to adapt to a new economical and acquisition environment. It is assumed that Packard had an idea that the forces of society would lead to process changes; therefore, he wanted to reduce the amount of hassle and unnecessary red tape to help a program continue to progress through the process. However, with each new publication of the DoD 5000 Series, there is an attempt to find the balance of oversight that provides the greatest amount of flexibility and ensures the most efficient deployment of products to the warfighter.

2.4.2 Consistent Themes of the DoD 5000 Series

Over the different variation of the DoD 5000 Series there have been some consistent principles that remained the same throughout. Ferrara suggests that DoD has consistently stressed the importance of centralized policy-making and decentralized program execution, fly before buy, streamlined organizations, limited reporting requirements, and program stability (21:113-115). By having a central board develop

policy, the DoD acquisition policies will have the same focus. It also ensures that each program has a standard set of guidelines to follow. By doing so, DoD hopes that these policies would help keep the cost of acquisition to a minimum. Because the policy makers have the best interest of the Department in mind and not their program, they are better suited to make policies for all DoD entities. However, they realized that the day-to-day decisions of a program should be made by someone who has access to the inside data on that program. These individuals know what is best for that program and can make decisions that will help the program along the different stages of development. They have a better idea of what tradeoffs need to be made when issues arise. This type of strategy is known today as "tailoring" or "streamlining" the acquisition process to fit a particular program's requirements. The basis of thesis was derived on the effects tailoring or streamlining has on a program's oversight cost (21:114). Fly before you buy stresses the importance of testing. If taxpayer dollars are being spent, there should be some proof that the dollars are being spent on a product that does the job the government needs it to do. Each edition specifies that dollars should not be committed until it first proves useful to the warfighter and producible given the current industrial base and technology. Prototypes should be used when necessary and the product should be thoroughly tested prior to system fielding. Streamlined organizations are stressed in each revision because it is important not to have excessive layers in the acquisition process. Extra layers are more detrimental to an efficient operation because they slow down the process and add additional costs. Limited reporting requirements attempts to remove duplicated efforts. Ferrara called these themes the "management principles etched in the granite of the [first] 5000.1" (21:113) and supports this observation in several instances

by comparing how different revisions of DoDI 5000.1 address and incorporate the key themes in a similar manner.

2.4.3 Changes by Administration

As stated before, the DoD 5000 Series has had many changes since its inception in the early 1970s. One of the major drivers for the changes has been presidential influence. Beginning with the Nixon era, each administration has changed or revised the DoD 5000 Series in some way. According to Ferrara, the DoDI 5000.1 was first issued in 1971 under Nixon with two revisions under President Ford (1975,1977); one revision under Carter (1980); four revisions under Reagan(1982,1985,1986,1987); one revision under Bush(1991) and one revision under Clinton(1993) (21:115). There have also been two revisions under the current President Bush (2000, 2003). The following sections will try to highlight the changes made during each administration.

2.4.3.1 The Nixon Administration (1968-1974)

The conception of the DoD 5000 Series was a reaction to the rising cost of defense acquisition costs. It was under President Nixon's administration that the first edition of the DoDI 5000.1 was released. It was the first official policy set by the government. Created from the ideas of Packard, it outlined both the vertical layers of hierarchy and the horizontal steps required by a program in order to reach full production. Under the first series, the horizontal steps included program initiation, full scale development, and production/deployment (21:112). These steps are somewhat similar to today's milestones A through C steps, but the final approval authority in the vertical layer that enabled a program to move from one milestone to the next went all the way to the

Secretary of Defense level. Nixon's administration is credited for setting the first official rules and regulations governing the DoD acquisition process.

2.4.3.2 The Ford Administration (1974-1977)

Under the Ford Administration, there were two revisions made to the DoD 5000 Series. The first change by his administration was made in 1975. Few changes were made to the document; however, the major change was the issuance of an accompanying instruction, DoDI 5000.2 signed by the then-Director of Defense Research and Engineering (21:116). The changes made the new document more user-friendly and it brought a greater focus to the series itself.

The 1977 revision came in response to "the recommendations of the commission on government, the establishment of the Office of Federal Procurement Policy, and the issuance of Office of Management and Budget Circular A-109, and it instituted a new milestone decision point; Demonstration and Validation (21:117). This initiative attempted to mitigate technical risks as early as possible in the life of a program. Ferrara asserts that this event was likely brought about in part due to the large amount of money being spent to keep up with the Russians as the Cold War had not yet ended (21:117).

2.4.3.3. The Carter Administration (1977-1981)

The Carter administration's revision in 1980 was very aggressive. It attempted to reduce cycle time in order to get products to the warfighter more quickly and add more detail in the form of requiring new documents. In support of reducing cycle time, this version authorized services to do some novel things including, "omitting phases altogether" (21:118). This version also expanded the descriptive nature of the DoD 5000.2 Instruction, added a new document, the Integrated Program Summary (IPS) to the

list of reports required at a major milestone review. According to the revision, the purpose of the IPS was to provide a document in which the service in charge of the program could summarize the implementation plan for the life cycle of the product being developed (21:118). The position of the DSARC Executive Secretary was also described in the new version.

2.4.3.4 The Reagan Administration (1981-1989)

The Reagan administration has to be considered the most active administration for making changes to the DoD 5000 Series because there were four revisions during his eight year administration. The administration released its first DoD 5000 Series revision in 1985. The series was revised in response to the acquisition horror stories about that made its way to the public. Accusations of $900 hammers and $500 toilet seats plagued the media and the government had to respond. Wilbur Jones describes how these stories affected the climate in Congress in his book *Arming the Eagle*, "Congress at mid-decade was overloaded with some 150 different defense procurement bills in the hopper, many counter productive and contradictory" (27:374). As a response to Congress, the 1985 version created the Defense Acquisition Executive (DAE). The DAE became the single accountable point of contact over the approval of each acquisition program (21:119).

Great change was in store for the DoD 5000 Series and the defense acquisitions system between 1986 and 1987. Congress enacted the Defense Acquisition Improvement Act in 1986 to implement the Packard Commission recommendations (21:20). The act created the Under Secretary of Defense for Acquisition (USD(A)) in response to recommendation made by the Packard Commission that was formed in 1985 (21:120).

Almost immediately after assuming the role of USD (A), Richard Godwin initiated another version of the DoD 5000 series. In the new version, it codified the new streamlined the chain of command for the acquisition process; it ran from the PM thru the PEO to the Acquisition Executive. Previously, the Secretary of Defense held the role of the acquisition executive and corresponding role of milestone decision authority. The new edition also created three committees that were focused on programmatic matters: strategic systems, conventional systems, and C3I systems (21:120). The reason for this was to streamline and cut down on the number of committees that met with the new Under Secretary as the chair of the DAB and MDA. The article states that at "one count [the number of committees] went as high as 126 separate boards and councils" (21:120). The revision also established Milestone IV and Milestone V. Milestone IV was designed to be a review of the program two to three years after the initial deployment of the system to assure its operability and supportability, and Milestone V was designed to determine the operational effectiveness five to ten years after deployment (21:120). Both milestones were added to ease the minds of critics who questioned the departments' attention to life cycle implications of new systems (21:120).

2.4.3.5 The George H.W. Bush Administration (1989-1993)

There was only one revision to the DoD 5000 Series under the Bush administration. However, those changes were more noticeable than any other changes made prior to that date. The 1991 revision of the DoD 5000 Series took place as a result of the 1989 Defense Management Repot (DMR) authored by then Secretary of Defense, Dick Cheney (21:121). The objectives of the 1991 revision were to create: 1) a uniform system of acquisition policy, 2) provide rigid guidelines for programs through the

acquisition life cycle-did not allow services to supplement the DoD 5000 series, 3) made the DoDI 5000.2 applicable to all acquisition programs not just major programs, and 4) mandated that all necessary information would be transmitted in writing (a clear departure from Packard's vision of less paperwork). And while previous versions failed to exceed 60 pages, the 1991 version consisted of over 900 pages (21:122). The 1991 version removed all program flexibility by forbidding waivers to the instructions. This burdened the defense acquisition process because now paperwork was required for everything!

2.4.3.6 The Clinton Administration (1993-2001)

There were two revisions made during the Clinton era. The first took place early in the administration in 1993 and very little changes were made. However, the second edition was released in 1996. The Clinton administration's version drastically changed the 1991 revisions to the DoD 5000 Series. It was as if the administration set out to undo what the Bush administration had done in 1991. Ferrara made the following statement in his article:

> The 1991 documents represented a dramatic centralization of policy control and procedural specificity. And the 1996 version represents an equally dramatic reversal of these elements (21:121)!

The 1996 revision was the antithesis of the 1991 version as it attempted to re-instill the Packard spirit into the regulations. The 1996 version reversed the decision to make the 5000.2 applicable to all programs in an attempt to give more authority and flexibility to components to run their programs efficiently. It also attempted to respond to the changing world environment brought on since the end of the Cold War. Since threats to the United States could come from anywhere at anytime, the acquisition process had to

be flexible so that the U.S. could respond rapidly to any threats. The 1996 edition instituted the concept of "Advanced Concept Technology Demonstrations (ACTD)," Integrated Product Teams (IPT), and it canceled numerous reports required in the 1991 version (21:123). The value of these additions to the 1996 version of the DoD 5000 Series was evident after the attacks of September 11, 2001. The flexibility of the acquisition process was tested when terrorists hijacked three commercial airplanes, crashing one into the World Trade Center in New York, one in a field in Pennsylvania, and the other into Pentagon building in Washington D.C. Although many other changes had occurred before the attacks, the principle of flexible and responsive systems became more apparent during that crucial period.

2.4.3.7 The George W. Bush Administration (2001-present)

According to an article written for National Defense Online, president Bush's Secretary of Defense, Donald Rumsfeld demanded the "transformation of the Defense Department business practices, for greater innovation and flexibility in weapons acquisition" from the time he stepped into office (20:3). Dr. Rumsfeld's main vehicle for codifying his "transformation" was to make changes to the DoD 5000 Series. In the memo that canceled the DoDD 5000.1 and DoDI 5000.2, dated 2000 and 2002 respectively, Rumsfeld's Deputy Secretary of Defense Paul Wolfowitz states:

> "I have determined that the current subject documents require revision to create an acquisition policy environment that fosters efficiency, flexibility, creativity and innovation (42:1)."

Although the DoD 5000 Series was canceled in October 2002, the latest version was released on May 12, 2003. According to the National Defense article, the reason the defense department sought to again revise the DoD 5000 series in 2003 was that previous

attempts at instilling flexibility in the regulations, "…have not gone far enough because they have not addressed adequately the need for more innovation and efficiency" (20:1). The author of the article asserts that senior defense officials are still frustrated because, "…many weapons programs are years behind schedule, as a result of a cumbersome procurement process, and that acquisition managers don't work as efficiently as commercial businesses do, because they are restricted by the rules" (20:2). Erwin theorizes that despite all of the previous revisions to the DoD 5000 Series, defense officials see the instructions as requiring too much oversight and that the oversight continues to slow down the process. In Hawthorne's briefing entitled "Evolutionary Acquisition Update and the DoD 5000 Revision, he summed up the DoD 5000 Series pitfalls prior to its 2003 revision. He stated that the policies were "overly prescriptive" and did not "constitute an acquisition policy environment fostering efficiency, creativity, and innovation" (26:14). However, he stated that the objectives of the latest version of the DoD 5000 Series are to, "encourage innovation and flexibility; permit greater judgment in the employment of acquisition principles; focus on outcomes instead of process; empower program manager's to use the system vice being hampered by regulation" (26:14).

Over the thirty plus years of the existence of the DoD 5000 Series, the different presidential administrations attempted to implement procedures in the instructions that would foster an acquisition environment of "efficiency, flexibility, creativity, and innovation." Although the previous changes have only become cyclical points in the history of the ever evolving DoD 5000 Series, the outcome of the latest version has yet to be determined, but only time will tell.

2.5 Previous Research

There has not been a lot of research that focuses on capturing the cost of oversight of MDAPs. However, there have been studies that examined cost overruns or the cost of oversight for contractors. This section will discuss some of the research that has been conducted in these areas. This research is being conducted to fill the gap in current literature. No previous literature specifically addresses the cost of the vertical levels of oversight of MDAPs that accrues while an MDAP moves from one stage of development to the next. A look at studies dealing more generally with the topic of oversight of DoD acquisition follows.

2.5.1 Contractor Oversight

The cost of contractor oversight was the subject of a 1994 study conducted by the General Accounting Office (GAO). The GAO report, printed in 1997, entitled *Acquisition Reform: DoD Faces Challenges in Reducing Oversight Costs*, the GAO stated that the results of "reinvention laboratories which were conducted in ten different defense contractor sites in 1994 with an eye on reducing oversight costs" (23:1). This effort was one of the major reforms to come out of the National Performance Review of 1993. Each of the test sites set up functional evaluation teams consisting of members from various different government departments, including representatives from weapon systems program offices. Their objectives were to perform cost benefit analyses of oversight requirements and eliminate non-value added requirements. It was a large undertaking with mixed results. The labs' work resulted in "limited progress in implementing changes to reduce contractors' costs of complying with government regulations and oversight requirements" (23:4). They concluded that although they still

firmly believed the initiatives were worthwhile, great progress could not be made without greater support from across the DoD. The GAO report highlights an important part of the cost of oversight of acquisition programs; however, it deals only with the cost of contractor oversight, and the costs of government oversight will be evaluated in this thesis.

2.5.2 Cost Overruns

Over the years different committees have been formed to either reform the acquisition process or look for ways to help reduce cost overruns. Cost overruns have often been a problem in acquisition and represent a major reason why the DoD 5000 Series is in existence today. There have been some studies done on the effectiveness of the recommendations made by committees such as the Packard Commission of 1986. A study conducted by Christensen, Searle, and Vickery reported in a 1999 *Acquisition Review Quarterly* article concluded that "despite the implementation of more than two dozen regulatory and administration initiatives, there has been no substantial improvement in the cost performance of defense programs for more than 30 years (8:252). The report used data from the Defense Acquisition Executive Summary (DAES) database and found that Packard Commission initiatives, "did not reduce the average cost overrun percent experience on 269 completed defense acquisition contracts" (8:251). Of note, the study concluded that not only were the Packard initiatives ineffective in regards to reducing cost overruns, but that overall cost overruns on the 269 contracts they reviewed actually increased (8:258).

In an effort to reduce cost the government has implemented many initiatives. In a 1994 GAO report, it reported that DoD developed new standards to reform the military

specifications and standards in hopes of reducing acquisition cost (22:1). It also stated that the DoD military specification process was complex, and often rigid, and blocked the use of commercial products and processes which prohibited the government from reducing cost (22:2). The reform being reported built on previous studies in the same area. The report also stated that most of the recommendations were not new and had been suggested prior to this report. According to the report, "this reform effort focuses on changing the acquisition culture and contains several actions to accomplish this change (22:3). Like others before it, the changes implemented have made no significant difference in cost overruns within the acquisition process.

In a 1998 article in *Acquisition Review Quarterly,* Delano stated that the "Department of Defense acquisition programs and projects frequently experience cost overruns, performance deficiencies, schedule delays, or cancellation" (12:1). He believed that because the DoD had such large programs that cost overruns were inevitable (12:1). Delano set out to find success factors that DoD program managers could effectively apply to enhance the success of their acquisition programs (12:2). Delano's goal was to find success factors that could be implemented quickly without policy changes. His results did mirror that of previous studies, but he was unable to clearly determine if these factors would in fact reduce the cost of acquisitions.

2.6 Summary

This chapter presented the guidelines under which an IT program as well as a normal program must operate. It also defined the important terms that will be used throughout the thesis, and then it went on to discuss the evolution of the regulatory series that establishes those guidelines. The chapter also looked at the DoD 5000 changes by

presidential administration and concluded with a look at some previous research in the area of cost overruns and oversight. There has not been much studies done in the area of cost oversight of MDAPs and this thesis will be one of the first steps to determining that cost. Future research may determine if that oversight is worth its cost.

3.0 Methodology

3.1 Overview

The previous chapters outlined changing oversight of Major Defense Acquisition Programs under the guidelines provided in the DoD 5000 series of regulations. The primary goal for this research is to estimate the cost of program oversight by comparing the oversight of IT acquisition programs to the oversight of space programs (16:1) and traditional programs (35:1) using the Delphi. In additional to this goal, the following additional questions are examined:

1. What is the cost of oversight for an IT program?
2. How does cost of oversight for IT programs compare to other MDAPs using traditional and nontraditional approaches?
3. What are the drivers for oversight costs?

This chapter outlines the current application of the Delphi Method.

3.2 Delphi Method

This section will provide some background information on the Delphi Method, and its history will also be discussed. After the background and history of the Delphi Method is explored, a discussion of what it is and description of how it works will follow. Once a general understanding of the Delphi Method has been given, it will be obvious that this methodology provides makes sense to evaluate the research topic. The final section of this chapter will go into further detail on the reasons for selecting the Delphi methodology for this research project. The methodology for the execution of this research project will be combined within of each of the subject areas' description.

3.2.1 History of the Delphi Method

According to Linstone and Turoff, "Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, deal with a complex problem" (30:15). The word "Delphi" originated from Greek mythology; it refers to a Delphi Oracle which was capable of predicting the future" (9:376). The Delphi method uses past experiences from a panel of "experts" without group discussions to predict future outcomes (34:17). This methodology was developed in the 1950s by the The RAND Corporation when conducting a study in support of an Air Force exploration and the defense industry as part of a project called "Project Delphi" (34:17). The U.S. Air Force wanted to determine what would be key nuclear targets and what would be the likely number of warheads employed against the United States in the event of nuclear attack by the Soviets. "Project Delphi" sought to reach a consensus of expert opinion in order to answer those two critical questions from the viewpoint of a Soviet nuclear strategist. Because there was a lack of data in this type of research the Delphi method was created.

3.2.2 What is the Delphi Method

The Delphi Method is best described as a communication tool that facilitates a communication process by allowing a group of individuals to work as a whole to deal with a problem (6:701). The Delphi Method attempts to reach a consensus of opinions among the members of a group, which from here on will be referred to as an expert panel, through a series of questionnaires. The use of anonymous questionnaires in the Delphi process eliminates heated confrontation amongst panel members because there are no face to face meetings or discussions throughout the process and replace them with a

carefully planned, anonymous, and orderly program of sequential individual interrogations usually conducted by questionnaires" (40:30). Anonymous questionnaires allow each panel member the freedom of expression. Although panel members are provided with the overall responses, only the administrator has knowledge of the participant's individual responses and arguments. The characteristics of the Delphi method is intended to overcome the drawbacks of conventionally structured groups by using the anonymous questionnaire technique (18:25). Another key element of the process is the panel of pre-selected experts which never has to be physically in the same location. In the early years of the Delphi process, the studies were conducted using the traditional mailing system; however, in today's virtual society, the studies can be conducted via web-based system, email or a combination of the two methods.

3.2.3 How the Delphi Method Works

The previous section of this chapter offered a preliminary look at how the Delphi Method works, but this section will go into much greater detail on the workings of the Delphi Method. First, it is important to answer some questions. The first is why use a panel of experts that never meet instead of just a single expert. The reason is that an individual is operating alone which means they could forget something or fail to consider an issue. Clayton highlighted this issue when he discussed the fact that individuals don't get the benefit of hearing the ideas of others so that they can perhaps refine their ideas (9:375). Clayton goes on to state that by combining the judgment of a large number of people, there's a better chance of arriving at the truth.

Having explained why a separated group and not an individual, the question then becomes, if a group is better than an individual, wouldn't it be better to put them in a

room together to allow them to brainstorm and hammer out a consensus? Though this research operates under Clayton's premise that the shared ideas of a group of experts is better than a single expert, putting a panel in a room together could lead to group think (9:375). This phenomenon is the result of a few dominant personalities controlling the discussion and potentially strong arming a consensus despite the initial objections of possibly better informed, yet more timid panel members. Anonymity eliminates the influence of the dominant individual and reduces both noise and the pressure for conformity (18:25).

Now that the two preliminary questions regarding the overall set up of the Delphi Method have been answered, the next step is to describe the workings of the Delphi Method. To aid in this presentation, the key elements of the workings of the Delphi Method are explained best in Figure 3.1.

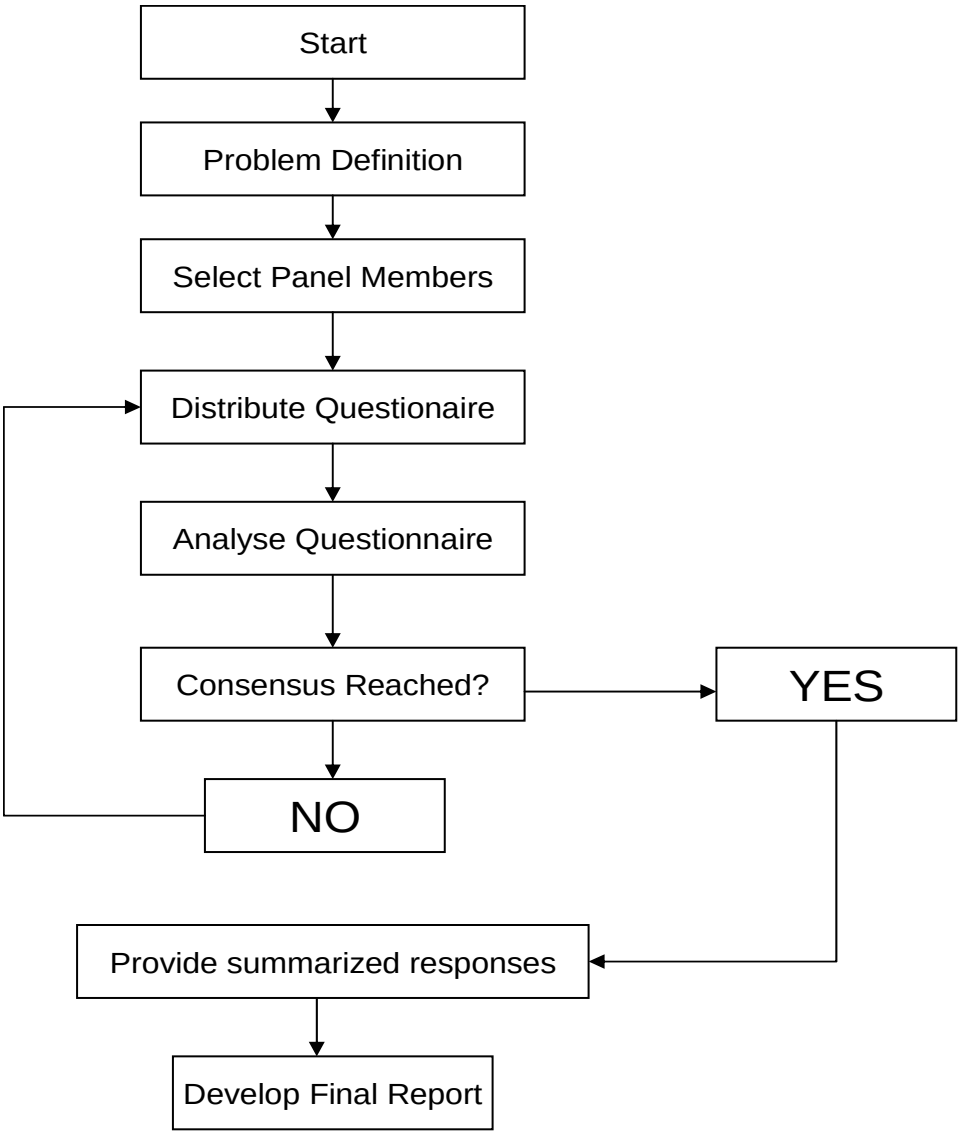

Figure 3.1: Oversight Approval Levels (13:2)

First, a problem is defined. For this research, the research questions are the main problems defined which is to determine the cost of oversight for IT programs as well as compare the costs of those IT programs to the "box" and space programs. The other research focus, using the Delphi Method is to determine key oversight cost drivers. The next step is to develop a questionnaire that is specific enough to divulge the data necessary to answer those questions. The following step is to select a panel of experts to

answer the questionnaire. The questionnaires are then sent to the panel and when completed they are collected, analyzed, and summarized. If consensus is not reached, the summarized responses will then be sent back out to the panel to allow them to rethink the questions now that they have the added benefit of the input from the other group members. This process of sending out the questionnaires and then getting them back and analyzing them continues in a looping pattern and each loop is referred to as a "round." Each time a new questionnaire is distributed marks the beginning of a new round. The number of rounds is determined by the achievement of consensus of the expert's opinions. Early criticisms of the Delphi Method centered on the fact that originally, (due to lack of technology) questionnaires were sent by traditional mail channels and depending on the number of rounds needed to achieve consensus, the process took from several months up to a year or two to complete. Today's technology enables the process to flow much more quickly, and for the purpose of this particular research effort, all communication during the process will be conducted via e-mail. Chou takes this e-mail centered Delphi methodology a step further by conducting a web based Delphi Process whereby panel members and the survey director interact in a shared web program (7:233-236). In summary, the Delphi Method, as employed in this research effort, will act as a communication facilitator that attempts to achieve a consensus of opinions from an anonymous, geographically separated panel of experts through a series of questionnaires all conducted via e-mail.

3.2.3.1. The Rounds of the Delphi Method

As previously mentioned, each time a questionnaire is distributed to panel members and returned to the person directing the research effort constitutes a round of

the Delphi Method. The big question that arises deals with how many rounds of the Delphi are necessary to ensure the data is stable. Clayton states that only four phases are needed and that the final round is sent out to "provide reasons as to why they agree or disagree with the final results" (9:129). Chan et al. agreed in their study by establishing four rounds (6:701). Ludwig states that "Delphi rounds continue until a predetermined level of consensus is reached or no new information is gained" (31:3), but a study in Scotland by Dr. Kerr limited the number of rounds to 3 (28:3). In recent nursing research, Hasson et al. limited the number of rounds depending on "time available…" (25:1011). The research did not find a specific number of rounds needed. Most researchers using the Delphi Method set the criteria of consensus and time available while some limited on a firm number. Based on the evidence, the Delphi method as employed in this research effort to answer the research questions will contain a minimum of two rounds and a maximum of four.

3.2.3.2 Delphi Method Questionnaires

Mitchell goes into great detail outlining the construction and administration of the Delphi questionnaires. He clearly outlined the length the questionnaire should be by stating how long it should take each panel member to complete the questionnaire. On this topic he states that the questionnaire should take no longer than 30 minutes to complete (32:345). The basis for this assertion is his own experience as he goes on to state that there have been no empirical studies conducted on the appropriate length of time to complete a Delphi questionnaire. Mitchell also discusses the construction of the questionnaire for each round of the Delphi Method. He states that questions should be clearly stated and should not be identical from round to round because the repetition

could cause participant boredom, which could hamper results (32:342). Clayton also discussed the format of the questionnaires on a round by round basis. He states that the round one questionnaire should be clearly worded but allow for the most freedom in responses. Round one responses, once collected, should be turned into generic statements summarized with measures of central tendency and then resent to panel members to begin Round two. In round two, the process of seeking consensus begins. To aid in the quest for consensus panel members that wish to change previous responses must provide reasons for doing so. In round three and subsequent rounds, questionnaires should summarized responses with a summary of reasons for changing responses and this process continues until consensus is met (9:378). The questionnaires in support of this research effort will be constructed according to the procedures outlined by Clayton and Mitchell. The number of questions will be limited to ten or less. The maximum amount of time needed to complete each questionnaire is estimated at 20 minutes. Each returning questionnaire's questions are altered in each round based on the previous round's input. This will ensure each panel member has the opportunity to re-evaluate each question.

3.2.3.3 Delphi Method Consensus

The rounds of questionnaires must eventually come to a close. In order to set the parameters prior to beginning, once consensus is reached, the rounds will discontinue. Webster's New International Unabridged Dictionary defines consensus as, "unanimity or general agreement in matters of opinion" (39:567). If that definition is applied to the Delphi Method as employed in this research effort, once the panel reaches a majority opinion, the process is complete, but just a majority may not be far enough. Simply operating under the theme of "majority rule" could overlook important, though less

frequently occurring opinions. Therefore, in terms of the application of the Delphi Method for this research effort, consensus must be defined. The problem, as Williams and Webb state, "Consensus is poorly explained in studies which use the Delphi technique…" (41:182). Hasson et al. also state that: "A universally agreed proportion does not exist for the Delphi…" (25:1011). Hasson et al. does list various studies who established percentages for defining consensus, but all vary dramatically and result in mostly a straight majority rules. A study completed by Schiebe et al. recommends stability of responses throughout the rounds as a better indicator of consensus by evaluating the changes in the questions to a quartile in a distribution (36:IV:C). Without much empirical evidence to support a concrete definition of consensus, this research effort will take an approach similar to the one recommended by Schiebe et al. Each question will be evaluated on the response and as answers become stable, the question will be considered "closed" until all questions are closed or four rounds have been completed.

3.2.3.4 Delphi Method Expert Panel

Another obstacle when performing the Delphi Method is deciding how big the expert panel should be. Spinelli conducted research utilizing the Delphi Method and the panel consisted of "24 key influential persons knowledgeable as to the factors influencing the general environment…" (37:74). Ludwig conducted research but had a different approach to establishing a panel. Ludwig stated that "The number of respondents was generally determined by the number required to constitute a representative pooling of judgments and the information summarizing capability of the research team" (31:2). This establishes the precedent that as long as all members of the focus research are

represented, the number of members on the panel is up to the researcher. Ludwig then states "The majority of Delphi studies have used between 15-20 respondents and run over periods of several weeks" (31:2). Since it seems difficult to find 15-20 volunteers for this research, further studies were scanned and established more attainable precedents. Chan et al. stated in their selection process "The ten members of the panel represent a wide distribution of professional people…" (6:701). Another study by Des Marchais reduced the panel size to six (17:504). But overall, William and Webb summarize the panel selection methodology by stating "First, there is no agreement regarding the size of the panel, nor any recommendations concerning sampling techniques" (41:182).

The panel assembled to answer the research questions posed in this thesis will be of the heterogeneous type and will embody the principal of breadth of members' experience while maintaining the similar target career field. The panel will contain a minimum of four and a maximum of ten members.

Once the size of the panel has been decided, a criterion to determine exactly who is an expert has to be established. Based on the findings that were a result of the research conducted to complete this chapter, it appears there is no clear cut definition of what constitutes an expert. While discussing the topic of expert panel member selection, Mitchell states, "No reported Delphi study has addressed this selection issue" (32:340). In their research, Dawson and Brucker summarized the criteria for determining experts used in several Delphi studies in their field (11:132). The common theme was: general experience of seven years; specific experience of five years; at least one published article; at least one national conference presentation; and experience should be recent to within the last three years (11:132-134). For the purpose of this research, we'll relax those

general standards a bit by requiring: general experience of five years; specific experience of two years; recent experience within the last five years; and no qualification of presentations or publications.

Once the expert panel is formed, but prior to the process starting, a plan must be instituted for panel attrition. In a study by Chan et al. conducted in the field of medicine, they achieved a response rate of 80% and went on to state that derived from various studies that the average response rate for the medical field ranged from 58% to 80% (6:708). Mitchell states that, "High rates of attrition may mean that final results are based upon an unrepresentative sub sample of the original sample" (32:341). To combat panel attrition and the resulting degraded response rates, this research effort will choose experts from different but related fields and have at least one backup expert for every expert so in the end, even with an attrition as high as 50%, all groups will be represented and the bias that Mitchell describes will be avoided.

3.3 Uses of the Delphi Method

The Delphi Method has had many uses in research. According to the book *The Delphi Method: Techniques and Applications*, the Delphi Method was principally used as a forecasting tool back as early as the 1960s and went on to say today the Delphi Method is used for: normative forecast; to ascertain values and preferences; quality of life estimates; simulated and real decision making; and inventive planning. The book also went on to state that the Delphi Method is used extensively where "judgmental input data" is needed when other data is unavailable or too costly (30:615). Hasson et al. stated that the Delphi Method is used frequently in health and social sciences (25:1008). Mitchell's article cites a table listing the use of the Delphi method by percentage by field

of study from a total of 800 studies. Delphi was most heavily used in physical sciences and engineering (26% of all studies conducted) and the second most frequent usage was in business and economics (23%) (32:334).

3.4 Criticisms of the Delphi Method

If employed properly, the Delphi Method is an excellent tool for gathering data to answer questions when that data first appears to be unavailable. Since this research effort originally sought to analyze historical data and because that data was unavailable, the Delphi Method appeared to be a suitable backup method. However there are criticisms of the Delphi Method. The first criticism deals with who actually decides what qualifies as an "expert". Clayton acknowledges that expertise is not exactly measurable however, he states that the criteria is really relative based on the peers of the experts. For this research effort, criteria for panelists will be based criteria found in the section on the expert panel found in this chapter. Using Clayton's premise that experts are deemed as such by their peers, the research will include a preliminary survey of potential experts. We'll supply them with our panel criteria and ask them whether they agree with each of the criteria or not and why.

Williams and Webb introduce a second criticism of the Delphi Method which is that the researcher's analysis and summary of each rounds' responses could introduce bias into the process (41:182). That point is well taken and to combat that threat, responses will be analyzed using basic statistical methods (mean, median, standard deviation) to the fullest extent possible. Additionally, because this research will conduct the Delphi Method as part of a group project, there will be more than one set of eyes analyzing the responses which should also help to keep the process honest.

A final criticism of the Delphi Method regards the question of reliability; specifically, what evidence is out there that proves the Delphi Method is reliable. In other words, have studies been conducted that prove findings were consistent in different Delphi experiments using similarly composed panels answering the same questions. Williams and Webb found that, "there is no evidence that the Delphi Method is reliable" (41:182). Hasson et al. support these findings stating that their research discovered, "There is no evidence of the reliability of the Delphi Method" (25:1012). Mitchell stated that other studies have found a high degree of replicability which would contradict the criticism that the Delphi Method is unreliable or at the very least unproven (32:351).

3.5 Strengths of the Delphi Method

The strengths of the Delphi Method outweigh the weaknesses previously mentioned. First, the Delphi Method enables a group of experts in geographically separated locations to work together without the cost or other logistical problems associated with bringing experts together at a central location (11:129). Anyone who has tried to put together a major conference would greatly appreciate this strength.

The second strength focuses on the fact that the Delphi Method results in a consensus of opinion without the bias or group think that might result from a roundtable process (41:181). This "anonymous factor" ensures all panel members are equally involved and all panel members feel free to answer honestly. By this, the researcher has the opportunity to receive uncensored answers.

Williams and Webb's research also highlights the Delphi concept of conducting a series of rounds to achieve consensus (41:181). The series of rounds allows panel members to review the responses of their fellow panel members and gives them the

chance to reconsider or even alter their original responses with the benefit of the added input of their fellow panel members. Conducting only one round would destroy the intellectual synergy created by the sharing of ideas throughout the rounds.

Finally, a criticism of the traditional Delphi process (the process was too long to complete) has evolved into a strength. This long time period was due to the fact that it was used in the 1960s and 1970s at a time when there was no means other than through postal channels to conduct Delphi rounds. Chou's article highlights the final strength of the Delphi that evolved—speed. Chou stated that traditional Delphi processes averaged six to twelve months from start to finish, but with e-mail and web-based Delphi a three round study can be conducted in four weeks (7:236).

3.6 The Reason the Delphi Method was Chosen

The originally theorized methodology for this research effort was to examine the paper trail left by an actual MDAP going through a milestone decision point i.e. Meeting minutes, meeting notes, sign in rosters to arrive at an estimated cost of oversight. Using these documents, the ranks and number of people at the meetings could be ascertained as well as the number and duration of the meetings. This data could then be used to estimate a cost of meetings based on length of meeting and the hourly wages of each attendee. The estimate for meeting costs at every level of vertical oversight could then be tallied to arrive at a total estimate of the cost of oversight for an MDAP at a certain key decision point. The problem encountered with this methodology was the lack of data. Assuming that meeting minutes, notes, and logs would be readily available was a mistake. In some cases these items were nonexistent. Therefore, the methodology used for the purpose of this research had to be able to answer the research questions without

the availability of historical data. An article by V.W. Mitchell that appeared in *Technology Analysis & Strategic Management*, outlines why one would use the Delphi Method with the number on reason listed being the unavailability of historical data (32:338).

3.7 Comparative Analysis for Data Collected

Once the rounds of the Delphi are completed, data collected from this study will be compared to the Space data collected by DeReus (16:1) and the "Box" data collected by Rousseau (35:1). The data collected for all questions on the questionnaires will be statistically analyzed using a software package containing a graphical user interface, such as JMP 5.0.1 statistical software. The data will be analyzed to determine if there are any statistical differences in cost of oversight amongst the three processes.

3.8 Summary

This research effort is aimed at answering the following research questions:

1. According to the panel of experts, what is the cost of oversight for an IT program using the RIT process?
2. How does the cost of oversight for an IT program compare to the cost of oversight for Box and Space programs?
3. What are the top five cost drivers for the oversight of IT acquisition programs?

This chapter outlined exactly how this research effort will answer those questions. In summary: the research will consist of assembling a panel of five to ten experts in the field of defense acquisition; prepare questionnaires aimed at collecting the cost of oversight at one key decision point and aimed at identifying oversight cost drivers; then employ the Delphi Survey technique of sending out the questionnaires, collecting, analyzing, summarizing, and resending questionnaires to the panel; and continue with the

Delphi rounds until a consensus of expert opinion is reached. In Chapter 4, the results of each round's questionnaires will be recorded and summarized.

4.0 Data Results

4.1 Overview

The goal of Chapter 4 is to provide the results of the data collected from the members of the panel of experts used in the Delphi Method. In the first section of this chapter, only general demographics of the panel members will be provided to ensure anonymity of the members. The next section will provide the results of the survey for each question. Results will be presented for each of the ten questions and will include initial answers to the questions and any changes made during the four separate rounds of the Delphi Method. The final section will provide a review of the change in the standard deviation for each question. The chapter will conclude with the final numbers to be analyzed and will be used to statistically compare with the results from studies conducted by Rousseau (35:1) and DeReus (16:1).

To establish the cost of oversight, an algorithm was created which multiplies and adds the respondents' estimates together to create low, average, and high estimates for the cost of oversight. By multiplying the results of specific questions together, the algorithm works. For example, to obtain a TDY cost estimate, questions two, three, and four are multiplied; to create a personnel cost estimate, questions five, six, and seven are multiplied; questions eight, nine, and ten are multiplied together to create a meeting cost estimate. Finally, to arrive at a total program cost for one milestone decision point, the estimates for TDY, personnel, and meeting are added together. The total program cost for the low estimate is then represented by the following algorithm:

3*((Q2low*Q3low*Q4low)+(Q5low*Q6low*Q7low)+(Q8low*Q9low*Q10low))

The total program cost for one milestone decision point has to be multiplied by "3" because there are three milestone decision points. The same process is used to obtain the average and high estimates.

4.2 Panel Selection

The goal of panel selection was to gather experts within the IT community with the appropriate acquisitions' experience. A varied breadth of experience amongst the panel members was also a goal in order to collect data from individuals with different opinions because of different experiences. The demographics of the selected panel of experts are listed in table 4.1 below.

Table 4.1: Panel Selection Demographics

Number	Military/Civilian	Position	Acq Exp (Years)	IT Exp (Years)
1	Military	Military Officer	10	5
2	Civilian	Retired Civil Servant	30	30
3	Civilian	Retired Military Officer; Contractor	30	20
4	Civilian	Civil Servant	29	20

With the panel members numbered, the remainder of the results and analysis will refer only to the number assigned for the Delphi Method. Although the table looks heavy with civilian experience, the military viewpoint is represented from both the "worker bee" (Junior officer) and senior staff levels (Retired O-6). With an average of 24.75 years of defense acquisition experience and 18.75 years of IT acquisition experience this

panel of experts has a wealth of experience to offer. The panel members have worked at various levels of the acquisition process. Their experiences levels range from the Program Office IPT levels through the OSD levels which provides enough breadth of experience to provide the appropriate level of heterogeneity referred to in the methodology section of this thesis. The differences of the panel members will provide the greatest probability of approaching the true answer of the unknown forecast we are trying to make and compare. Prior Internal Review Board permission was requested and obtained for this research and the letter of approval can be seen in the attachment section.

4.3 Question One

> *From the Program Executive Officer (PEO) request for a Defense Acquisition Board (DAB to the DAB milestone approval, what are the five major cost drivers in the oversight process?*

The goal of question one was to obtain the top five cost drivers, according to the respondents, that drove the cost of oversight. There were no stipulations placed on the answers to be provided by the panel members; however, they were limited to five responses.

4.3.1 Results by Round

In round one, the panel was asked to provide the top five cost drivers within the oversight process but they were asked to put them in no particular order. In all, the panel members identified a total of 18 cost drivers, and they are listed below:

1. Documentation development
2. Documentation review/staffing
3. Negotiating viewpoints of the various stakeholders…acq strategy re-do
4. Changing oversight requirements
5. After Milestone B, future milestones require less effort since much of the groundwork is already complete
6. Lack of oversight requirement and process

7. Lack of functional requirements that are clearly defined and understood
8. Travel and prep work
9. Review and approval of ORD/Architecture
10. Review and approval of Cost Estimate
11. Review and approval of Clinger-Cohen Act
12. Review and approval of C4ISP
13. Review and approval of TEMP
14. Lack of defined and managed acquisition processes in the PEO/PMO
15. The need for OSD to serve as MDA when there is no defined or managed acq. process in the PEO/PMO
16. Lack of trust by OSD gate keepers in the Component counterparts thus preventing them from delegating
17. The serial process of document approval by several echelons of oversight
18. The lack of established architectures and the resulting need for unique C4ISP efforts

For round two, the 18 items received from round one were sent back out to the panel members. They were then asked to select the five of the top cost drivers from the list and put them in the provided space on the survey. Seven drivers were dropped from the list because they received no votes. The following drivers were sent back to the panel members for round two. They are listed in no particular order.

1. Documentation development
2. Documentation review/staffing
3. Negotiating viewpoints of the various stakeholders…acq. re-do
4. Changing oversight requirements
5. Lack of oversight requirement and process
6. Lack of functional requirements that are clearly defined and understood
7. Travel and prep work
8. Lack of defined and managed acquisition processes in the PEO/PMO
9. Lack of trust by OSD gate keepers in the Component counterparts thus preventing them from delegating
10. The serial process of document approval by the several echelons of oversight
11. The lack of established architectures and the resulting need for unique C4ISP efforts

As for round three, there were a total of 11 drivers sent back to the panel members with the same instructions given in round 2. This time, only two items were dropped because they received no votes. The results from round three are listed below:

	Votes
1. Documentation Development	1
2. Documentation review/staffing	1
3. Negotiating viewpoints of the various stakeholders…acq strategy re-do	3
4. Changing oversight requirements	3
5. Lack of oversight requirement and process	0
6. Lack of functional requirements that are clearly defined and understood	3
7. Travel and paperwork	0
8. Lack of defined and managed acquisition processes in the PEO/PMO	2
9. Lack of trust by OSD gatekeepers in the Component counterparts thus preventing them from delegating	3
10. The serial process of document approval by the several echelons of oversight	2
11. The lack of established architectures and the resulting need for unique C4ISP efforts	2

Since the goal of question one was to identify only the top five drivers, the drivers from the round three results that received only one vote were also eliminated from the fourth survey sent to the panel members. With only one round remaining, eliminating the drivers with the fewest votes was determined to be the best way to narrow the list down to one that would meet the goal of identifying just five drivers. After eliminating those drivers from the list, there were seven remaining drivers in which the panel members could make there selection. Once again, panel members were instructed to select only the five drivers they believed to be the top five. However, in the final round they were also instructed to prioritize their selections. By prioritizing their selections, the data can be analyzed to create a ranking of the top five cost drivers. A simple average, by adding the values of the votes and dividing by the number of votes, would provide a scale to rank the cost drivers. The results from the final round of question one are list below:

	Votes
1. Negotiating viewpoints of the various stakeholders…acq strategy re-do	3
2. Changing oversight requirements	3
3. Lack of functional requirements that are clearly defined and understood	4
4. Lack of defined and managed acquisition processes in the PEO/PMO	2
5. Lack of trust by OSD gatekeepers in the Component counterparts thus preventing them from delegating	2
6. The serial process of document approval by the several echelons of oversight	3
7. The lack of established architectures and the resulting need for unique C4ISP efforts	3

To arrive at a final top five list of cost drivers, the two drivers that received only two votes were eliminated from the list, and the list was prioritized using the simple average technique described above. The final prioritized cost drivers for cost oversight in the IT community are listed below:

1. Lack of functional requirements that are clearly defined and understood
2. Changing oversight requirements
3. The lack of established architecture and the resulting need for unique C4ISP efforts
4. The serial process of document approval by the several echelons of oversight
5. Negotiating viewpoints of the various stakeholders…acq. strategy re-do

According to the data, "the lack of clearly defined and understood functional requirements" is the number one cost driver for oversight within the IT community.

4.4 Question Two

From the PEO recommendation, to the DAB approval of the milestone, use your professional judgment and estimate how many TDYs are taken by one person to get one program through one Milestone.

The goal of question two was to find out how many TDYs are completed by one individual in one program to get through one milestone. The members were asked to provide a low, high and average, or most likely occurrence for this portion. This will allow us to establish a triangular distribution that will be used later for the data analysis

portion, as well as to allow us to estimate the low, average, and high costs of oversight for our comparison of the three different MDAP processes. Question two sets up our initial number in our algorithm to calculate the first portion of our cost of oversight model. Question two, three, and four will be multiplied to establish our travel estimate for the cost of oversight.

4.4.1 Question Two - Low Estimate

The low estimate for round one ranged from two TDYs to twelve TDYs, but that range shrunk significantly (seven to twelve TDYs) by the end of round four. Although the median stabilized between rounds two and three it shifted upwards to equal the mode that was set early on at an estimate of twelve TDYs. A consensus was not reached for this question, but the data shows very little difference between the mean, median, and mode for the total TDYs. The standard deviation by the end of round four was less than three. The results of the low estimates are listed in Table 4.2, shown below.

Table 4.2: Question Two - Low Estimate Results By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	2 to 12	12,2,4,12	7.50	8.00	12.00	5.26
2	4 to 12	12,4,10,12	9.50	11.00	12.00	3.79
3	6 to 12	12,6,10,12	10.00	11.00	12.00	2.83
4	7 to 12	12,7,12,12	10.75	12.00	12.00	2.50

4.4.2 Question Two - Average Estimate

The ranges for the average, or most likely, estimate doubled that of the low estimate during rounds one through four. There was a wide-range in the early rounds but that range was cut in half by the end of round four. Although the median increased throughout the process, the mode decreased from 24 to 20 with three of the four panel

members selecting 20. Again, consensus was not reached but the standard deviation was minimized. The results are listed in Table 4.3, shown below.

Table 4.3: Question Two - Average Estimate Results By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	4 to 24	24,4,5,24	14.25	14.50	24.00	11.27
2	6 to 24	24,6,15,20	16.25	17.50	NA	7.76
3	8 to 20	20,8,15,20	15.75	17.50	20.00	5.68
4	9 to 20	20,9,20,20	17.25	20.00	20.00	5.50

4.4.3 Question Two - High Estimate

The high estimate followed suit with the other two estimates. There was a difference of 40 at the end of round one but that range decreased to just 18 after the completion of round four. As the rounds continued, the sizes of the mean, median, and mode decreased as the range decreased while the standard deviation was minimized to the fullest by the end of the rounds. Again, the panelist did not reach a consensus, but three panel members estimated the same number. The results for the question two-high estimate are found below in Table 4.4.

Table 4.4: Question Two - High Estimate Results By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	8 to 48	48,8,10,48	28.50	29.00	48.00	22.53
2	10 to 48	48,10,20,30	27.00	25.00	NA	16.21
3	12 to 30	30,12,20,30	23.00	25.00	30.00	8.72
4	12 to 30	30,12,30,30	25.50	30.00	30.00	9.00

4.5 Question Three

Estimate how many people normally go TDY throughout the Milestone Decision process.

Question three established another portion of the travel estimate in our cost of oversight algorithm. The goal of question three is to find the number of personnel that actually go TDY during the milestone decision process. The respondents were given the

same instructions as was given with question two and the answers will be presented in the similar manner.

4.5.1 Question Three - Low Estimate

Question three's low estimate outcomes were not much difference from that of question two. Once again, the range from round one to round four decreased; however, take notice that member one and member four were the outliers. Member one began with a low estimate and kept it low throughout the Delphi process. Member four started out high and although the member dropped from 48 to 20, there is still a significant difference from the final estimate of member one. This is just one example of how the Delphi process is not completely successful at shortening the range of answers from the various experts. The various experiences of the panel members could be reasoning for the differences also. In the end, both the median and mode equaled five, and the mean was less than nine. The standard deviation is a bit high compared to the ending range but that is because of the two outliers mentioned earlier. Once again, no consensus was reached. The results of question three-low estimate are listed below in Table 4.5:

Table 4.5: Question Three - Low Estimate Results By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	3 to 48	3,3,5,48	14.75	4.00	3.00	22.19
2	3 to 40	3,3,5,40	12.75	4.00	3.00	18.19
3	3 to 40	3,4,5,40	13.00	4.50	3.00	18.02
4	4 to 20	4,5,5,20	8.50	5.00	5.00	7.68

4.5.2 Question Three - Average Estimate

The average estimate also had a wide range of values throughout the process. Unlike the low-estimates, the average estimates only had one panel member with a vast difference of opinion. While three of the panel members estimated 10 or below, panel

member four started out extremely higher than the other members of the panel. In the end, member four was still at least threes times higher than that of the other panel members. Because of the extreme difference, the standard deviation is somewhat high in comparison to the previous estimate. In this case, the safest estimate would have to be the mean.

Table 4.6: Question Three - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	6 to 70	6,6,10,70	23.00	8.00	6.00	31.39
2	6 to 60	10,6,10,60	21.50	10.00	10.00	25.74
3	6 to 60	10,6,10,60	21.50	10.00	10.00	25.74
4	7 to 30	10,7,10,30	14.25	10.00	10.00	10.59

4.5.3 Question Three - High Estimate

The high estimate results listed in table 4.7 show almost the same pattern that occurred with the low and average results. There was a wide range of estimates from 8 to 100 in the first round but in the final round, it ranged from 12 to 40. The mean, median, and mode hovered around the low twenties and a consensus was not reached. The results ended with a fairly high standard deviation at 11.94.

Table 4.7: Question Three - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	8 to 100	9,8,20,100	34.25	14.50	NA	44.17
2	8 to 80	20,8,20,80	32.00	20.00	20.00	32.50
3	12 to 80	20,12,20,80	33.00	20.00	20.00	31.56
4	12 to 40	20,12,20,40	23.00	20.00	20.00	11.94

4.6 Question Four

*What is your estimate of the cost for **each** person on **each** TDY?*

Question four provides the final number for the travel portion of the cost of oversight formula. By multiplying the estimates from questions two, three, and four, an

estimate for the cost of travel in the oversight process can be obtained. Question four will provide an actual dollar figure estimate for the cost of one TDY for one person on a team. Results are presented in the same format as previous questions.

4.6.1 Question Four - Low Estimate

Question four's low estimate began with a somewhat small range compared to that of previous questions, and closed out with a margin of only $200. Three of the four panel members estimated the TDY cost per person at $1,000 which made the median and mode equal to one another. The standard deviation was $100. The panel was only one member shy of reaching a consensus. All of the results can be seen in Table 4.8 below:

Table 4.8: Question Four - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$500 to $2000	$2000,$1000,$500.$1000	$1,125.00	$1,000.00	$1,000.00	$629.15
2	$1000 to $2000	$2000,$1000,$1000,$1000	$1,250.00	$1,000.00	$1,000.00	$500.00
3	$1000 to $1200	$1000,$1200,$1000,$1000	$1,050.00	$1,000.00	$1,000.00	$100.00
4	$1000 to $1200	$1000,$1200,$1000,$1000	$1,050.00	$1,000.00	$1,000.00	$100.00

4.6.2 Question Four - Average Estimate

The range for the average estimate is slightly higher than that of the low estimates in the beginning round, but the range closes substantially by the fourth round. And again, the estimates are just one panel member's estimate shy of reaching a consensus. However, the standard deviation decreased from $1,314 to only $250 which is an acceptable margin. The results are shown in Table 4.9 below.

Table 4.9: Question Four - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$1000 to $4000	$4000,$2000,$1000,$1500	$2,125.00	$1,750.00	NA	$1,314.98
2	$2000 to $4000	$4000,$2000,$2000,$2000	$2,500.00	$2,000.00	$2,000.00	$1,000.00
3	$1500 to $2000	$2000,$1500,$2000,$2000	$1,875.00	$2,000.00	$2,000.00	$250.00
4	$1500 to $2000	$2000,$1500,$2000,$2000	$1,875.00	$2,000.00	$2,000.00	$250.00

4.6.3 Question Four - High Estimate

The high estimate for question four had a relatively large range, seen in Table 4.10, but the range constantly reduced throughout all four rounds. The panel members had not reached a consensus. There were three different estimates at the end of round four. Results from the high estimates can be seen in Table 4.10.

Table 4.10: Question Four - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$1500 to $6000	$6000,$3000,$1500,$2000	$3,125.00	$2,500.00	NA	$2,015.56
2	$3000 to $6000	$6000,$3000,$3000,$3000	$3,750.00	$3,000.00	$3,000.00	$1,500.00
3	$3000 to $5000	$5000,$3000,$3000,$4000	$3,750.00	$3,500.00	$3,000.00	$957.43
4	$3000 to $4000	$4000,$3000,$3500,$4000	$3,625.00	$3,750.00	$4,000.00	$478.71

4.6.4 Travel Cost Estimate

With all the necessary data collected, it is now possible to develop an overall estimate for travel costs using the previously mentioned algorithm. To review, the travel cost estimate will be developed by multiplying the estimates from question two; the number of TDYs taken by one person, by the estimates from question three; the total number of persons who go TDY, by the estimates from question four; the cost per person for each TDY. The results can be seen below in Table 4.11.

Table 4.11: Estimates of Travel Cost for One Milestone

Questions 2-4 MEMBER	Travel-LOW	Travel-AVG	Travel-HIGH
1	$48,000.00	$400,000.00	$2,400,000.00
2	$42,000.00	$94,500.00	$432,000.00
3	$60,000.00	$400,000.00	$2,100,000.00
4	$240,000.00	$1,200,000.00	$4,800,000.00
MEAN	**$97,500.00**	**$523,625.00**	**$2,433,000.00**
STD DEV	**$95,294.28**	**$473,355.99**	**$1,799,876.66**

The estimates were calculated by member for low, average and high and then a mean and standard deviation was calculated for all five members for the low, average,

and high estimates. Based on the mean, the end result of four rounds of the Delphi was a travel estimate that ranges from $97.5K to $2.4M for one milestone.

4.7 Question Five

> *Estimate how many hours are spent on support for the DAB approval process per person, not including TDY travel time, but actual job performance while TDY or at home base. (Slide prep, meeting prep, etc)*

In question five, a new segment of the cost of oversight algorithm is started. Question five is the beginning of the personnel portion of the estimate. With question five, the goal is to find the number of hours personnel put in directly towards the DAB process.

4.7.1 Question Five - Low Estimate

The results, shown in Table 4.12, started off with a range of 12 which appears to be a moderate range. The range stabilized by round three, but the panelists were still unable to reach a consensus by the end or round four. With a standard deviation of two, the group managed to get three of the four members to agree on the same number of hours spent supporting the DAB. The median and mode were equal, and they were only one off from the mean. The complete results can be seen in Table 4.12:

Table 4.12: Question Five - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	4 to 16	4,8,15,16	10.75	11.50	NA	5.74
2	8 to 16	10,8,15,16	12.25	12.5	NA	3.86
3	10 to 16	10,10,12,16	12	11	10	2.83
4	12 to 16	12,12,12,16	13	12	12	2.00

4.7.2 Question Five - Average Estimate

The average estimates for question five is completely inconsistent throughout all of the rounds. The range of estimates from rounds one and four change by only six

hours. There was no mode during either of the rounds although the mean and median were equal by round four. The panel members were adamant about their initial estimates and did not make many changes to their first instinct. Only panel member one changed their initial estimate more than once throughout the rounds. Table 4.13 shows complete results below.

Table 4.13: Question Five - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	8 to 24	8,16,20,24	17.00	18	NA	6.83
2	15 to 24	15,16,20,24	18.75	18	NA	4.11
3	17 to 24	17,20,18,24	19.75	19	NA	3.10
4	14 to 24	18,14,20,24	19	19	NA	4.16

4.7.3 Question Five - High Estimate

As with the average estimates, the high estimates are very unstable. The range decreased by fourteen hours over the course of the Delphi process, but the panel members were still unable to come to a consensus. For the high estimate, there was a modal value of thirty hours. The mean, median and modal values were all within four hours of one another, and the standard deviation closed out at 4.90. Further results are shown in Table 4.14.

Table 4.14: Question Five - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	16 to 40	16,24,30,40	27.50	27.00	NA	10.12
2	24 to 40	25,24,30,40	29.75	27.5	NA	7.32
3	25 to 40	30,30,25,40	31.25	30	30	6.29
4	30 to 40	30,36,30,40	34	33	30	4.90

4.8 Question Six

Estimate how many people are normally involved with the preparation process.

Question six places an actual number of personnel into the second portion of the algorithm for cost of oversight. The number of personnel involved in the preparation process included those creating slides, preparing briefings, and supporting the DAB. The results are given in similar format as previous data collected.

4.8.1 Question Six - Low Estimate

The low estimate had a moderate range at the end of round one. However, the range began to decrease in round two and by round three the panelists were very close to a reaching consensus. By round four, the panel members had reached its first consensus during the process. Although it is not shown below in the table, the final estimate for all of the panel members was 6 hours. Below in Table 4.15, the results are shown.

Table 4.15: Question Six - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	3 to 15	3,4,15,4	6.50	4.00	4.00	5.69
2	3 to 10	5,3,10,6	6.35	5.50	NA	2.63
3	5 to 6	6,5,6,6	5.75	6.00	6.00	0.50
4	Reached Consensus					

4.8.2 Question Six - Average Estimate

Again the panel reached an overall consensus, but this time they did so at the end of round three. They determined that for the average estimate, 10 people were normally involved with the preparation process. All of the results can be seen below in Table 4.16.

Table 4.16: Question Six - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	6 to 20	6,8,20,6	10.00	7.00	6.00	6.73
2	8 to 15	10,8,15,10	10.75	10.00	10.00	2.99
3	Reached Consensus					

4.8.3 Question Six-High Estimate

The high estimate, seen below in Table 4.17, also ended up with a consensus by the end of round three. The panel decided that the high estimate for the number of people involved in preparation was 15.

Table 4.17: Question Six - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	9 to 25	9,12,25,12	14.50	12.00	12.00	7.14
2	12 to 20	15,12,20,14	15.25	14.50	NA	3.40
3	Reached Consensus					

4.9 Question Seven

Estimate the cost per hour for each person involved in the process.

Question Seven provides the last portion of the personnel cost estimate for the total cost of oversight. With the estimates provided in question seven, multiplied by the estimates given in questions five and six, the estimated forecast for the cost of personnel in the oversight process can be determined.

4.9.1 Question Seven - Low Estimate

In Table 4.18, the low estimates are provided. The estimates changed in the first two rounds and remained unchanged for the last two rounds. The standard deviation was reduced and leveled out after round three. The mean, median, and mode remained constant after round two. In the final round the mean, median and mode were all different, but were within a total of less than thirteen dollars.

Table 4.18: Question Seven - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$50 to $100	$60,$100,$50,$80	$ 72.50	$ 70.00	NA	$ 22.17
2	$70 to $100	$70,$100,$80,$80	$ 82.50	$ 80.00	$ 80.00	$ 12.58
3	$70 to $100	$70,$100,$100,$80	$ 87.50	$ 90.00	$ 100.00	$ 15.00
4	$70 to $100	$70,$100,$100,$80	$ 87.50	$ 90.00	$ 100.00	$ 15.00

4.9.2 Question Seven - Average Estimate

Although the ranges for question seven's average estimates begin a bit larger than that of the low estimates, the margin at the end was much smaller. By the end of round two, the panel members had almost reached a consensus, but the estimates of member four were very consistent throughout the process up to round three. Member four only made changes to the original estimate in round four. In the end, the mean was less than four dollars shy of the median and mode, and the standard deviation minimized to only 5. All of the results can be seen in Table 4.19.

Table 4.19: Question Seven - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$70 to $150	$150,$150,$70,$125	$ 123.75	$ 137.50	$ 150.00	$ 37.72
2	$120 to $150	$150,$150,$120,$125	$ 135.25	$ 137.50	$ 150.00	$ 16.01
3	$125 to $150	$150,$150,$150,$125	$ 143.75	$ 150.00	$ 150.00	$ 12.50
4	$140 to$150	$150,$150,$150,$140	$ 147.50	$ 150.00	$ 150.00	$ 5.00

4.9.3 Question Seven - High Estimate

The high estimate for question seven started out with a moderate range. There was not a mode in rounds one in two, but a mode was established and stabilized in round three. Over the four rounds both the mean and median grew, but the standard deviation fell throughout the process and finally minimized in round four at 47.26. One thing to notice about the high estimate was that most members made very few changes to their

initial estimates. Needless to say, a consensus for the high estimate was not reached. More details on the results can be seen in Table 4.20.

Table 4.20: Question Seven - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$100 to $300	$300,$200,$100,$220	$ 205.00	$ 210.00	NA	$ 82.26
2	$150 to $300	$300,$200,$150,$220	$ 217.50	$ 210.00	NA	$ 62.38
3	$200 to $300	$300,$200,$200,$220	$ 230.00	$ 210.00	$ 200.00	$ 47.61
4	$200 to $300	$300,$200,$200,$240	$ 235.00	$ 220.00	$ 200.00	$ 47.26

4.9.4 Personnel Cost Estimate

With all the necessary data collected, it is now possible to develop an overall estimate for personnel costs using the previously mentioned algorithm. The personnel cost estimate will be developed by multiplying the estimates from question five; the number of hours one person spends in support of a milestone review, by the estimates from question six; the total number of persons who support a milestone review, by the estimates from question seven; the cost for one person involved in the milestone review. The results can be seen below in Table 4.21.

Table 4.21: Estimates of Personnel Cost For One Milestone

Questions 5-7 MEMBER	Person-LOW	Person-AVG	Person-HIGH
1	$5,040.00	$27,000.00	$135,000.00
2	$7,200.00	$25,200.00	$129,600.00
3	$7,200.00	$30,000.00	$90,000.00
4	$7,680.00	$33,600.00	$144,000.00
MEAN	**$6,780.00**	**$28,950.00**	**$124,650.00**
STD DEV	**$1,181.86**	**$3,678.31**	**$23,851.42**

The estimates were calculated by member for low, average and high and then a mean and standard deviation was calculated for all five members for the low, average, and high estimates. Based on the mean, the end result of four rounds of the Delphi was a

personnel cost estimate that ranges from nearly $6.8K to almost $125K for one milestone.

4.10 Question Eight

> *Estimate how many meetings are normally held from the PEO preparation, through DAB approval. (This includes meetings while TDY or TDY prep meetings).*

Question eight provides insight on how meetings are included into the oversight process. By multiplying questions eight, nine, and ten, we will get an idea of what part meetings play in the cost of oversight. Question eight deals specifically with the number of meetings that are held during one milestone in a program. The results are listed in the following paragraphs.

4.10.1 Question Eight - Low Estimate

The low estimate for meetings held for PEO preparation began with a very wide range. The gap closed some throughout the Delphi process, but there was not a consensus in the end. Although a consensus was not reached, a mode of 15 was established by the end of round four and the standard deviation continued to decrease. At the end, the standard deviation minimized at 4.24. The results of the low estimates can be seen in its entirety in Table 4.22.

Table 4.22: Question Eight - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	3 to 48	48,3,10,9	17.50	9.50	NA	20.57
2	6 to 20	20,6,10,18	13.50	14.00	NA	6.61
3	7 to 20	20,7,10,18	13.75	14.00	NA	6.24
4	8 to 18	15,8,15,18	14.00	15.00	15.00	4.24

4.10.2 Question Eight - Average Estimate

Again, the average estimates compared to that of the low estimates at the beginning of the process. However, the average estimates never showed any signs of stabilization. A mode was never established and the standard deviation minimized at a high 12.18. The range (12 to 40) was still considerably high after the four rounds. Table 4.23 illustrates the lack of stability in the estimates.

Table 4.23: Question Eight - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	6 to 100	100,6,20,12	34.50	16.00	NA	44.04
2	10 to 75	75,10,20,34	34.75	27.00	NA	28.58
3	12 to 50	50,12,20,34	29.00	27.00	NA	16.69
4	12 to 40	40,12,25,34	27.75	29.50	NA	12.18

4.10.3 Question Eight - High Estimate

The high estimates for question eight are seen in Table 4.24. As the estimates for the low and average estimates, the high estimates are just as unstable. The estimates range from nine to two hundred in round one, and a mode is never established for the estimates. While the standard deviation stood at 28, the mean and median were 50 and 52 respectively. No consensus was reached in any of the estimates for question eight, but the results from the high estimates can be found in Table 4.24.

Table 4.24: Question Eight - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	9 to 200	200,9,30,18	64.25	24.00	NA	90.91
2	15 to 150	150,15,25,64	63.50	44.50	NA	61.42
3	15 to 100	100,15,30,64	52.25	47.00	NA	37.86
4	16 to 80	80,16,40,64	50.00	52.00	NA	28.00

4.11 Question Nine

What do you estimate as the length, in hours, for each meeting?

Question nine provides a length for each meeting, which will be multiplied by the number of meetings, provided in question eight and the cost per hour for each person attending, which will be provided in question ten. Question nine was an estimate that came in with relatively low standard deviations for each estimate, but overall, was not significantly volatile from one round to the next. Results are provided in the following three sub-paragraphs.

4.11.1 Question Nine - Low Estimate

The range for the low estimate in question nine was quite small (3) and was reduced even more by the end of the process. Only panel members changed their initial estimates throughout the rounds, but member 2 was the only one that made changes after round two. The panel members were short one estimate from a consensus in the end and the margin of separation of the estimates was only .5. The median and mode equaled each other and the mean differed by .12. The standard deviation was also very small. All of the results can be seen in Table 4.25.

Table 4.25: Question Nine - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	1 to 4	4,1,2,2	2.25	2.00	2.00	1.26
2	1 to 2	2,1,2,2	1.75	2.00	2.00	0.50
3	1.25 to 2	2,1.25,2,2	1.81	2.00	2.00	0.38
4	1.5 to 2	2,1.5,2,2	1.88	2.00	2.00	0.25

4.11.2 Question Nine - Average Estimate

Question nine's average estimate should a similar pattern in the range since it too was quite small. However, the two estimates were different because there was little

changes made from the initial estimates throughout the process and there were no same estimates. Therefore, no mode was established. There is little difference in the mean and median, and the standard deviation is also low. The statistics are favorable only because the range was small to begin with not because the members had a change of opinion. All of the results can be seen below in Table 4.26.

Table 4.26: Question Nine - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	2 to 8	8,2,4,3	4.25	3.50	NA	2.63
2	2 to 6	6,2,4,3	3.75	3.50	NA	1.71
3	2.5 to 5	5,2.5,4,3	3.63	3.50	NA	1.11
4	2.5 to 5	5,2.5,4,3	3.63	3.50	NA	1.11

4.11.3 Question Nine - High Estimate

The high estimate for question nine, located in Table 4.27 below, had a much wider range than that of the low and average estimates previously shown. Although the mean, median, and mode were equal and the standard deviation was at a low 3.27, the range was a bit wider than that of the low and average estimates. A consensus was not met for the high estimate but it would be safe to estimate eight hours as a high estimate for the length of a meeting.

Table 4.27: Question Nine - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	3 to 20	20,3,8,8	9.75	8.00	8.00	7.23
2	3 to 15	15,3,8,8	8.50	8.00	8.00	4.93
3	3.5 to 15	15,3.5,8,8	8.63	8.00	8.00	4.75
4	4 to 12	12,4,8,8	8.00	8.00	8.00	3.27

4.12 Question Ten

What is the cost per hour of each person involved in the meetings?

Question ten provided the cost per person to include in the final portion of the cost of oversight estimate for meetings conducted for a milestone. The results of question ten mirrored the results of question seven, due to both dealing with the cost of personnel per hour. The results will still be provided separately due to future discussion on the cost of oversight and the analysis portion of the thesis. The estimates will be provided in the same format as previous questions.

4.12.1 Question Ten - Low Estimate

The range for the cost per hour was changed very little during the process. In the end, the range only decreased by $20. Members of the panel made very few changes to their initial estimates. Although round three showed some promise when a mode was established, the final results of round four ended without an established mode. Round four ended with the standard deviation increasing from that established in round three. Members could not agree on an estimate; therefore, a consensus was not met for the low estimate. Results have been listed in Table 4.28.

Table 4.28: Question Ten - Low Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$50 to $125	$60,$100,$50,$125	$ 83.75	$ 80.00	NA	$ 34.97
2	$70 to $125	$70,$100,$80,$125	$ 93.75	$ 90.00	NA	$ 24.28
3	$70 to $125	$70,$100,$100,$125	$ 98.75	$ 100.00	$ 100.00	$ 22.50
4	$70 to $125	$70,$100,$125,$110	$ 101.25	$ 105.00	NA	$ 23.23

4.12.2 Question Ten - Average Estimate

Initially there was a very large range amongst the panel members and no mode had been established. However, by the third round the panel members had locked in their

estimates and established a mode. The median and mode were the same and the mean was less than three dollars different from the two. The standard deviation was also minimized at a low $5 per hour. The range had also decreased to only $10 and the panel three of the four panel members had reached an agreement on the overall high estimate cost, but that was still one member's estimate short of a consensus. The results can be seen below in Table 4.29.

Table 4.29: Question Ten - Average Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$70 to $200	$150,$200,$70,$140	140.00	145.00	NA	53.54
2	$120 to $200	$150,$200,$120,$140	152.50	145.00	NA	34.03
3	$140 to $150	$150,$150,$150,$140	147.50	150.00	150.00	5.00
4	$140 to $150	$150,$150,$150,$140	147.50	150.00	150.00	5.00

4.12.3 Question Ten - High Estimate

Panel members never really decided on a high estimate. The estimates had a wide range in the beginning and closed the gap some by the end of round four. Although the gap of the range reduced, there was no real stability between the panel members. There were a couple of occasions when a mode was established but in the end, there was no mode or consensus. The standard deviation was also high at the end of round four. Panel members were very confident with their estimate early on which shows in their responses. A complete listing of their responses can be found in Table 4.30.

Table 4.30: Question Ten - High Estimate By Round

Round	Range	Frequency (Member 1,2,3,4)	Mean	Median	Mode	Std Dev
1	$100 to $300	$300,$300,$100,$220	230.00	260.00	300.00	94.52
2	$150 to $230	$300,$300,$150,$230	245.00	265.00	300.00	71.41
3	$200 to $300	$300,$200,$200,$230	232.50	214.00	200.00	47.17
4	$230 to $300	$300,$200,$230,$240	242.50	235.00	NA	41.93

4.12.4 Meeting Cost Estimate

With all the necessary data collected, it is now almost possible to develop an overall estimate for the cost of all the meetings supporting the DAB milestone review process using the previously mentioned algorithm. The meeting cost estimate will be developed by multiplying the estimates from question eight; the number of meetings held from PEO preparation to DAB approval, by the estimates from question nine; the length in hours of each meeting, by the estimates from question ten; the cost for one person involved in one meeting. Using the algorithm, we are able to develop a cost estimate for one person at all of the meetings necessary to get through milestone approval. In order to come up with an estimate for the cost of all the meetings, the Delphi panel was asked to provide a low, medium and high estimate for the number of people who attend the meetings. The results can be seen below in Table 4.31.

Table 4.31: Estimated Number of People Attending Meetings for One Milestone

Member #	Low	Med	High
1	5	12	25
2	6	15	40
3	10	20	30
4	5	10	25
	Low	**Med**	**High**
Mean	6.50	14.25	30.00
Standard Dev	2.38	4.35	7.07

With all of the necessary today now available, the data was compiled and produced the following estimates for the cost of the meetings in support of one milestone.

Table 4.32: Estimate of Meeting Costs for One Milestone

Questions 8-11

MEMBER	Meeting-LOW	Meeting-AVG	Meeting-HIGH
1	$10,500.00	$360,000.00	$7,200,000.00
2	$7,200.00	$67,500.00	$512,000.00
3	$37,500.00	$300,000.00	$2,208,000.00
4	$19,800.00	$142,800.00	$3,072,000.00
MEAN	**$18,750.00**	**$217,575.00**	**$3,248,000.00**
STD DEV	**$13,590.81**	**$135,637.47**	**$2,841,160.33**

The estimates were calculated by member for low, average and high and then a mean and standard deviation was calculated for all five members for the low, average, and high estimates. Based on the mean, the end result of four rounds of the Delphi was a cost of meetings estimate that ranges from about $18.75K to nearly $3.25M for one milestone.

4.13 Summary of Results

Using a simple algorithm, we were able to develop estimates for the three major oversight cost portions of a milestone review for an IT or "virtual" MDAP. By adding these individual estimates together, we can arrive at an overall estimate for the cost of one milestone decision point. The results of summing the estimates for travel cost, personnel cost, and meeting cost can be seen below in Table 4.33.

Table 4.33: Estimates for Oversight Cost of One Milestone

Milestone Decision Point (MDP)

MEMBER	MDP Low	MDP Avg	MDP High
1	$63,540.00	$787,000.00	$9,735,000.00
2	$56,400.00	$187,200.00	$1,073,600.00
3	$104,700.00	$730,000.00	$4,398,000.00
4	$267,480.00	$1,376,400.00	$8,016,000.00
MEAN	**$123,030.00**	**$770,150.00**	**$5,805,650.00**
STD DEV	**$98,624.55**	**$486,232.36**	**$3,860,017.89**

The estimates for milestone costs were calculated in a similar manner to the estimates for travel, personnel and meetings which was by member for low, average and high and then a mean and standard deviation was calculated for all five members for the low, average, and high estimates. The mean statistic shows a milestone oversight cost range from almost $123K to over $5.8M. By itself, this statistic is interesting enough, however more value can be added by comparing this range to the range for oversight costs developed by the Oversight and Review PAT; "this team came up with an average estimate of $10-12 million for a single milestone and an estimate of $40-50 million for an entire joint acquisition program in 1994 dollars" (5:9). Using raw inflation indices, the ORPAT team's figures can be inflated to fiscal year 2003 dollars or the figures we developed could be brought back to 1994 dollars. We chose to calculate the latter and the results can be seen below in Table 4.34.

Table 4.34: FY2003 Milestone Oversight Costs Brought Back to FY1994 Dollars

Milestone Decision Point (MDP)-Adjusted Milestone	**MDP Low**	**MDP Avg**	**MDP High**
MEAN	$123,030.00	$770,150.00	$5,805,650.00
3080 Raw Indice (1994)	0.885	0.885	0.885
Adjusted Mean	**$108,881.55**	**$681,582.75**	**$5,138,000.25**

As the chart shows, the "high" milestone estimate is nearly half of the cost estimated by the ORPAT estimate when the dollars are the same. The procurement or 3080 index was used because we're dealing with the procurement of weapons systems. If the index for wages was used, the figure would be smaller since the military wage index is .750 and the civilian employee index is .738 (38:1).

After developing a milestone oversight cost estimate, a total program oversight cost estimate can be created quite easily. Our methodology for developing a total

program oversight cost was simply to multiply the milestone figures by three to represent the three milestones. The assumption here is that each milestone costs relatively the same. We decided to stick to that assumption because a whole series of research could be conducted on the cost difference from milestone to milestone. The results of our calculation for total milestone cost can be seen in Table 4.35 below.

Table 4.35: Estimates for Total Program Oversight Costs

Program MEMBER	Program Low	Program Avg	Program High
1	$190,620.00	$2,361,000.00	$29,205,000.00
2	$169,200.00	$561,600.00	$3,220,800.00
3	$314,100.00	$2,190,000.00	$13,194,000.00
4	$802,440.00	$4,129,200.00	$24,048,000.00
MEAN	**$369,090.00**	**$2,310,450.00**	**$17,416,950.00**
STD DEV	**$295,873.66**	**$1,458,697.07**	**$11,580,053.66**

Looking at the range on the mean we see a total program oversight cost estimate from a little over $369K to over $17.4M. Again, these results can be compared to the range developed by the ORPAT team of $40-$50 million. To make the comparison meaningful we again brought our figures back to 1994 dollars. The results can be seen in Table 4.36 below.

Table 4.36: FY2003 Total Oversight Costs Brought Back to FY1994 Dollars

Program	Program Low	Program Avg	Program High
MEAN	$369,090.00	$2,310,450.00	$17,416,950.00
3080 Raw Indice (1994)	0.885	0.885	0.885
Adjusted Mean	**$326,644.65**	**$2,044,748.25**	**$15,414,000.75**

The “high” program oversight cost estimate of just over $15.4M is still well below the estimate of $40-$50 million developed by the ORPAT. The ORPAT estimate however, may be on the high side since back when it was developed little information on the effectiveness of “virtual” acquisition programs were known.

The goal of the Delphi Method was to complete at least four rounds while trying to reach consensus. The objectives were clear for how consensus would be determined. The rule was met for all ten questions provided in the survey and all objectives for the data collection portion were met.

Now that the estimates have been provided, the information will be placed in statistical software as a database. Each respondent will have their estimates entered for each question. These estimates will be compared with other respondents from the theses research conducted by Rousseau (35:1) and DeReus (16:1). When comparing all of the estimates together, an analysis of variance test will be conducted by question, by type of regulatory guidance policy programs typically fall under (i.e., NSSAP 03-01, DoDD 5000 series, or Virtual oversight). Once this analysis has been completed, the results and analysis will be presented in chapter five to see if there truly is a difference in the cost of oversight among programs.

5.0 Analysis

5.1 Overview

The goal of Chapter 5 is to compare the results of the final round of Delphi surveys for each of the acquisition disciplines examined. The first section will contain a question by question statistical comparison of final responses submitted by the panel members. Using the methodology described in Chapter 3, a comparison of the three processes are conducted. Question one contains qualitative discussions for the cost drivers identified, but will list all drivers to complete the goal of research question three. Questions two through ten are quantitatively compared with a significance level of .05 for testing the null hypothesis of finding any statistical differences in the mean, for the forecast data collected. Each question will include a discussion on where the differences are and discuss some of the similarities among the different disciplines, answering research question two.

Recommendations for future research in oversight costs will be discussed in the final section. The final section will also provide any insights gained during this research which may help make our acquisition process function more efficiently. Finally, any future research efforts that could continue to build on this thesis will be provided to assist in defining the cost of oversight in MDAPs in the future

5.2 Question One

> *From the Program Executive Officer (PEO) request for a Defense Acquisition Board (DAB to the DAB milestone approval, what are the five major cost drivers in the oversight process?*

While the results from the Space programs focuses on TDY expense and salaries of contract employees, the results from the IT and "Box" programs focuses more on the

program and the acquisition processes. The cost drivers selected by the Box panel members were program driven. Multi-service programs, new programs, and program upgrades, especially technological upgrades were among the top cost drivers. Results from chapter four revealed that the IT community believed process and requirements changes were the main cost drivers. They also felt that trust between OSD and program leaders was an issue that drove cost higher. It seems that both the IT and Box programs have issues at a higher level than that of Space programs. The cost drivers identified by these two programs will require some directive changes to eliminate most of them, but the drivers identified by the Space panel members are at a lower level. TDYs can be managed by the PMs in most cases and they usually have some flexibility on the contract personnel hired to support the program. Because both the IT and Box programs are required to follow the guidelines established by the DoD 5000 series, they have more "red tape" that restricts their flexibility to eliminate the unnecessary obstacles throughout their MDA approval process, and the Space program has been given permission to establish its own guidelines to follow. By doing so, they have internally eliminated the "red tape". The top five cost drivers selected by each group of panel members are shown in table 5.1. In the table, the Box program is represented by DoDD 5000, Space is simply Space, and IT is C3I.

Table 5.1: Cost Drivers for Oversight Processes

Drivers Picked--DoD 5000	Rank
Program is Multi-Service	1
Whether Completely new system or just block upgrade	2
Number of Technologies going into the system	3
Number of Systems the System must interact with	4
Milestone B (requires most documents; 30 to be generated for review)	5
Drivers Picked--Space	**Rank**
Time away from primary responsibilities while supporting IPA at expense of rest of program	1
TDY from the program office IPA or IPA folks to program office	2
IPA Personnel Costs (Program Evaluation)	3
Salaries of IPA core members and "gray beard" members who are not government employees	4
IPA Travel/Per Diem costs (Team and support personnel)	5
Drivers Picked--C3I	**Rank**
Lack of functional requirements that are clearly defined and understood	1
Changing oversight requirements…changing personalities, policy etc.--requires climbing learning curve again	2
Lack of established architectures and the resulting need for unique C4ISP efforts	3
The serial process of document approval by the several echelons of oversight	4
Negotiating viewpoints of the various stakeholders…acq strategy re-do	4

5.3 Question Two

From the PEO recommendation, to the DAB approval of the milestone, use your professional judgment and estimate how many TDYs are taken by one person to get one program through one Milestone.

When comparing question two, there were statistical differences for all three oversight processes when comparing the Box and Space programs with the IT programs except for one (high estimate of the Box and IT programs). Table 5.2 shows that at all levels of the forecasts, none of the estimates for the Space program were statistically similar to IT oversight. However, the shaded area shows that the high estimate of the Box program is statistically similar to the high estimate of the IT program. Because both programs follow the same guidelines, the worst case scenarios should be somewhat similar which may be the reason the high estimates of the two programs are similar. Although one would expect the IT programs would have the least amount of TDYs throughout the approval process for each milestone, the data shows that the Space

program actually goes on fewer TDYs than both the IT and Box programs. This is ironic because under the IT process, program information is accessible to all interested parties.

Table 5.2: ANOVA for Question Two

Question 2	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0004	0.0038	0.0075
C3I vs 5000	0.008	0.0317	0.1766

5.4 Question Three

Estimate how many people normally go TDY throughout the Milestone Decision process.

In question three, there were not any significant statistical differences when looking for the number of people that actually go TDY in the MDA/KDP process. According to the information provided in table 5.3, there are no statistical differences between the different oversight processes in the number of people going TDY. Although every member in the IT approval process has access to program data, there is still a relatively higher number of people traveling in support of their programs during the MDA process. Therefore, contrary to what one might expect, the IT process has only a slightly lower number of people going TDY than that of either the Box or Space programs.

Table 5.3: ANOVA for Question Three

Question 3	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0811	0.1071	0.1345
C3I vs 5000	0.2769	0.2335	0.1612

5.5 Question Four

*What is your estimate of the cost for **each** person on **each** TDY?*

The results of question four when compared to the other two program types varied. The low estimate revealed that there were statistical differences between Space and IT; however, there were no statistical differences at the average and high estimates. On the other hand, there were no statistical differences with the Box program at the low estimate level, but there were statistical differences at both the average and high estimate levels. When comparing cost per person for the IT programs' personnel to that of the Box and Space programs, the comparisons are total opposites. Differences amongst the different program types are found in table 5.4.

Table 5.4: ANOVA for Question Four

Question 4	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0008	0.0582	0.1143
C3I vs 5000	0.4071	0.0123	0.0017

5.6 Question Five

Estimate how many hours are spent on support for the DAB approval process per person, not including TDY travel time, but actual job performance while TDY or at home base. (Slide prep, meeting prep, etc)

Question five results are located in Table 5.5 and it shows that there were statistical differences between IT and the other two programs at each estimate level. When comparing IT estimates with the Space estimates, the preparation hours were lower in the IT programs at the lower, average, and higher estimate levels. Information accessibility should be given credit for the differences. One would believe that the availability of program data to all concerned parties help eliminate the need for numerous

hours of meeting preparation. Any information that may be needed is already available. PMs would only have to prepare for the possible questions about the data that may need to be answered during the meeting.

The IT program's estimates were also lower than that of the Box programs. Once again the accessibility of the program data in the IT programs made the difference. The Box programs are usually overloaded with questions about their programs. Because miniscule details of the program data are held at the program office levels, PMs are required to flow that data to the upper levels of management. Therefore, they must spend more time preparing for meetings in order to be able to answer the questions that may come up during the meetings. The number of meetings required between each level of approval also contribute to the larger amount of time required for the Box programs. This is a significant finding because it shows potential cost reductions a virtual process may have if adopted by other programs.

Table 5.5: ANOVA for Question Five

Question 5	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0019	0.0012	0.0007
C3I vs 5000	0.0039	0.0003	0.0002

5.7 Question Six

Estimate how many people are normally involved with the preparation process.

Once again the statistical data reveals that the IT and Space programs are statistically different in all three estimates. Again, it is assumed that the virtual process of data availability used in the IT programs is the main reason for this difference. It is assumed that when data is available to everyone in the decision making process, there are

fewer people required to prepare that decision maker for a meeting because the information needed is at his or her fingertips. Based on the raw data, the number of people normally involved in the IT preparation process is lower than the Space and Box programs. Although the number of people involved in the preparation process in the IT program is lower than the Box programs, statistically, there are no differences between the two programs. Although it seems impossible, the two programs are required to follow the same DoD 5000 series' rules and regulations; therefore, the two programs should not be statistically different. The number of meetings required and the essential personnel are set by regulation which may explain the statistical similarities of the programs. The statistical comparisons of the programs are shown below in table 5.6.

Table 5.6: ANOVA for Question Six

Question 6	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0001	0.002	0.0001
C3I vs 5000	0.1906	0.1331	0.0587

5.8 Question Seven

Estimate the cost per hour for each person involved in the process.

For the most part, there is a significant difference between IT and Space and IT and Box programs. However, there is no statistical difference between the IT and Space programs for the high estimates. The raw data shows that estimates for the lower and average cost were higher for IT programs, but the high estimates of the two programs were somewhat closer in terms of dollars. However, the results for the IT program are significantly higher in all areas than the Box estimates. These differences may be due to the pay grades involved. While Box programs generally have lower grades involved in

the preparation process to get the PMs prepared for meetings, IT managers uses the virtual network to get the necessary information. And although less hours are spent preparing for meetings, the cost per hour is higher; therefore, the cost per hour will be significantly higher for the IT program. The statistical comparisons of the different programs can be seen below in table 5.7.

Table 5.7: ANOVA for Question Seven

Question 7	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.003	0.0001	0.2178
C3I vs 5000	0.0012	0.0001	0.0004

5.9 Question Eight

Estimate how many meetings are normally held from the PEO preparation, through DAB approval. (This includes meetings TDY or TDY prep meetings).

Of all the comparisons, there was a single statistical significance found. When comparing the means in the ANOVA test, the low estimates for the Space and IT programs there was a significant statistical difference. Although the other comparisons did not show any differences at the .05 significance level, there were still some notable differences when reviewing the main data collected. Both the IT and Space programs had a low number of meetings while the Box programs continued to show a large number of meetings held during the MDA approval process. One might conclude that the waivers to the DoD 5000 series' procedures obtained by these two programs allowed them to streamline the meetings being held to obtain MDA and KDP approval. However, based on the results, there are no statistical differences between the number of meetings held in IT programs and either Space or Box programs. The differences will appear when

dollar values are placed on those meetings held by each program. Comparisons of the three program's number of meetings held are shown in table 5.8 below.

Table 5.8: ANOVA for Question Eight

Question 8	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0372	0.1248	0.1306
C3I vs 5000	0.1129	0.2234	0.2686

5.10 Question Nine

What do you estimate as the length, in hours, for each meeting?

Comparisons for the estimated length of meetings between IT and Space as well as between IT and Box programs are shown in table 5.9. The results shows there are no statistical differences in either comparison. As a matter of fact, the mean of the IT and Space programs are identical. Although the raw data for total time required for meetings show differences amongst the programs, the statistical data of the mean shows there is not enough evidence to prove a statistical difference.

Table 5.9: ANOVA for Question Nine

Question 9	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0601	1.00	0.6963
C3I vs 5000	0.2977	0.3489	0.3326

5.11 Question Ten

What is the cost per hour of each person involved in the meetings?

Once again, there appear to be statistical differences between IT programs and that of the Space and Box programs. Only the high estimates of IT and Space programs show no statistical differences. The meeting cost per hour for the IT programs are significantly higher than both the Space and Box programs. In some instances, the IT

cost nearly doubles and sometimes triples the cost of the other programs. However, at the high estimate level there is not enough statistical evidence to prove a difference between the IT and Space programs. The pay grades of the individuals attending these meetings must again be attributed for the significant differences between the programs. Since most of the pre-meetings are eliminated from use of the real-time virtual database, high level personnel meet to make the decisions necessary for program progression. Although the raw data is not shown, table 5.10 shows the statistical data for the means.

Table 5.10: ANOVA for Question Ten

Question 10	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
C3I vs Space	0.0028	0.0001	0.1008
C3I vs 5000	0.0026	0.0001	0.0002

5.12 Summary of Results

Overall, the three research questions that were stated as goals for this thesis have been answered. The total cost of oversight has been calculated as an estimate for the MDA process under the RIT Pilot Study process, the top five cost drivers have been identified, and finally, when compared to the other processes, the research question dealing with any statistical differences in the cost of oversight between the different oversight processes has been answered for all but one combination; total cost comparison.

After getting answers to the other questions, a final comparison for the total cost of oversight was taken to determine if there were any statistical differences between the three program types. Given our assumptions from chapter one, results of the analysis

show no statistical differences for the cost of oversight between the programs. Results of the analysis are shown in table 5.11 below.

Table 5.11: ANOVA for Total Cost Comparison

Total Cost	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.1625	0.1932	0.5188
Space vs 5000	0.1393	0.117	0.1629
5000 vs C3I	0.1655	0.1557	0.343

Although no statistical differences were shown when the data was analyzed, the ranges for total cost were very different. The total range of cost, estimated by the panel members for the three programs, was as low as $82K to as high as $94M. A complete look at the ranges can be found in table 5.12.

Table 5.12: Total Cost Ranges by Oversight Process within Range

Process	Low Range	Average Range	High Range
C3I	$201,000 to $861,840	$696,600 to $4,471,920	$3,028,800 to $52,605,000
Space	$82,434 to $222,000	$1,271,250 to $1,779,187	$11,443,500 to $26,019,000
5000	$417,600 to $8,581,680	$3,219,960 to $27,931,500	$11,838,240 to 94,968,000

With such a range of cost, it is inevitable that each process has its own cost savings potential. Table 5.13 shows the means of the total program cost. As you can see the Space program has the lowest average for the total program cost; but in the following section, recommendations to reduce cost even lower will be made.

Table 5.13: Average (Mean) Total Cost by Program

Process	Low Range	Average Range	High Range
C3I	$399,735	$2,777,505	$23,679,750
Space	$146,379.75	$1,534,359.38	$15,979,687.50
5000	$3,758,590.08	$13,417,272	$44,211,936

5.13 Recommendations

After calculating the total costs for the IT process and comparing those costs with the Space and Box programs, perhaps there is a way to reduce the overall program cost for all programs if processes are taken from the programs with the least amount of oversight cost. The results show that the Space program has the lowest TDY and meeting cost and the IT program has the lowest preparation cost. By combining some of the Space and IT procedures, there may be evidence that the total oversight cost can be reduced. Therefore, I would recommend using the IPA process but the virtual accessibility of the program data should also be incorporated into the process. This process should produce the least amount of cost based on the comparisons made from this study and the studies conducted by DeReus (16:1) and Rousseau (35:1). If these changes are made for all programs in the acquisition process, there is much potential for the overall program cost to decrease. Of the three programs, the mean total program cost for the Space program was lower in each of the categories, low, average and high cost estimates. However, if you used the overall meeting and travel cost from the original Space program numbers and add that number to the personnel cost from the IT program, DoD could realize some savings in oversight cost. Although more research in this area would need to be done to validate this proposal, by implementing a virtual database into the Space programs' acquisition process the total program cost for program oversight can be reduced by as little as $55K to more than $4.5M. The funds can be realized either directly or indirectly by saving man-hours or actual bottom-line budget savings. Either way, some sort of live program test or feasibility study should be performed. An example of the potential oversight cost savings are shown in table 5.14.

Table 5.14: Potential Cost Reductions with IPA + Virtual Database

Process	Low Range	Average Range	High Range
Space	$146,379.75	$1,534,359.38	$15,979,687.50
Space/Virtual	$91,404.75	$865,771.88	$11,475,450.00
Potential Savings	**$54,975.00**	**$668,587.50**	**$4,504,237.50**

5.14 Follow-on Possibilities

This research was just a beginning. This study produced a baseline to calculating the cost of oversight for a major defense acquisition program, but there is a lot of potential for further research in this area. A study of the Ballistic Missile Defense Agency's acquisition process in comparison of the IT, Space, and Box programs could be conducted. Cost oversight below the PM level can also be researched to determine if there is potential to save additional funds by streamlining the oversight. Because this study focused only on Air Force programs, further studies can be conducted for the cost of oversight of the sister services (i.e. Army, Navy, and Marines). A study that compares the oversight costs of the Air Force and its sister services is another research project. These are just a few of the endless possibilities of research in this area. This research has provided a basic way to identify oversight cost within MDAPs.

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Vita

Captain Monroe Neal, Jr. was born in Peoria, Illinois but grew up in Waynesboro, Mississippi and graduated from Wayne County High School. In the fall of 1994, he joined the Air Force Reserve Officer Training Corp at the University of Mississippi in Oxford, Mississippi. Captain Neal graduated with a Bachelors of Business Administration in August 1996 and he was also commissioned as a Second Lieutenant in the United States Air Force the same day.

Captain Neal began his active duty career at Barksdale AFB, Louisiana where he was assigned to the 2nd Comptroller Squadron. During his tenure at Barksdale, Capt Neal served as two years as the Financial Services Officer and one year as the 2nd Operations Group budget analyst. In the fall of 1999, he was transferred to the Air Warning and Control Systems (AWACS) Program Office at Hanscom AFB, MA. While at Hanscom, Captain Neal was the Financial Specialist for the Block 30/35 modification upgrade and initial spares budget analyst for the entire AWACS fleet. He also spent 18 months in the Plans and Programs System Program Office (SPO) as Chief of Programming and Budgeting. In August 2002, Captain entered the Air Force Institute of Technology (AFIT), Wright Patterson AFB, OH. Upon graduation, Captain Neal will be assigned to the Special Operations SPO at Wright Patterson AFB, OH.

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14. ABSTRACT

The Department of Defense standardized the acquisitions process in the early 1970s by introducing the first version of the Department of Defense Directive 5000 (DoD 5000). The DoD 5000 established oversight forums and groups to ensure the policies and procedures created were followed. These oversight forums track a program's progress throughout the milestone process and identified programs in trouble. Changes to the DoD 5000 have been made because of political and economical changes over the years. However, few studies have been conducted to estimate the cost of oversight, and no one knows, for sure, how much this oversight process costs individual programs throughout its life cycle. There are several oversight processes being used today, but research has been done to determine if one form is statistically better than the other. Nor have studies been done to determine the cost drivers for oversight.

This thesis will provide a foundation and potential cost saving recommendations that would benefit the Department of Defense in most of the acquisition programs it monitors. The cost of oversight will be forecasted based on a panel of experts in the field, using the Delphi Methodology. These costs will then compare with the oversight processes for the Department of Defense Directive 5000 and the new National Security Space Policy for acquisitions. Total costs for the three oversight processes will then provide insight on where cost benefits appear, based on collected data. A future track for the next generation of oversight processes will develop from the recommendations.

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