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Comparative Analysis on the Cost of Oversight for the New National Security Space Acquisition Policy- A Delphi Method Approach

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COMPARATIVE ANALYSIS ON THE COST OF OVERSIGHT FOR THE NEW NATIONAL SECURITY SPACE ACQUISITION POLICY—A DELPHI METHOD APPROACH

THESIS

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COMPARATIVE ANALYSIS ON THE COST OF OVERSIGHT

FOR THE NEW NATIONAL SECURITY SPACE ACQUISITION

POLICY—A DELPHI METHOD APPROACH

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Abstract

For the past 50 years, the military's use of space for our national defense has increased exponentially. The use of space has increased so much that recent events have led to the approval for most space Major Defense Acquisition Programs to fall under their own process of oversight to track and monitor these programs. The largest reason for this change is due to the difference in spending profiles and current acquisition regulations that are not structured to meet these space expenditure plans. The key problem is no one knows, for sure, how much the oversight process actually costs and if one form of oversight is actually statistically better than the other. If the other processes are better, what actually drives the cost for their 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 other oversight processes for the Department of Defense Directive 5000 and the Command, Control, Communication, and Intelligence new virtual process, to discover where the statistical differences are in the cost of oversight. The total costs for all three oversight processes will then provide insight on where the largest cost benefits appear to be, based on data collected, and recommendations will develop a future track for the next generation of oversight processes.

To my wife and my beautiful children.
Thank you for putting up with me
and supporting me for these past 18 months

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Darrin L. DeReus

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COMPARATIVE ANALYSIS ON THE COST OF OVERSIGHT FOR THE NEW NATIONAL SECURITY SPACE ACQUISITION POLICY—A DELPHI METHOD APPROACH

1.0 Introduction

1.1 Overview

Space has been an important part of today's military operations. It is hard to imagine a military engagement in OPERATION ENDURING FREEDOM or OPERATION IRAQI FREEDOM that did not involve military technologies in space. From the collection of intelligence, the communication of information, the positioning of ground troops, the target selection, the bomb positioning via global positioning guidance systems, and the post impact analysis, space applications are involved in every step. Moving into the future, space will be even more necessary to ensure the United States' national security. Increases in the need for communication and intelligence satellites and the need for the Ballistic Missile Defense System places additional stresses on an already stretched budget. There is a need to make sure every dollar is being spent properly and prudently.

With the creation of a new process for all space acquisition programs, there is hope that the needed space systems will be procured cheaper and easier through a new acquisition process. The process will decentralize the acquisition procurement process by moving more decisions to the lower levels of government. The problem with the new oversight process is that no one knows if it actually saves money and if oversight is better when it is centralized or decentralized.

This thesis will use the Delphi Method of forecasting to estimate the cost of oversight for space acquisition in the new National Security Space Acquisition Policy (NSSAP) 03-01. By using experts in the space acquisition field, an estimate of oversight costs will be established and compared to other acquisition processes. The goal will be to evaluate if the perception of new streamlining reforms are taking affect and benefiting the acquisition oversight processes as well as identifying the five main cost drivers. The struggle between centralized and decentralized oversight has lasted for the last 60 years, and this thesis will provide insight to whether the streamlining efforts to decentralize the current space acquisition procedures are being accepted by those using the new NSSAP 03-01 process.

Even prior to the Air Force's existence, the oversight process has been a constantly fluctuating process that moved from decentralization to centralization of control and oversight. This chapter will introduce the background of the problem and show how this research is needed in the National Security Space Acquisition environment. This chapter will provide a brief history of current knowledge and will list all assumptions for establishing the boundaries for the research.

1.2 Background

Twenty-one years prior to the creation of the Air Force, the oversight of acquisition programs was left to the local level managers. In 1947, with the creation of the Air Force, the first Secretary of the Air Force, Stuart Symington, established a centralized procurement system (5:9). By changing the location of oversight approval authority, a precedent had been set that continues to be inherent in today's acquisition oversight process; the struggle for oversight control. For the next 56 years, the oversight process changed from centralized to decentralized and back again 10 times; only 19 percent of the time was spent decentralized. The most recent change was to create a new National Security Space Acquisition Policy that gives the Director of the National Reconnaissance Office (DNRO)/Under Secretary of the Air Force (USecAF) the decentralized control to make the key decisions. The new process decentralizes the decision making process and potentially streamlines the approval process of space programs going through major milestones in their program lifecycles. This step, however, is just a potential round in the fight for oversight. To place the struggle visually, Figure 1.1 shows the length of time the acquisition process has remained in the decentralization model, starting in 1926. When the process is decentralized, the points are at zero.

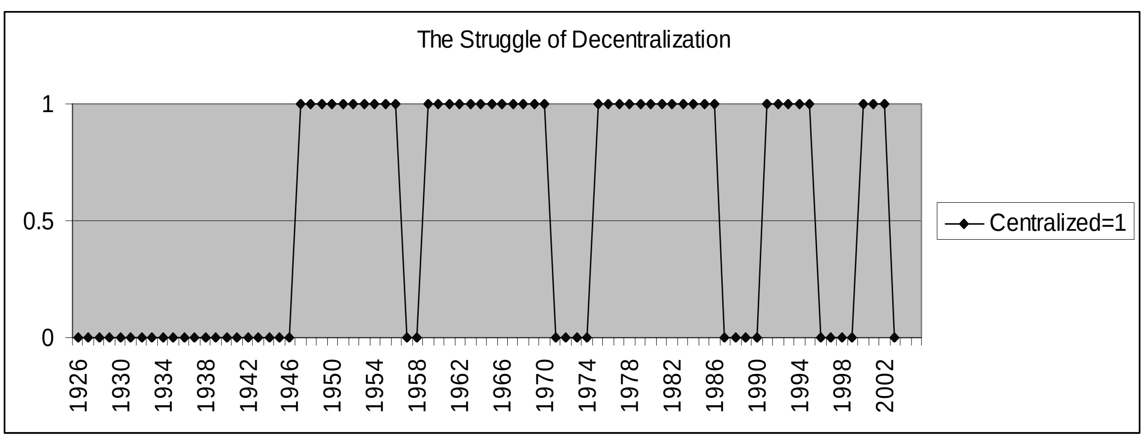

Figure 1.1: The Struggle for Decentralization

If the decentralization of government actually provides cost savings, why is it that the maximum time spent in decentralization, other than pre-World War II, is four years? Does loosening centralized control make it easier and faster to procure weapon systems and does that outweigh the possible increased costs of fraud? Is there a perceived difference in the actual cost of performing the oversight between the centralized, or standard DoDD 5000.1, and the new National Security Space Acquisition Policy?

1.3 Problem

This research will answer three questions and provide insight to the answers of those questions. There are three questions that will be addressed in the research.

1. According to experts in the field, what is the estimated cost of oversight for a space acquisition program under the NSSAP 03-01 IPA oversight process?
2. How does the cost of oversight for space programs compare to the cost of oversight for programs under the DoDD 5000 series and the virtual acquisition processes?
3. What are the five main cost drivers for the oversight of space acquisition programs?

The Key Decision Points (KDP) will be the primary measure for establishing costs for oversight. These are the points in the acquisition program when a major decision must be made to judge if a space system can move forward. For each KDP, experienced people whom do not specifically have a major stake in the program being reviewed must perform an Integrated Program Assessment (IPA). If the IPA finds, through its independent review, that there is a problem, the program must either be fixed prior to moving forward, or can move forward, with approval from the DNRO/USecAF, with an approved plan for fixing the program. The IPA process occurs a minimum of three times in a program's life-cycle.

The IPA process is what will control the length of time the program spends in the KDP. The process takes approximately 180 days, not including the initial start of the Independent Cost Analysis/Estimate (ICA/E). Since this thesis will only cover the IPA process from day 10 forward to completion, the only part of the ICA/E covered are the portions included in the standard IPA process.

1.4 Summary of Current Knowledge

Knowing that the process of decentralization has been fought for over 56 years, the main focus now shifts to one distinct question: exactly why is the establishment of the cost of the new oversight process so important? Over the past 56 years, with the revisions of the acquisition process, whether it was centralized or decentralized, the revision added or subtracted points in the oversight that cost or gained the program because of the change in time for the decision. These results could have been positive or negative, but no true comparison currently exists. For the DoDD 5000 series, the oversight process is a series of decision points that must be met in order for that program to progress through the acquisition lifecycle. In order to accomplish this, several meetings with various stakeholders, members, and principal decision makers must occur. There is normally a schedule produced with estimated completion dates set for each meeting. In 1994, the Acquisition Reform Process Action Team estimated that it cost $10-12 million dollars in oversight for a program to pass through one decision point (17:9). This cost was taken over three programs and the exact nature of the programs could not be ascertained. Since this dollar figure is nine years old, the figure will be adjusted with average inflation rates in Chapter 2 to reflect current dollar amounts. This does provide a comparative baseline when completing the analysis and the establishment of the IPA cost of oversight.

In the *Report of the Commission to Assess United States National Security Space Management and Organization* (11), the Commission focused on the need to restructure the space acquisition process through the reorganization and decentralization of oversight. The main reason for this reorganization is the differences between a normal Major Defense Acquisition Program (MDAP) and a Space MDAP. The normal system prepares its lifecycle for an increased cost in the production and development cycle as well as the operations and support cycles.

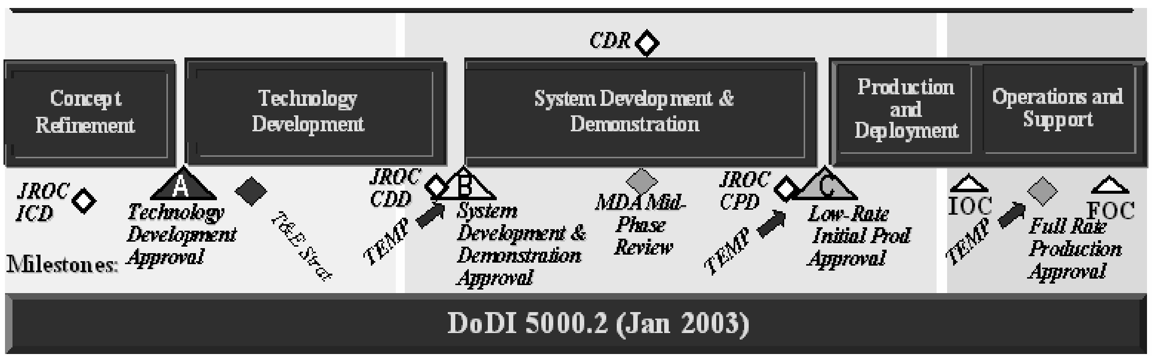

Figure 1.2: Milestone Decision Points for DoDD 5000.1 (33:14)

Addressing Figure 1.2, the points of interest are the triangles marked A, B, and C. At these points are the major milestones when key decisions are made and the process of oversight will be measured and compared. When this process is compared to the new NSSAP, the differences caused by the nature of the acquisition and the differences in the life cycles are immediately apparent.

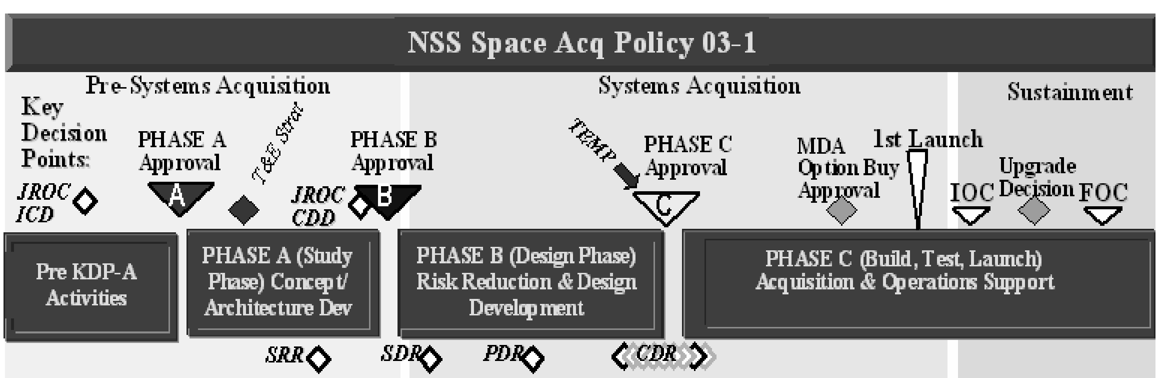

Figure 1.3: National Security Space Acquisition Policy 03-01 KDP (33:14)

A review of the literature revealed several articles on the revisions and the history of the acquisition process, with only one discovery that briefly mentioned the actual cost of oversight, the Acquisition Reform Process Action Team (17), mentioned earlier. Although these pieces of literature provide a historical perspective and allow the tracking of the oversight process changes over time, it is the goal of this thesis to establish the actual cost of the oversight process in the new NSSAP 03-01.

1.5 Assumptions

Several assumptions are relevant for the present research. First, one KDP will be similar to the next. Since the process takes 180 days, only one process will be reviewed. This assumption will allow for an easy calculation to equate to the entire program cost. The next assumption is that the oversight process will be limited from the Program Executive Officer to the Director/NRO. This will allow for a traceable medium in which the time the Program Manager is spending in meetings for the IPA will be gathered. This will also allow for smooth comparisons with the other forms of oversight when placed for comparison. Another assumption for the comparative analysis is that the variances are all equal. This will enable a simplistic comparison when conducting the analysis of variance testing.

1.6 Scope

This research sets out to find the cost of oversight as perceived by those experts extensively involved in the space acquisition process. The estimates will be obtained by querying a panel of experts, who will remain anonymous, with questions that will ultimately provide a group consensus on the cost of oversight to get one program through one KDP. The panel of experts will be asked to estimate from the PEO to the final decision member, which is the USecAF, the cost of all meetings, support, temporary duty costs, everything involved with the oversight to get a space program through an IPA with an approval. The costs will be compared to a report filed in 1994 by the Acquisition Reform Process Action Team (17), the DoDD 5000 series research, conducted by Captain Gary Rousseau (40); and the C3I RIT (Virtual Process) research, conducted by Captain Monroe Neal (32). The comparison will show if perception of the streamlining of the acquisition oversight processes have been accepted fully by the respective acquisition panel experts.

The process will not include anything below the PEO level and will not go higher than the DNRO/USecAF. This will allow for a normalized comparison between the other programs being researched by Captain Rousseau and Capt Neal. The oversight process will be reviewed. This research will not include external influences on the oversight process. These external influences are the budget, the requirements and generation process, and other congressional/political processes that inherently affect programs and their everyday oversight operations. The focus of this research is to establish an estimate of the cost of oversight for the NSSAP 03-01. The goal is to set the framework and the foundation for future research for the cost of oversight.

The research will stop once sufficient data has been collected from at least one KDP going through the IPA process, as described in NSSAP 03-01. Once the framework has been established, the research will conclude with the analysis of the results and the conclusion of the findings. The possibility of future research on this topic is expected.

1.7 Standards

Since this is a new direction in the research on oversight. With the list of assumptions and the scope of the research, the goal will always be maintained: establish the foundation for the cost of oversight for the NSSAP 03-01 acquisition IPAT KDP process. The comparison with the 1994 Process Action Team will be necessary to equate their cost figures to the cost figures gathered in this research. The comparison with the research conducted by Captain Rousseau and Captain Neal will provide insight in testing for differences among the separate acquisition processes.

1.8 Summary of Thesis

The collection of information is the most vital portion of the research. After reviewing the proposal, the literature review will provide the background of the history of oversight and the research conducted on the acquisition cycle. The third chapter will provide the methodology for gathering data, the use of the Delphi method, and how the research focus will be maintained. The fourth chapter will display the results of the results from following the Delphi methodology and will lead to the fifth chapter where all analysis will be completed and all comparisons will be made.

2.0 Literature Review

2.1 Overview

As of 31 December 2002, there are 72 categorized major defense acquisition programs (MDAPs) in the Department of Defense (DoD) (20). These programs currently total over $1.12 trillion dollars of taxpayer's money (20). Of these programs, seven are considered space programs, not including the Ballistic Missile Defense Program (20). These seven programs, as of December 2003, totaled $35.79 billion. Although these programs constitute only three percent of the total programs listed in the Selected Acquisition Report (SAR), recent changes place several of them under new oversight guidance. These changes will alter the way all space programs are managed and tracked in the future.

A literature search for background and pertinent information revealed limited research on the actual cost of oversight for MDAPs. Several documents addressed contract oversight, but only one touched on actual cost of oversight reviews. The common theme found in the research uncovered a historical chronological struggle with the centralization and decentralization of oversight on the acquisition process.

This chapter covers topics ranging from the beginning of Air Force acquisitions, when space programs began, and the beginning of the Department of Defense Directive (DoDD) 5000 and its reforms. It also contains a brief history of space acquisitions and recognizing the need for change. The chapter will show the realigning of space acquisitions and seeing if the new acquisition process really worked.

2.2 The Beginning of the Air Force Acquisition Process

Prior to World War II, most defense acquisition processes were handled by the Dayton, Ohio Air Corps' Materiel Division. "Although some key decisions were made in Washington, DC, the Materiel Division played a critical role in fostering the development of American aviation…" (5:1). At that time, it was believed that most of the oversight could be handled locally and that only during key decision times should Washington, DC be involved. The remainder of the time, local leaders were expected to implement the procedures for procuring weapons systems.

In 1941, the Materiel Division split. The Army created the Air Corps Maintenance Command and in 1942, headquarters moved to Patterson Field (5:7). Research, Development, Testing & Evaluation (RDT&E) became Materiel Command in 1942 and moved to Wright Field in 1943 (5:7). This move placed acquisitions and logistics functions in practically the same location.

According to Benson, the move in 1943 created "confusion and duplication" (5:7). In 1944 the two commands were merged to become the Army Air Force Air Technical Service Command, and settled at Patterson Field, which was located only a few blocks away from Wright Field. At this time "much of the authority over acquisition matters remained in Washington" (5:7).

With the end of World War II and the creation of the Air Force in 1947, a centralized procurement system was planned by the first Secretary of the Air Force, Stuart Symington. The goal was "to perform three pair of core functions: (1) research and development, (2) supply and maintenance, and (3) procurement and industrial planning" (5:9). This decision created the Air Materiel Command.

In the 1950s, the Research and Development Command was created at Wright-Patterson Air Force Base, Ohio, which had merged earlier in 1948. It was developed from existing infrastructure and missions. Later that same year, it was renamed the "Air Research and Development Command (ARDC)…the new command moved its headquarters to Baltimore, Maryland, in June 1951" (5:10). During this time, space was starting to be explored as a new frontier for the United States. A new acquisition process had to be initiated in order to maintain the security of the United States in the new space environment and ensure that the weapon systems met the goals of the United States' security policies.

2.3 Space Acquisition Programs Begin

From the beginning of space exploration in the 1950s to today, space programs have followed the standard MDAP acquisition cycle. Only in cases of secret, or "black world", operations have there been any differences between the acquisition procedures of the two. This section discusses the beginning of space program acquisitions for "open" programs in the military. The "black world" operations will be discussed in a separate section.

In the 1950s, a new organization designated the Weapon System Program Office (WSPO) was created. "WSPOs pulled together members of ARDC, AMC, and (the) operational command(s) who would use the system….WSPOs also maintained close liaison with the contractors involved" (5:12). The use of the word "Weapon" in WSPO's indicated that all weapon systems would be included; missiles, aircraft, and new space technologies. This weapons systems approach was based on a new acquisition strategy called "concurrency" (5:12). With new threats of nuclear missiles placed in countries that could reach the United States, there was a need for intermediate range and intercontinental ballistic missiles (IRBMs and ICBMs) and to acquire them as quick as possible. The concurrency process enveloped all of the previous acquisition steps into overlapped procedures carried out in a coordinated effort that was “reminiscent of the streamlined procurement of World War II” (5:13). Additional problems, in this case, included the need for the new technology and the uncertainty of space.

To address the uncertainty of space and to explore the space frontier, the Air Force Ballistic Missile Division was created in 1957 (31:10). The Ballistic Missile Division managed programs including the Thor IRBM and the WS-117L reconnaissance satellite program. The Ballistic Missile Division had the luxury of funding priority after the launch of the Soviet satellite “Sputnik” in 1957 (5:13). With this funding priority, the Ballistic Missile Division developed and deployed missiles and subsystems, built launch sites and support equipment, and trained crews; all simultaneously. “Although this effort…led to cost overruns, extensive modifications, and unrealistic training, it truly achieved the goal of giving the United States a ballistic missile deterrent as soon as possible” (5:14).

In 1951, the test and evaluation portion of the acquisition process had split into seven phases; in 1956, it increased to eight (5:14). The Air Force recognized the need to cut the costs included with the extensive oversight process. In 1957, to “help expedite production decisions” (5:14), the Air Proving Command was abolished and in 1958, the eight-phase test portion was changed to a three-phase system.

In 1958, the National Aeronautics and Space Administration (NASA) was activated as a non-DoD agency for the peaceful exploration of space by the United States

(27:11). With this new agency, the military was allowed to play an important support role in scientific programs and offered several assets to the new agency.

In 1959, "Headquarters Air Force formed the Weapon Systems Management Study Group" (5:15). The goal was to review the current acquisition cycles and the issue of concurrency. The group reached compromises that resulted in the "better defining authority at each stage of the acquisition strategy" (5:15). The group created a new series of acquisition regulations and renamed the WSPO the System Program Office (SPO). This movement "recognized the growing importance of C3, surveillance, and other technologies that supported the war-fighter (5:15).

In 1961, there was "an offer the Air Force couldn't refuse," the control and responsibility for military space programs. This control came with the condition that the current acquisition process had to change to better handle the unique mission of space. By 1963, however, the new oversight in the acquisition process had become burdensome. "At the top was the Office of the Secretary of Defense (OSD) and its new requirements for cost effectiveness data and disciplined programming and budgeting schedules" (5:16). The oversight seemed to trickle down the process until it reached the contractor. The new processes made programming and budgeting difficult and the new scope of the programs "made cost predictions difficult and led to unrealistic bids" (5:16). Another problem was the increased number of reports, audits, proposals, studies and the other oversight items requested by OSD.

In 1969, after several cost overruns and under Congressional pressure, President Nixon commissioned a round of acquisition reforms. Then Deputy Secretary of Defense, David Packard, was chosen to lead these efforts. The result would lead to many years of oversight battle and reforms of the acquisition process. A closer look at the reforms and the resulting documents follow in the chain of events.

2.4 The Beginning of DoDD 5000 and Its Reforms

2.4.1 The Start of the DoDD 5000 series

During the 1969 review, Secretary Packard established the Defense Systems Acquisition Review Council (DSARC), which essentially served the same functions as today's Defense Acquisition Board (DAB) or Defense Space Acquisition Board (DSAB) (1:74). The DSARC's main function was to advise the Secretary of Defense of anything considered significant in the acquisition of a defense program. Secretary Packard also asked that the Director of Defense Research & Engineering conduct management reviews "at least once on each major acquisition program" (1:74).

Secretary Packard had other ideas for improving the acquisition process. He published these ideas in a memorandum that became the foundation for the first DoD Directive 5000.1 published in 1971. The new "5000 series" (1:75) called for "decentralization of responsibility and authority for the acquisition of major defense systems to the greatest extent possible, consistent with the urgency and importance of a particular defense system being acquired" (5:75). Secretary Packard recognized the need to limit oversight of programs to only items that could potentially damage the system. His basic premise was that if anything was wrong with the program, it would be discovered at the lowest level. Therefore, DoDD 5000.1 "ordered that program managers be given adequate authority to make major decisions, rewards for good work, and more recognition toward career advancement" (5:75). With the new DoDD 5000 series, the DoD assumed "responsibility for establishing acquisition policy...." (5:75), but the DoD services were responsible for identifying their needs and actually acquiring the items to fulfill them. The first of the 5000 series was only seven pages long and stated the duties of only three DoD officials (21:111).

2.4.2 Past Reforms to DoDD 5000.1

Ferrara (21:113) points out that "with very few exceptions there has not been wide variation in the fundamental management principles underlying the defense acquisition system." Even the first published version of DoDD 5000.1 pushed for the centralization of policy making, but emphasized decentralized program execution. Ferrara cites two statements made in two different versions of the DoDD 5000 series. The first is from the 1971 version:

> Responsibility and authority for the acquisition of major defense systems shall be decentralized to the maximum extent practicable consistent with the urgency and importance of each program (21:113).

The 1977 version states:

> Responsibility for the management of system acquisition programs shall be decentralized to the DoD Components except for decisions retained by the Secretary of Defense (21:113).

This oversight decentralization recommendation goes back to the acquisition policies in use the years prior to World War II when the key program decisions were made in Washington and the routine, system program decisions were made by the ones performing the day-to-day tasks of running the program.

With each new Presidential term, there has been at least one change to the DoDD 5000 series. The revision in 1975 created DoDI 5000.2, the "instruction guidelines governing the use of the Decision Coordinating Paper (DCP) and the DSARC" (21:116). With the new DoDI 5000.2, the DSARC was only an advisory panel to the Secretary of

Defense on MDAPs. This format was held in place for two years, until 1977 and the development of a new milestone was implemented. The 1977 revision, signed two days prior to President Carter's inauguration, put an end to DoDI 5000.2 and made it an actual DoD Directive (21:117). The 1977 revision cancelled the DSARC and placed the duties and responsibilities of the DSARC members directly into the directive. "The major change evident in this version was the addition of a new milestone….demonstration and validation" (21:117). The two prior versions of DoDD 5000 contained only three milestones.

In 1977, after all these additional oversight additions, a comment was made by the Chairman of the Acquisition Cycle Task Force of the Defense Science Board: "These procedural changes have become institutionalized and have been applied inflexibly to all programs with the result that the acquisition process has steadily lengthened and the procurement of defense systems has become increasingly costly" (1:79). This statement synopsizes a perception of constant change and reform that perhaps shows no signs of stopping.

The 1980 revision of DoDD 5000, again added a new document to "summarize the implementation plan of the DoD Component for the life cycle of the system" (21:118). This revision added more oversight and more documentation to the acquisition process. This swing of centralization and decentralization of oversight continues to fluctuate throughout the history of the DoDD 5000 series. Even in 1982, with the implementation of the Carlucci Initiatives, the decision to centralize the oversight process was tied to DoDD 5000. The Carlucci Initiatives contained 32 management initiatives, including multiyear procurement and linking acquisition and budgeting. Some of these ideas presented were reminiscent of the old “concurrency” process from the beginning of the space acquisition programs and in the years prior to World War II. By 1982, the goal was to reduce oversight and increase responsibility at the lowest level. With the media reports of $500 hammers and $300 toilet seats in the mid-1980s, Congress demanded new acquisition oversight procedures. There came a point when “the logjam of procurement legislation awaiting implementation had become so great that the Pentagon and defense industry officials pleaded with Congress for a moratorium on further reform legislation” (21:119). The biggest change in that time period was the creation of the Defense Acquisition Executive (DAE). This new position was established to show Congress that the Pentagon was taking steps in the right direction to fix its acquisition problems. This assurance was again accomplished by increasing oversight and adding layers to an already burdensome system.

In 1985, Packard was requested by President Reagan to form another Commission on acquisition. In 1987, this commission attempted to issue new recommendations based on Packard’s original ideas when the first DoDD 5000 was issued. One new recommendation was the creation of an Under Secretary of Defense for Acquisition (USD(A)). Even though the newest revision was deemed controversial, it made significant changes that are still seen today. One of those major changes was the creation of the Defense Acquisition Board (DAB). This group was slightly larger than its predecessor, the DSARC, but it essentially served the same purpose. DABs were created for each specific section (i.e., aircraft). Each DAB was to become the “experts” in that area. When initially started, there were a total of 10 DABs, some focusing on specific topics, but most focused on broad issues. At one point, there were at least 126 different

DABs and committees that reported to the new USD(A) (21:120). Another item with the 1987 revision was the increasing of milestones from four to six. These milestones added oversight to an area where it was felt that oversight was needed, at the beginning and the middle of the production cycle. In the attempt to streamline the acquisition process, the Packard Commission inadvertently added additional layers to the process.

In 1991, oversight became more centralized only to become decentralized again in a revision in 1996. The new 1991 revision made the DoDD 5000.2 an instruction once more, but added a new DoD 5000.2-M Manual to the stack of documents. The DoDD 5000 series, as a basic "cookie cutter" acquisition procedure for MDAPs, was now creating a policy of "no supplements" for this version and that it was for all programs, regardless of size (21:121). The 1991 version ballooned to approximately 900 pages and 152 references to other sources. The 1991 documents also created acquisition categories, or "ACATs" (21:122). Although the statutory requirements of Title 10 were still upheld, it created additional tiers of oversight for the smaller acquisition programs due to the newly created ACAT levels.

After this new oversight was created, the 1996 version of DoDD 5000 was issued and removed some of the past restrictions and centralization. The 1996 version came with four objectives (21:122-123):

1. Clearly separate mandatory policies and procedures from discretionary practices. This decentralized control and allowed managers to once again attempt to control their programs.
2. Took new laws and regulations since the last update and included them in the series.
3. Consolidated, for the first time, policies for MDAPS and automated information systems.
4. Finally, try and stop the overall feeling that the 5000 series was getting too large and too complex to understand and implement.

The goal was to make it easier to use and provide understandable guidance for all major systems. The latest revision included space programs. The 1996 version also implemented a recommendation from the Acquisition Reform Process Action Team of having Integrated Product Teams (IPTs) for the acquisition programs (17:38).

Since 1996, there have been two additional revisions to the DoDD 5000 series, one of them being finalized at the time of this research effort. The new DoDD 5000 series will implement more decentralization than previous editions. One of the major changes in the acquisition process is the ability to separate acquisition programs into different acquisition procurement channels. This separation is accomplished by allowing waivers from the constraints of DoDD 5000 and places the program into these separate proposed tracks. These proposed tracks are currently acquisition under DoDD 5000 series, space systems acquisitions, Ballistic Missile Defense acquisitions, and acquisitions operating in a virtual realm which is called C3I RIT. All of these processes have some connection to the basic DoDD 5000 series, but each has its own perceived cost saving methodology. Because this research concentrates on space systems, it is the acquisition reform process as it applies specifically to the history of space acquisition that needs particular attention. Space acquisition had its beginning in the "black world." In order to relate the transformation of oversight to the new space acquisition process the history of the Corona Project is reviewed.

2.5 History of Space Acquisition-the Corona Project

The United States space acquisition program was started almost by accident. Space was barely mentioned or considered until the United States captured and interviewed the creator of the V-2 rocket, German scientist, Dr. Werner von Braun, who submitted a report about the future of space and "included ideas about satellites" (34:4). This report caught the Navy's attention and the department was interested in creating a satellite test program.

By the time two different test studies were completed, the United States Air Force had been created and in 1948, Gen Vandenberg, Air Force Chief of Staff, learned that the Air Force "had the logical responsibility for the satellite" (34:6). But even after the Navy withdrew its request for its own satellite programs, the remaining program was given limited funding and restricted on the research and development of the satellite.

In the early 1950s, the RAND (Research ANd Development) company was awarded a contract to do a feasibility study on the use of satellites for photographic imagery of earth. During RAND's study, another group was establishing the requirements for reconnaissance for the years 1952 through 1960. The concept of satellite use was never entertained in the reconnaissance plan. The only comment made was that satellite systems would not be worth the financial outlay required.

In September 1953, the RAND report was sent to the ARDC for possible development and design. By December of that same year, "Project 409-40" was born. It was given the unofficial designation of "Weapon System 117L" (34:15). Since the design exploration was completed, the next step was to find a contractor who would attempt to put the WS-117L into space. In June 1956, Lockheed was awarded the contract (34:25). The biggest challenge the program faced was the limited budget of $3 million for a program that required extensive testing of the design and the technology needed had not been developed. In November of that same year, the program was halted until the launch of the Russian satellite, Sputnik, had shown the need for satellites. After the Sputnik launch in 1957, the need for the United States to get reconnaissance into space became a top priority. When the true satellite concept was finally realized, it was set up to be a generalized program with minimal oversight. The basic program was run with the basis of "instructions were not so much marching orders as 'marching suggestions'" (34:43).

With the limited oversight established under the Corona Project, from the initial concept exploration in 1953 to the first launch in 1959, showed how quickly a program can move with decentralized oversight. The process was seen as successful because "the group was so small and its members were so close that decisions could be made jointly" (34:43). From the beginning of the launches in 1959 until the program ended in 1972, 145 satellites were developed, enhanced, improved, and launched.

The Corona project was conducted in a shroud of secrecy that did not follow the normal acquisition guidelines of those times. That theory carried forward as the National Reconnaissance Office (NRO) was born on 10 June 1960 (34:94). Even through the 1990s, a separate acquisition process was used by the NRO, separate from other agencies. This process contained limited oversight and a perception of quick acquisition timelines. However, as space became more available to the world, the use of satellites and missiles became more open. With the creation of the DoDD 5000 series, more of the space acquisitions fell under the control of the directives and was placed under the standard oversight process for acquisitions. This gradual move brought the once decentralized process under a centralized control.

With the knowledge of the NRO acquisition process and the foresight of the need for acquisition oversight reforms, the DoDD 5000 acquisition guidance was seen as ineffective for space programs. A change was needed and a new direction was taking place in space acquisition.

2.6 Recognizing the Need for Change

On 11 July 2001, a report was published by the Commission to Assess United States National Security Space Management and Organization. In this report, several aspects of the United States Space Program were reviewed. One key point was the way the acquisition environment and oversight of space was handled by different organizations and the need for central control. One item for potential change was the way the information was presented to key decision makers and another was who those key decision makers were. As seen in Figure 2.1, the flow of information is sent from different locations for decisions for different levels. This type of oversight "responsibility and accountability for space are broadly diffused throughout the government" (11:xix).

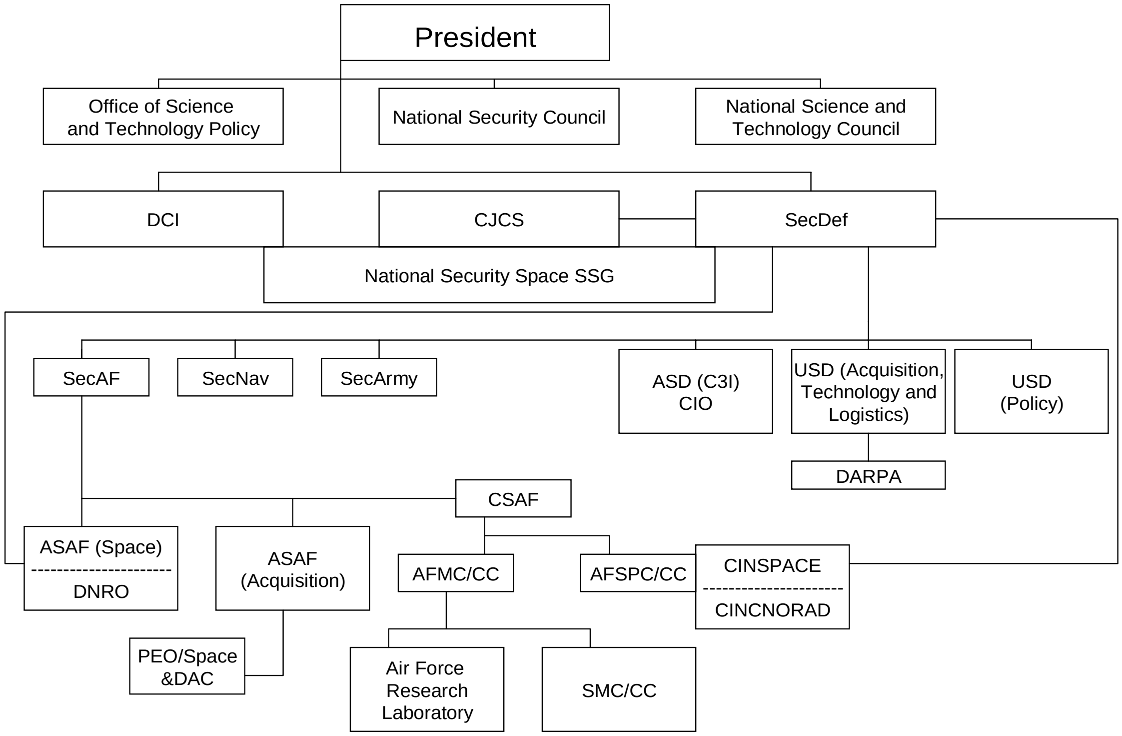

Figure 2.1: Acquisition Management Chain of Command (11:xix)

In the Commission on Space report, it is shown that both the military services as well as the NRO execute specific space programs. The military leaves it up to each service to define and implement their own space program to meet their needs, but "no single service has been assigned statutory responsibility to 'organize, train and equip' for space operations" (11:xxii). According to the report, "eighty-five percent of space-related budget activity within the (DoD)….resides with the Air Force" (11:xxii).

The NRO currently "is the single national organization tasked to meet the U.S. Government's intelligence needs for space-borne reconnaissance" (11:xxiii). The NRO is a joint venture between the DoD and the CIA. With their concerted effort, they try to maintain the needs of the intelligence community.

Highlighting the differences between the NRO acquisition process and the main DoD process followed by the Air Force, the Commission shows that the NRO takes a "cradle-to-grave" approach while the Air Force separates the process among different commands (11:xxvi). Understanding these differences, a chance to merge the above items to create a synergistic effort for space acquisitions programs is needed. With the Space Commission's recommendation, a new organizational structure was proposed.

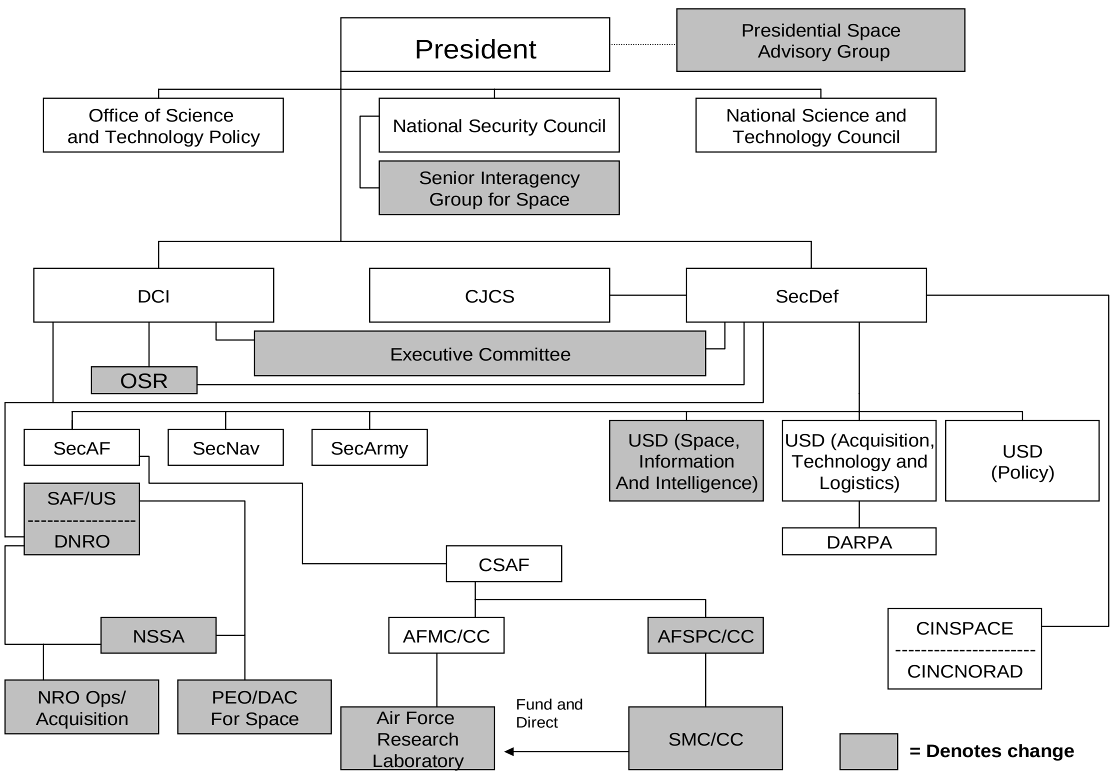

Figure 2.2: Space Commission's Proposed Space Acquisition Organization (11:xxvi)

Under the proposed organizational structure, some highlights include;

1. Reorganizing the Air Force and making it the sole responsibility for MDAPs in the Space environment.
2. Align the Air Force and the NRO Space Programs. The Commission to Assess Space proposed to "Assign the Under Secretary of the Air Force as the Director of the National Reconnaissance Office. Designate the Under Secretary as the Air Force Acquisition Executive for Space" (11:xxxiv).

As in 1961, when the Air Force was tasked with the responsibility to take over the oversight of space acquisition programs, the plan was again set in motion in 2001. With the appointment of the Chairman of the Commission to Assess U.S. National Security Space Management and Oversight to his new position as the Secretary of Defense, the Honorable Donald Rumsfeld was able to implement the ideas that the Commission had created as he became the new Secretary of Defense.

2.7 The Realigning of Space Oversight

With the findings of the Commission to Assess Space and a new Secretary of Defense in charge, on 18 October 2001, Secretary Rumsfeld signed a memorandum that stated, "I agree with the Commission's conclusion that a new and comprehensive approach to national security space management and organization is needed…." (41:1). With this letter, the implementation of the new national security space program was set in motion. Secretary Rumsfeld's letter was preceded by a press conference, given by him, highlighting the changes. In that conference, he stated, "The majority of these changes involve realigning Air Force headquarters and field commands to more effectively organize, train and equip for space operations, ensuring that the Air Force will become the lead for space activities in the Department of Defense" (45:2).

The first recommendation was to establish a policy for acquisition that could easily be followed, but maintained the goals of the Commission. With the proposal to emulate the best practices of all services and the basic format of the NRO acquisition process, NRO Directive 7 was used as the foundation for the new space acquisition policy. In Directive 7, the general policy is, "the NRO will acquire systems using a fast-paced, streamlined management process" (31:Attach 1:2). The policy's objective is to create frequent interaction between the decision makers and the individual program managers. The NRO's Directive focuses on decentralized decision making except for three key periods in the program's life-cycle, which are called "key decision points" or KDPs (31: Attach 1:2). The NRO follows a program where all data is collected prior to the KDP for each milestone and a team of experts is collected for the purpose of evaluating the program independently, and providing a status for the Director, NRO. This team is known as the Integrated Program Assessment Team (IPAT) and the process is called the Integrated Program Assessment (IPA) (31:Attach 1:5). To complete the KDP, the IPAT must give the program a passing evaluation for the NRO Acquisition Board (NAB), where the NRO Director makes the decision to move forward. This process is perceived as successful due to the limited oversight and the fact that the IPA members have no stake in the outcome and provide a true independent review.

Taking the best practices from the other services and emulating the NRO process, the new space system acquisition policy was established. With a series of memorandums, delegations were made to comply with Secretary of Defense's vision and to comply with the recommendations of the Space Commission. Table 2.1 lists the chain of these memorandums and the direction in which they moved the space acquisition system.

Table 2.1: Policy Letters Establishing Space Acquisition Oversight

Date	**Subject**	**From**	**To**	**Reason**
No Date Given	AF Senior Procurement Executive Authorities and Responsibilities	SECAF	USECAF	Designation of USECAF to Senior Procurement Exectutive (SPE) (37)
No Date Given	AF Senior Procurement Executive Authorities and Responsibilities	USECAF	Assistant Secretary of the Air Force (Acquisition) ASAF(A)	Designation of ASAF(A) to Senior Procurement Exectutive (SPE) (46)
4 Feb 2002	Delegation of Milestone Decision Authority for DoD Space Systems	USECDEF	All Military Secretaries Under Secretary of Defense(Comptroller) Assistant Secretary of Defense (C3I) USECAF/DNRO	Notification of Space program MDAPs MDA to SECAF, but re-delegation limited to USECAF/DNRO (2)
7 Feb 2002	AF Acquisition Executive Authorities and Responsibilities	SECAF	USECAF ASAF(A)	Assisting in the fulfillment of Air Force Acquisition Executive duties (36)
14 Mar 2002	Re-Delegation of Milestone Decision Authority for DoD Space Systems	SECAF	USECAF/DNRO	Re-delegated all MDA to USECAF/DNRO (39)
1 Apr 2002	Space Based Radar Acquisition	USECAF	USECDEF (AT&L)	Established SBR as a test program for the new space acquisition process (51)
12 Apr 2002	Organizational Stand-Up of Executive Agent for Space	DoD SECAF administrative assistant	Distribution C	Eliminated and created specific chains for the space acquisition process (14)
29 May 2002	Fiscal Year (FY) 2002 Major Defense Acquisition Program (MDAP) Lists	USECDEF	All Secretaries of the Military Departments and Director, Missile Defense Agency	Redesignated some space programs for lower levels of oversight IAW the new space process (3)
2 Oct 2002	Independent Cost Estimates	USECDEF	All Secretaries of the Military Departments USECDEF(Comptroller) ASECDEF(C3I) USECAF/DNRO	Eliminated the need for CAIG as responsible for Cost Estimate—Established that the AF has sole responsibility to comply (4)
21 Nov 2002	Defense Space Acquisition Board	USECAF	Several Recipients (Too long to list)	Establishes the Director of National Security Space Integration as the Executive Secretary for the Defense Space Acquisition Board (47)
4 Mar 2003	National Security Space (NSS) Acquisition	USECAF	All Service Secretaries, CJCS USECDEF (AT&L), ASECDEF(C3I), Director,(OT&E), DDNRO	Authorizes the release of NSS Acquisiton Policy 03-01 as interim guidance (50)
20 Mar 2003	Exemption and Waiver to DoDI 5000.2 and Related Guidance for AF Program Executive Officer for Space (AFPEO/SP) Space Programs	USECAF	Air Force Program Executive Office for Space	Grants exemption and waivers from DoDI 5000.2 for use of streamlined space acquisition process (48)
29 May 2003	Full Funding Policy for DoD Space Programs	USECAF	D,PA&E	Recommends the elimination of “full funding at KDP” policy (49)
7 Jul 2003	Delegation of (DoD) Executive Agent for Space Responsibilities	SECAF	USECAF	Delegates all DoD Executive Agent for Space to USECAF (38)

With the memorandums channeled and the approval received, the National Security Space Acquisition Policy (NSSAP) 03-01 was implemented as interim guidance. The NSSAP 03-01 incorporates much of NRO Directive 7, along with a few best practices. The goal was to tailor the acquisition process for space programs so the needs of National Security could be met in a streamlined process with a limited and decentralized oversight process. One reason noted in a Government Accounting Office (GAO) report focused on common problems in acquisition in military space programs. It was noted that the life-cycle spending on the space programs differs from spending on aircraft MDAPs. Normal DoD lifecycle profiles show that 28 percent of a normal program's budget is spent in its development, while 72 percent goes into the operations and support items for a certain period of time, as seen below.

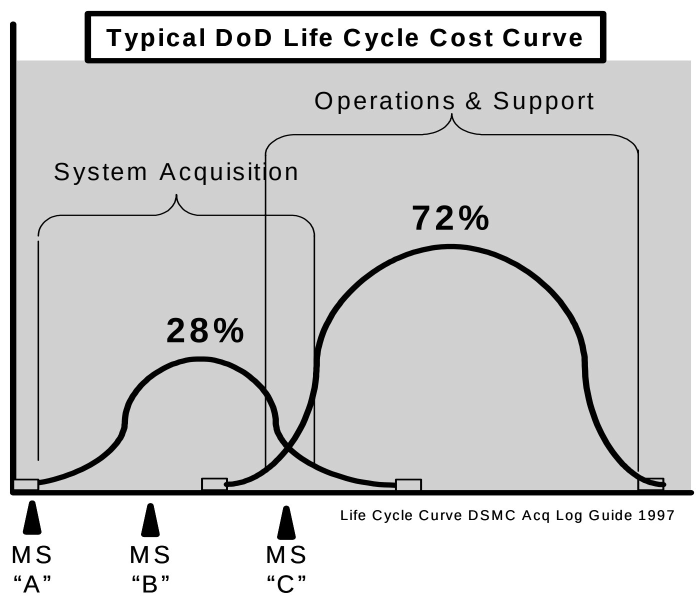

Figure 2.3: Funds Allocation in MDAP (33)

. For the space environment, the budget expenditure profile is exactly the opposite. The funds are needed up front to ensure the system will work once launched (23:8). For space programs, a traditional full rate production effort does not exist like there is in aircraft operations and support. On space programs, much of the work is done up front to eliminate any potential system failures once the satellite is launched. There are very few second chances once a satellite system is placed in service. The true expenditure profile of a space life cycle cost curve can be seen in Figure 2.4 in comparison to a typical DoD life cycle cost curve.

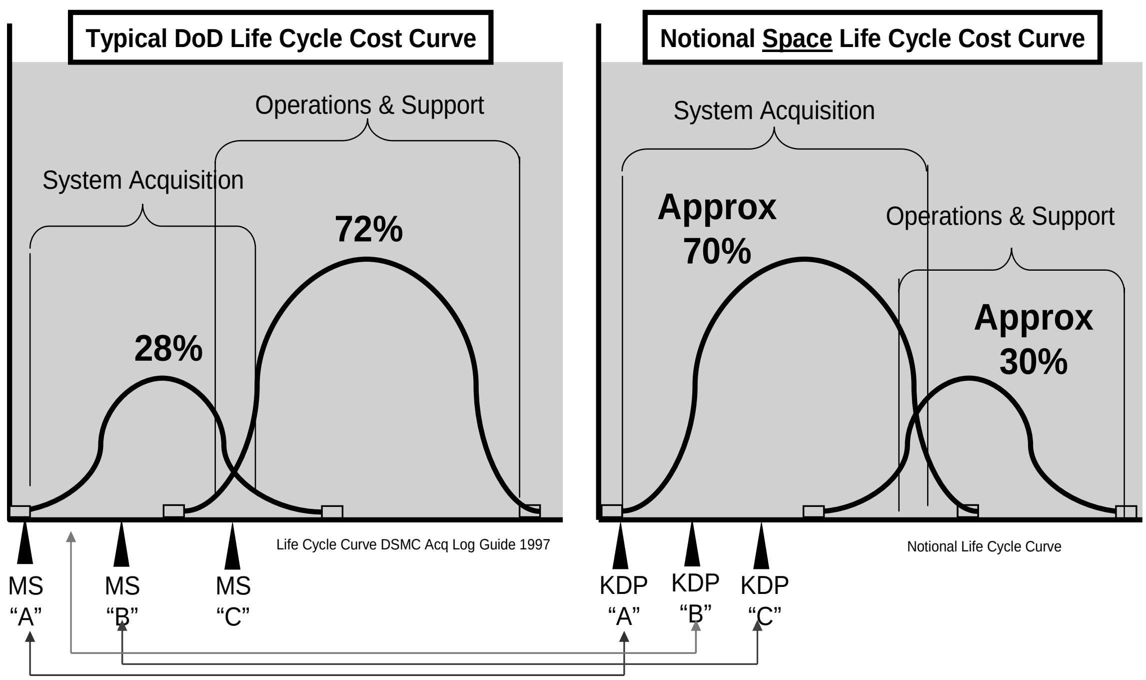

Figure 2.4: Comparing Normal MDAP to Space MDAP (33)

Because of this new process, new oversight controls are implemented as well. With NSSAP 03-01, the IPA process is brought up in full force with full explanations of who is responsible for specific duties. Once the Program Manager feels he/she is ready for a DSAB, a request is made and a date is set, and the calendar is rolled back for specific points in time to be met. A graphical presentation is given in NSSAP 03-01 and is replicated for easy interpretation of the IPA process. The IPA process is repeated once the program has reached a KDP for each KDP in the satellite’s life-cycle acquisition profile.

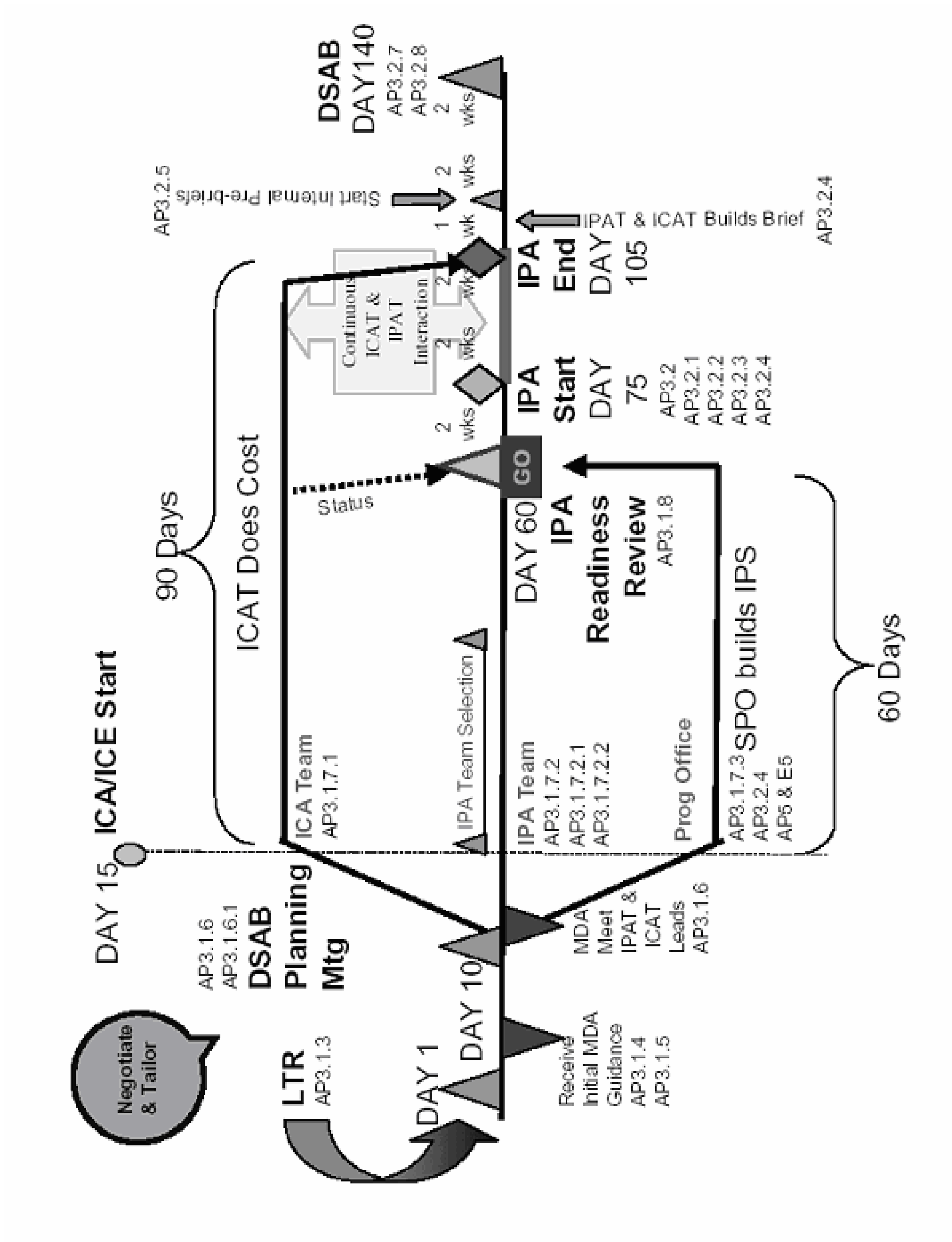

Figure 2.5: Extract from NSSAP 03-01 on IPA Process (19)

With the new process and information flow created by NSSAP 03-01, oversight is expected to decentralize and is hypothesized by some as being a cost effective way to manage MDAPs across all services.

2.8 Is it Working and How Will We Know?

After the implementation of NSSAP 03-01 as interim guidance, the new policy has already come under close scrutiny by civilian journals and the GAO. Some opponents were critical of the cost of space programs but recognized the efforts of the Undersecretary of Defense and that he "has identified eight priorities." Among the list is "getting space acquisition programs on track" (7:1). But the criticism still remains that the SBR program "has requested $274 million and has an estimated launch cost of $4.4 billion, (according to) Teets" (7:2).

In one GAO study, a pre-NSSAP 03-01 review was initiated to review the current challenges facing space programs and procurement. They noted, that although changes are coming, there are still challenges facing this new process. The GAO warns that: "Unless DoD adopts knowledge-based practices, space control acquisitions, such as the Space-Based Surveillance System, may well face higher cost and schedule risks" (24:2). The warning incorporates an understanding that if a program is not decentralized and a streamlined oversight process is not accepted at all levels, the costs and schedule could be increased and prolonged.

In another GAO study, after the NSSAP 03-01 interim guidance was issued, the GAO recognized that DoD "was taking steps to streamline the acquisition process and reduce the time it takes to acquire space-based systems required by the national security space community" (22:14). The GAO stated that the SBR was the first true hope for testing the new NSSAP 03-01 process.

So how do we know when the oversight process is working and how will we compare the cost of oversight? In the overview, the goal of this chapter was presented as showing how the process changed over time and how the focus moved from decentralized to centralized oversight and the struggle between the processes. The biggest problem was trying to find a way to compare the costs of the oversight process alone. The only document found addressing with any calculations of actual oversight cost did not provide any background information or methodology, but did provide a basic number for comparison. The Acquisition Reform Process Action Team published a document in 1994 that stated that a few programs were tracked and the cost of reviews was estimated. "Our estimates suggested that the costs were on the order of $10-12M, including the costs of a Cost and Operational Effectiveness Analysis" (17:9). That initial amount quoted was estimated for each milestone and "could add approximately $40-50M to a program over its life" (17:9).

Taking the estimate from the Process Action Team, and applying it to the current space programs listed on the SAR equates to $35.79 billion among seven programs. That would estimate the cost of oversight to $30-36M per program. Even though this dollar amount represents less than one percent of the total amount of programs' budget, the figures $210-252M for the total in potential space MDAP oversight a substantial amount of resources that could be spent on other programs.

This thesis will create a foundation by using a panel of experts to estimate the cost of space acquisition oversight using the current NSSAP 03-01 IPA process and compare these initial results to those of other acquisition methods. The findings of this thesis could come up with a potential measurement for any oversight savings by the new decentralization process and display any reluctance of experts to adopt the streamlining reforms. By identifying the main cost drivers and comparing with the other acquisition methods, the potential of future streamlining efforts may be able to focus on reducing or eliminating the cost drivers with the potential of reducing the vertical layers in the oversight process.

3.0 Methodology

3.1 Overview

From the previous two chapters, we now have a clear picture of the focus of this research. This research will attempt to estimate the cost of oversight of Major Defense Acquisition Programs (MDAPs) strictly under the direction of the new National Security Space Acquisition Policy 03-01. In addition to estimating the cost of oversight, the aim of this research is to answer specific research questions outlined in Chapter 1. Again, the first and most important question to be answered is what is the cost of oversight for space programs? The next question is how does the cost of oversight for space programs compare to the cost of oversight for MDAPs operating under a different framework; specifically, communications acquisition programs, which are operating in a "virtual box", and "box" programs which are operating under the DoDD 5000 series? The final research question to be answered is what are the five key drivers that affect the cost of oversight of MDAPs? As noted in Chapter 2, the Delphi Method of surveying experts will be employed to address these questions. This chapter will outline the Delphi Method, how it works, and how specifically the Delphi Method will be utilized for this research.

3.2 Delphi Method Background

In this section, of the chapter, some background information on the Delphi Method is provided. After discussing the history of the Delphi Method, it is important to discuss what it is, and finally describes how it works. After discussing the history and providing a thorough background, the Delphi Method will prove itself as a perfect fit and the chapter will close with why the Delphi Method was the chosen methodology for this research. The methodology for the execution of this current research project will be interspersed within the description of each of these subject areas.

3.2.1 History of the Delphi Method

According to Clayton, the name “Delphi” was associated with Greek mythology and refers to a Delphi Oracle which was capable of predicting the future (10:376). The Delphi Method was actually born in the 1960s out of the American defense industry as part of a project called “Project Delphi”, which was a study conducted by the RAND Corporation in support of an exploration by the Air Force (8:700-701). 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.

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 (8:701). The Delphi Method attempts to reach a consensus of opinion among the members of the group, which will here on be referred to as an expert panel, through a series of questionnaires. A key element of the questionnaires is that they are completed anonymously to allow for freedom of expression and then collected, summarized and returned to panel members to give them the opportunity to refine original responses with the added benefit of knowing the rest of the panel members’ responses. This process is continued, “until consensus is obtained or the law of diminishing returns sets in" (25:1010). Another key element of the process is that the panel is made up of pre-selected experts who never physically have to be in the same location. The process, which came into practice in the 1960s, could only be conducted by traditional mail, but of course can now be conducted via the web or e-mail, or a combination of both.

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 along 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 (10:375). 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.

With explaining the need for separated groups, a new question arises. 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 (10:375). 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.

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.

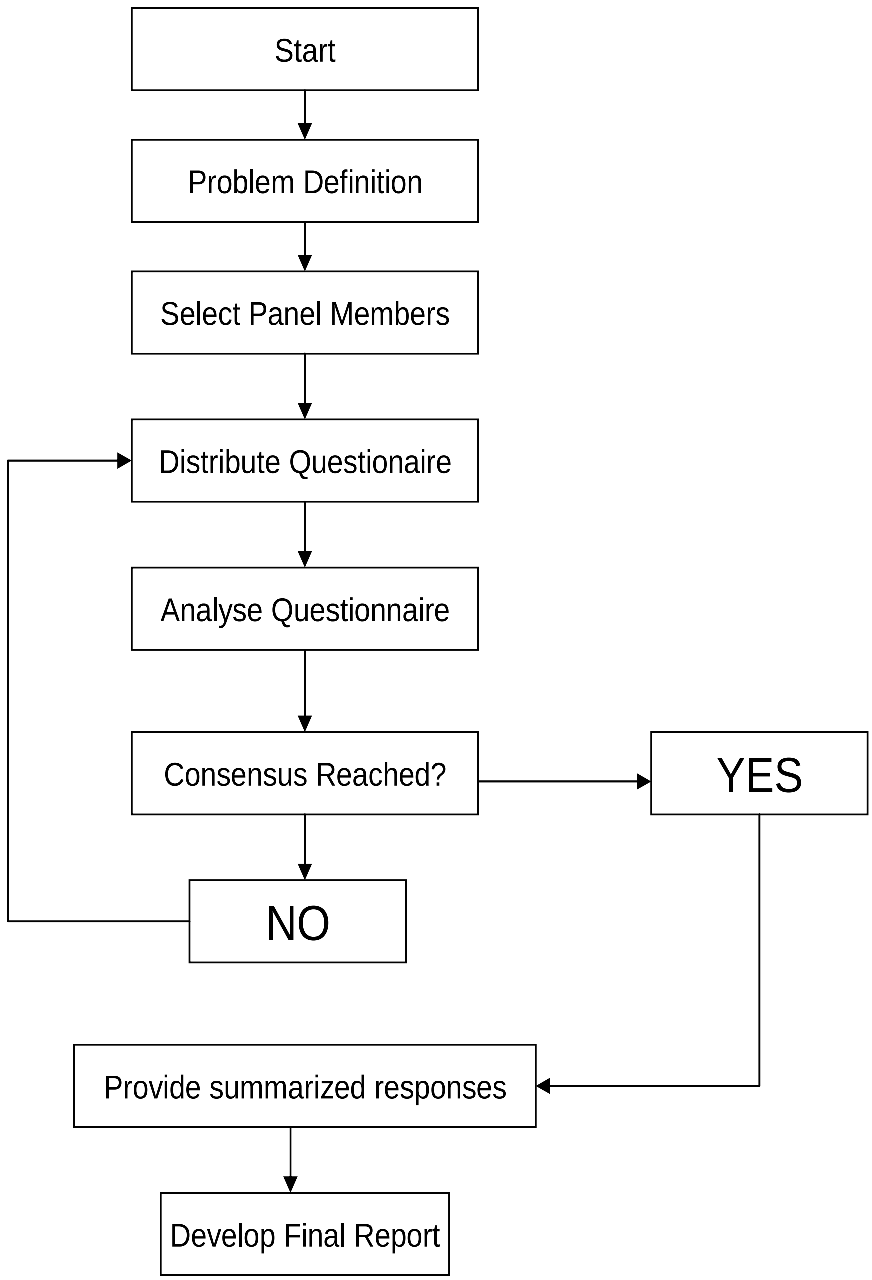

Figure 3.1: Oversight Approval Levels (16:2)

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 space programs as well as compare the costs of those space programs to the virtual and "box" 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, due to lack of technology, originally questionnaires were sent by traditional mail channels. 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 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 (9:233-236). 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 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" (10:129). Chan et al. agreed in their study by establishing four rounds (8:701). However, Ludwig states that "Delphi rounds continue until a predetermined level of consensus is reached or no new information is gained" (29:3). While a study in Scotland, by Dr. Kerr, limited the number of rounds to three (26:3). 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 (30:345). 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 (30:342). Clayton also discussed the format of the questionnaires on a round by round basis. He states that round one questionnaires 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 (10:378). 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 10 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" (52:567). 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 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…" (53:182). 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. This 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 (42: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…" (44:74). 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 judgements and the information summarizing capability of the research team" (29:2). 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" (29:2). Chan et al stated in their selection process "The ten members of the panel represent a wide distribution of professional people…" (8:701). Another study by Des Marchais reduced the panel size to six (12:504), 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" (53:182).

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 five and a maximum of ten members.

Once the size of the panel has been decided, establishing criteria is needed to judge who the experts are. 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” (30:340). Dawson and Brucker, in their research, summarized the criteria for determining experts used in several Delphi studies in their field. 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 (15:132-134). For the purpose of this research, those general standards are relaxed 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% (8:708). Mitchell states that, “High rates of attrition may mean that final results are based upon an unrepresentative sub sample of the original sample” (30:341). 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 (28:615). 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%) (30:334).

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 appears to be a suitable data collection method. There are criticisms to bear in mind before using 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. Those providing experts will be provided with our panel criteria and asked 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 (53:182). 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" (53:182). 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 (30:351).

3.5 Strengths of the Delphi Method

The strengths of the Delphi Method outweigh the drawbacks 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 (15:129). 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 (53:181). 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 (53:181). 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 that evolved into a strength for today was that the traditional Delphi process took a long time to complete. This long 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. Chien 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 (9:236).

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 is lack of data. There was an initial mistake made of assuming the meeting minutes, notes and logs would be readily available when in fact in some cases they were nonexistent. A methodology was needed that would enable me to answer the research questions without the availability of historical data. An article by W.L. Mitchell which appeared in *Technology Analysis & Strategic Management*, outlines why one would use the Delphi Method with the number one reason listed being the unavailability of historical data (30:338).

3.7 Comparative Analysis for Data Collected

Once the rounds of the Delphi are completed, all data from this study must be statistically compared with the data collected by Neal (32) for Command, Control, Communications, and Intelligence (C3I) and Rousseau (40) for Department of Defense Directive 5000 (DoDD 5000). After acquiring their data, all data for questions two through ten will be placed into a statistics analytical software package with a graphical user interface, such as JMP 5.0.1 statistical software. The data will be entered, for each question two through ten, in the format shown in Table 3.1.

Table 3.1: Data Input for Statistical Analysis

Oversight	2-Low	2-Avg	2-High
NSSAP 03-01	1	4	6
NSSAP 03-01	2	6	9
NSSAP 03-01	1	4	7
NSSAP 03-01	2	4	8
DoDD 5000	6	8	16
DoDD 5000	8	12	18
DoDD 5000	6	10	18
DoDD 5000	6	10	25
DoDD 5000	6	12	18
C3I	12	20	30
C3I	7	9	12
C3I	12	20	30
C3I	12	20	30

The format in Table 3.1 will allow JMP 5.0.1 to analyze the statistical differences and will provide a value which will test whether or not there is a statistical difference among the different oversight processes.

To conduct the analysis of variances, each oversight process will compare with one other oversight at a time. For example, NSSAP 03-01 will compare with DoDD 5000. The null hypothesis for the test is that there is no difference in the data collected. The alternate is that there is a statistical difference between them. The test significance for these statistical tests will be set at .05.

The first question will simply compare the different cost drivers identified for each specific oversight regulating document and provide insight to potential differences.

3.8 Summary

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

1. According to experts in the field, what is the estimated cost of oversight for a space acquisition program under the NSSAP 03-01 IPA oversight process?

2. How does the cost of oversight for space programs compare to the cost of oversight for programs under the DoDD 5000 series and the virtual acquisition processes?

3. What are the five main cost drivers for the oversight of space acquisition programs?

This chapter outlined 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 analyzed.

4.0 Data Results

4.1 Overview

The goal of chapter 4 is to provide the collection of the expert panel members for the Delphi Method and the generalized demographics of the panel members while still maintaining the members' anonymity. The next section will provide the results of the survey for each question. The results will be presented for one question as it passed through the four separate rounds of the Delphi Method. The information provided will include the initial answers for each question and how the answer changed through the rounds of the Delphi Method. The final section will provide a summary of results and reiterate the goal of the Delphi Method to ensure all objectives were met. The first research question for the total cost of oversight for space under the NSSAP 03-01 will be answered in the summary of results section. The discussion will also include the next step on the analysis of oversight and what will be used to statistically compare these results with the data gathered by Neal (32) and Rousseau (40).

To establish the cost of oversight, an algorithm was created with multiplies and adds the respondents estimates together to create low, average, and high estimates for the cost of oversight. This is completed by taking questions two, three, and four and multiplying them together to create a TDY cost estimate. Then taking questions five, six, and seven and multiplying them together to create a personnel cost estimate. Then, questions eight, nine, and ten are multiplied together to create a meeting estimate. Finally, the TDY, personnel, and meeting estimate are added together to provide an estimate for the cost of one program to get through one decision point. 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))

This will repeat for the average and high estimates as well.

4.2 Panel Selection

The goal of panel selection was to gather experts in the space acquisition field, but from different viewpoints in the oversight process. The following individuals, listed on the table below, were selected and numbered to keep them anonymous from each other.

Table 4.1: Panel Selection Demographics

Number	Military/Civlian	Position	Years Acq Exp	Years Space Exp
1	Civilian	Senior GS Employee	24	24
2	Military	Senior Military Officer	19	13
3	Military	University Professor in Acquisition	19	7
4	Civilian	Retired Military, Civ Contractor	8	8
5	Military	University Professor in Acquisition	18	4

Since the members are now numbered, the rest of the results and analysis will refer to only the number assigned for the Delphi Method. As seen in Table 4.1, there is a broad range of years of experience as well as the difference in viewpoints of the acquisition process. According to the information provided in the methodology section, this will provide the most probability of approaching the true answer of the unknown forecast we are trying to make and compare. These members contain a wealth of experience and had the desire to provide feedback. Prior Internal Review Board permission was requested and obtained for this research and the letter of approval can be seen in the attachment section.

When the first round was initiated, panel member 5 had to drop out due to an unforeseen incident. Even without panel member 5, the heterogeneous group was still maintained and, according to research conducted in chapter 3, four members were still enough to conduct a Delphi Method survey.

4.3 Question One

From the Program Executive Officer (PEO) recommendation, to the Defense Systems Acquisition Board (DSAB) approval (including the entire Integrated Program Assessment (IPA) process), what are the five major cost drivers in the oversight process?

The goal of question one was to obtain the five key cost drivers that the respondents felt drove the cost of oversight higher than it should truly be. These items aren't always budgeted for and may not have true dollar figures attached, but could potentially lead to increased costs in oversight.

4.3.1 Results by Round

Round one provided 13 items that were thought to drive costs in the oversight process. They are listed below, in no particular order;

1. Time away from primary responsibilities while supporting "this" effort (IPA) at the expense of the rest of the program.
2. Adding requirements to original program(from HQ & OSD, or other sources)
3. TDY from the program office to IPA or IPA folks to program office
4. Hiring individuals for the IPA may come at program office's expense
5. Time of the program office and PEM staff putting together packages as well as running
   them through the system
6. IPA Personnel Costs (Program evaluation)
7. ACE Personnel Costs (Process oversight)
8. SAF/USI Personnel Costs (Process oversight)

9. IPA Travel/Per Diem costs (Team and support personnel)
10. Facilities and Equipment
11. Salaries of IPA core members and “gray beard” members who are not government employees
12. Reproduction costs of the briefings, VTCs, copies, long distance calls, other admin requirements
13. Contractor cost of time spent answering IPA questions

With the 13 responses from round one collected, the drivers were compiled and sent out in round two. For round two, the members were only allowed to pick five from the list provided. This is the list that was created by the member and their peers. The round two results are listed below, again, in no particular order;

1. Time away from primary responsibilities while supporting “this” effort (IPA) at the expense of the rest of the program.
2. Adding requirements to original program(from HQ & OSD, or other sources)
3. TDY from the program office to IPA or IPA folks to program office
4. Hiring individuals for the IPA may come at program office’s expense
5. Time of the program office and PEM staff putting together packages as well as running them through the system
6. IPA Personnel Costs (Program evaluation)
7. SAF/USI Personnel Costs (Process oversight)
8. IPA Travel/Per Diem costs (Team and support personnel)
9. Salaries of IPA core members and “gray beard” members who are not government employees
10. Contractor cost of time spent answering IPA questions

In round two, only three drivers fell off from the previous round. In round two it was noticed that most items focus around paying non-DoD members and travel costs. The drivers eliminated from the previous round were numbers 7, 10, and 12 from round one.

Once again, these were compiled and sent out for round three, with the same instructions of picking only five. The answers for round three focused on a few specific areas, but still had a ways to go from identifying five main drivers. The results from round three are listed below;

1. Time away from primary responsibilities while supporting “this” effort (IPA) at the expense of the rest of the program.
2. Adding requirements to original program(from HQ & OSD, or other sources)
3. TDY from the program office to IPA or IPA folks to program office
4. Hiring individuals for the IPA may come at program office’s expense
5. Time of the program office and PEM staff putting together packages as well as running them through the system
6. IPA Personnel Costs (Program evaluation)
7. SAF/USI Personnel Costs (Process oversight)
8. IPA Travel/Per Diem costs (Team and support personnel)
9. Salaries of IPA core members and “gray beard” members who are not government employees
10. Contractor cost of time spent answering IPA questions

As one can begin to see, a problem was beginning to develop and a new way to come up with five main drivers was needed. Noticing that there was a few that were on each listing, the results were ranked by the number of votes received. Three of the items had the most selections and were set aside as the first three cost drivers. The remaining items that received two votes or more were left for round four, where the members were asked to only pick two of the drivers listed. The new list sent for round four is shown below;

4. Hiring individuals for the IPA may come at program office’s expense
7. SAF/USI Personnel Costs (Process oversight)
8. IPA Travel/Per Diem costs (Team and support personnel)
9. Salaries of IPA core members and “gray beard” members who are not government employees

With instructions to only select two from above, the results were almost unanimous. All members selected driver number 9 and three out of four selected number 8. With all rounds completed, the main cost drivers identified by the Delphi panel are listed below, in no particular order;

1. Time away from primary responsibilities while supporting “this” effort (IPA) at the expense of the rest of the program.

2. TDY from the program office to IPA or IPA folks to program office
3. IPA Personnel Costs (Program Evaluation)
4. Salaries of IPA core members and "gray beard" members who are not government employees
5. IPA Travel/PerDiem costs (Team and support personnel)

4.4 Question Two

From the PEO recommendation, to the DSAB approval of the KDP, use your professional judgment and estimate how many TDYs are taken by one person to get one program through one Key Decision Point (KDP)/Integrated Program Assessment (IPA) process?

The goal of question two was to find out how many TDYs are taken by one individual in one program in support of a KDP. The members are 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 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 establish a travel estimate for the cost of oversight.

4.4.1 Question Two - Low Estimate

The low estimate was established early in the survey process. In round one, the results were split directly down the middle. Two respondents answered 1 and two answered 2. This did not change at all during the rest of the survey process for all remaining rounds. Consensus was reached immediately, due to the reluctance of any member to change this portion of the answer.

4.4.2 Question Two - Average Estimate

The average, or most likely, estimate was similar to the low estimate. Once the initial numbers were established, there was no desire to change the answers by any respondent. The question was left in for three rounds to make sure that no last minute changes were made, but for the fourth round, it was removed due to the goals stated by the initial methodology, which was to minimize the standard deviation, or when the results are not being changed. The results are listed in Table 4.2, shown below. In the column labeled "Frequency" the answers are given by numerical order for all further result tables. So the first number is respondent one, the second is respondent two, and it continues. This will allow the reader to view who made what changes in each round.

Table 4.2: Question Two - Average Estimate Results By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	4 to 6	4,6,4,4	4.5	4	1
2	4 to 6	4,6,4,4	4.5	4	1
3	4 to 6	4,6,4,4	4.5	4	1
4	Consensus	Reached			

4.4.3 Question Two - High Estimate

The high estimate was slightly more volatile than the low and average estimates for question two. The high estimate moved slightly on the second round and then remained stationary. After the third round, consensus was declared and the question was closed. Only one member adjusted their response for question two. The results for question two-high estimate are found below in Table 4.3.

Table 4.3: Question Two - High Estimate Results By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	6 to 10	6,10,7,8	7.75	7.5	1.70782
2	6 to 9	6,9,7,8	7.5	7.5	1.29099
3	6 to 9	6,9,7,8	7.5	7.5	1.29099
4	Consensus	Reached			

4.5 Question Three

Estimate how many people normally go TDY throughout the KDP/IPA 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 in an IPA process for a KDP. 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

The low estimate's standard deviation slowly decreased through out the Delphi process, shown in Table 4.4 below. Panel member 1 answered 4 on the first round and changed their answer to 13 in round two, then didn't change it again for the remaining rounds. Member 2 answered 20 and stayed with 20 through all four rounds, which was similar to member 4, who answered 25. Member 3 moved their response the most. Each round, member 3 changed theirs closer and closer to the average, which is expected in this type of survey. This question was not closed until all rounds were completed.

Table 4.4: Question Three - Low Estimate Results By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	3 to 25	4,20,3,25	13	12	11.16542
2	10 to 25	13,20,10,25	17	16.5	6.78233
3	12 to 25	13,20,12,25	17.5	16.5	6.13731
4	13 to 25	13,20,15,25	18.25	17.5	5.37742

4.5.2 Question Three - Average Estimate

The average estimate for question three went all four rounds of the survey. The results are listed in Table 4.5 on the next page. The standard deviation was decreased by over 50 percent and the range was decreased as well. Members 1 and 4 selected an estimate and elected not to change their answer through all four rounds. Member 2 changed their estimate on the last round and member 3 changed their estimate at each survey round.

Table 4.5: Question Three - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	6 to 30	20,30,6,30	21.5	25	11.35781
2	15 to 30	20,30,15,30	23.75	25	7.5
3	20 to 30	20,30,25,30	26.25	27.5	4.78713
4	20 to 30	20,25,25,30	25	25	4.08248

4.5.3 Question Three - High Estimate

The high estimate results, listed in table 4.6, show almost the same pattern as the average results. Members 1 and 4 selected an estimate and stuck with it and member 2 stayed with their estimate until the last round, then lowered their estimate closer to the mean and median. Member 3 changed their estimate immediately and then stuck with it through the remaining rounds. Overall, the standard deviation did decrease, but not as much as the average estimate for question three.

Table 4.6: Question Three - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	14 to 45	30,40,14,45	32.25	35	13.67174
2	30 to 45	30,40,30,45	36.25	35	7.5
3	30 to 45	30,40,30,45	36.25	35	7.5
4	30 to 45	30,35,30,45	35	32.5	7.07106

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 number 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, low estimate showed a pattern of a constantly decreasing standard deviation. The decrease in the standard deviation was significant in coming to an almost full consensus on the low estimate. All panel members made some changes in their estimate at one point or another, which can be seen below in Table 4.7.

Table 4.7: Question Four - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	500 to 1000	$1000/ 500/ 700/ 850	762.5	775	213.6009
2	700 to 1000	$1000/ 750/ 700/ 700	787.5	725	143.61407
3	700 to 750	$750/ 750/ 700/ 700	725	725	28.86751
4	700 to 750	$750/ 750/ 725/ 700	731.25	737.5	23.93567

4.6.2 Question Four - Average Estimate

Results, listed in Table 4.8, show the initial range and standard deviation were quite large for the first round. The initial assumption was that this would decrease significantly over the next rounds. Members 1 and 4 set their initial estimates and did not change through the rounds, but members 2 and 3 did change their estimates. Member 3 changed their estimate once and left it alone and member 2 changed the estimate three out of four rounds. Although the standard deviation did not decrease to an actual number that most would consider small, it did decrease by over 50 percent, which could be considered significant, given the data set to analyze.

Table 4.8: Question Four - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	800 to 2000	$1800/ 800/ 2000/ 1200	1450	1500	550.75705
2	1200 to 1800	$1800/ 1200/ 1500/ 1200	1425	1350	287.22813
3	1200 to 1800	$1800/ 1300/ 1500/ 1200	1450	1400	264.57513
4	1200 to 1800	$1800/ 1300/ 1500/ 1200	1450	1400	264.57513

4.6.3 Question Four - High Estimate

The high estimate for question four had a large range, seen in Table 4.9, and similar to the average estimate, a large standard deviation. Member 1 stood fast in their estimate and never changed the high estimate. Member 2 changed their estimate in rounds two and four while members 3 and 4 only changed their estimates in round two and then left them alone. The standard deviation decreased to 32 percent of the original standard deviation.

Table 4.9: Question Four - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	1000 to 5000	$3600/ 1000/ 5000/ 2000	2900	2800	1762.5739
2	2200 to 3600	$3600/ 2800/ 3000/ 2200	2900	2900	577.35027
3	2200 to 3600	$3600/ 2800/ 3000/ 2200	2900	2900	577.35027
4	1200 to 1800	$3600/ 2900/ 3000/ 2200	2925	2950	573.73048

4.7 Travel Computation

When taking each value provide by each panel member and multiplying, as stated in the first section of our algorithm, the calculation becomes the first section in the cost of oversight estimate for the NSSAP 03-01 oversight process. These amounts are seen in Table 4.10. The range, from low to high, are $9,750 to $913,000.

Table 4.10: Total Travel Estimate for Cost of Oversight for One KDP

Member	Travel-Low	Travel-Average	Travel-High
1	$9,750	$144,000	$648,000
2	$30,000	$195,000	$913,500
3	$10,875	$150,000	$630,000
4	$35,000	$144,000	$792,000

4.8 Question Five

Estimate how many hours are spent on support for the DSAB 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 DSAB process.

4.8.1 Question Five - Low Estimate

The results, shown in Table 4.11, started off with another large range. In the round two, all members, but member 4, changed their estimates. Members 1 and 2 cut their estimates by half and member 3 raised theirs 450 percent. Member 4 made an estimate and stayed with that estimate. Since the answers did not change in round three, it was considered closed and consensus reached. It was assumed that no other changes were made which would cause any other member to change their answer.

Table 4.11: Question Five - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	10 to 120	120,160,10,44	83.5	82	68.67071
2	44 to 80	60,80,45,44	57.25	52.5	16.83993
3	44 to 80	60,80,45,44	57.25	52.5	16.83993
4	Consensus	Reached			

4.8.2 Question Five - Average Estimate

In Table 4.12, the average estimates have almost the same pattern as the low estimate for question five. This time, the only members to change any responses were members 2 and 3 and they only changed the estimates initially. Consensus was reached due to the similar circumstances stated in the low estimate portion of question five.

Table 4.12: Question Five - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	20 to 200	180,200,20,120	130	150	80.82903
2	90 to 180	180,120,90,120	127.5	120	37.74917
3	90 to 180	180,120,90,120	127.5	120	37.749174
4	Consensus	Reached			

4.8.3 Question Five - High Estimate

Table 4.13 below shows the results for the high estimates. Once again these showed the similar pattern as the earlier portions of question five. The range decreased by over half and the standard deviation decreased by over half. The members did not show any movement in changing estimates from round two to round three, so it was determined that consensus was reached for the high estimate of question five.

Table 4.13: Question Five - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	45 to 300	240,300,45,200	196.25	220	108.88641
2	135 to 240	240,160,135,200	183.75	180	46.07512
3	135 to 240	240,160,135,200	183.75	180	46.07512
4	Consensus	Reached			

4.9 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 IPA. The results are given in similar format as previous data collected.

4.9.1 Question Six - Low Estimate

The low estimate, seen in Table 4.14, was a volatile subject. Almost every respondent changed their estimate, except member 4, who chose nine and stuck with that estimate throughout. The rest of the panel agreed with member 4 and came closer and closer to that estimate. The standard deviation was reduced to less than one, which is considered a close consensus.

Table 4.14: Question Six - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	4 to 40	4,40,3,9	14	6.5	17.53062
2	5 to 10	9,10,5,9	8.25	9	2.21735
3	7 to 10	9,10,7,9	8.75	9	1.2583
4	9 to 10	9,10,10,9	9.5	9.5	0.57735

4.9.2 Question Six - Average Estimate

The average estimate, located in Table 4.15, showed less movement than other estimates. The mean and the median stayed constant while the standard deviation moved in round two. After round two, no other movement was made and the average estimate was not changed. Due to the change in the low estimate, however, question six remained open until the end of round four.

Table 4.15: Question Six - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	5 to 50	20,50,5,35	27.5	27.5	19.36491
2	20 to 35	20,30,25,35	27.5	27.5	6.45497
3	20 to 35	20,30,25,35	27.5	27.5	6.45497
4	20 to 35	20,30,25,35	27.5	27.5	6.45497

4.9.3 Question Six - High Estimate

The high estimate, seen below in Table 4.16, is rather stable from the start of round one through the end of round four. There were still changes made to the estimates by all panel members. Members 1 and 4 changed their estimates initially and then never changed the estimate again. Member 2 changed their estimate in round two and then reduced the estimate in round 4. Member 3 increased their estimate during each round.

In the final round the mean and median were stable and the standard deviation was reduced significantly from the initial round.

Table 4.16: Question Six - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	12 to 76	30,70,12,76	47	50	31.00537
2	40 to 55	40,55,40,50	46.25	45	7.5
3	40 to 55	40,55,42,50	46.75	46	6.99404
4	40 to 50	40,50,45,50	46.25	47.5	4.78713

4.10 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 is projected.

4.10.1 Question Seven - Low Estimate

In Table 4.17, the low estimates are provided. The estimates changed in the first three rounds and remained unchanged for the final round. The standard deviation was reduced and the median remained constant after round two. Member 1 and 4 remained with their initial estimate during all four rounds. Member 2 changed their estimate in round two and member 3 changed their estimate in rounds one, two and three.

Table 4.17: Question Seven - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	32 to 100	$32,$40,$100,$50	55.5	45	30.56686
2	32 to 75	$32,$50,$75,$50	51.75	50	17.67059
3	32 to 50	$32,$50,$50,$50	45.5	50	9
4	32 to 50	$32,$50,$50,$50	45.5	50	9

4.10.2 Question Seven - Average Estimate

Question seven's estimates, located in Table 4.18, came to a consensus in round three with a minimized standard deviation of 2.5. It was continued due to the potential decrease in round four. Member 4 was the only member who maintained a constant estimate while other members appeared to converge to member 4's estimate. The range went from eighty to five in three rounds.

Table 4.18: Question Seven - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	50 to 130	$60,$50,$130,$75	78.75	67.5	35.67795
2	60 to 100	$60,$70,$100,$75	76.25	72.5	17.01714
3	70 to 75	$75,$70,$75,$75	73.75	75	2.5
4	70 to 75	$75,$70,$75,$75	73.75	75	2.5

4.10.3 Question Seven - High Estimate

The high estimate for question seven, seen in Table 4.19, did not change as much s the average estimates. Although the standard deviation did not change a considerable amount, it was still decreased by 50 percent and the range was decreased by from 190 to 100. Member 1 stayed with their original estimate during all four rounds and was the highest. Member 2 increased their estimate during all four rounds and members 3 and 4 made minor changes initially.

Table 4.19: Question Seven - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	60 to 250	$250,$60,$200,$150	165	175	81.03497
2	100 to 250	$250,$100,$200,$175	181.25	187.5	62.5
3	130 to 250	$250,$130,$190,$175	186.25	182.5	49.56056
4	150 to 250	$250,$150,$190,$175	191.25	182.5	42.5

4.11 Personnel Cost Computation

Calculating questions five, six, and seven together provide the cost estimate for the total personnel costs for one KDP in a program. Seen below in Table 4.20, the figures are ranging from $17,280 to $2,400,000 for personnel costs in the NSSAP 03-01 oversight process.

Table 4.20: Total Personnel Estimate for Cost of Oversight for One KDP

Member	Personnel-Low	Personnel-Avg	Personnel-High
1	$17,280	$115,200	$2,400,000
2	$40,000	$180,000	$1,200,000
3	$22,500	$112,500	$1,154,250
4	$19,800	$210,000	$1,750,000

4.12 Question Eight

Estimate how many meetings are normally held from the PEO preparation, through DSAB approval. (this includes meetings 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 truly what part meetings play in the cost of oversight. Question eight deals specifically with the number of meetings that are held during one KDP in a program. The results are listed in the following three paragraphs.

4.12.1 Question Eight - Low Estimate

The low estimate, in Table 4.21, was immediately moved in round two and then remained constant until survey completion. The standard deviation showed significant reduction, even for only being changed once. The range was decreased from twenty to three and members 1 and 4 were the pace setters, once again, by creating an estimate and staying with that estimate throughout all four rounds.

Table 4.21: Question Eight - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	5 to 25	7,25,5,8	11.25	7.5	9.25112
2	7 to 10	7,10,7,8	8	7.5	1.41421
3	7 to 10	7,10,7,8	8	7.5	1.41421
4	7 to 10	7,10,7,8	8	7.5	1.41421

4.12.2 Question Eight - Average Estimate

The average estimate, seen below in Table 4.22, fell mostly in between 15 and 16. The standard deviation was decreased to 25 percent of the original value. The response range was decreased from twenty-seven to seven, with some hesitation. The round three values were not changed and almost considered a consensus, but in round four, member 3 changed their estimate to approach the mean and median of the other respondents.

Table 4.22: Question Eight - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	8 to 35	8,35,10,13	16.5	11.5	12.50333
2	12 to 20	16,20,12,13	15.25	14.5	3.59397
3	12 to 20	16,20,12,13	15.25	14.5	3.59397
4	13 to 20	16,20,14,13	15.75	15	3.09569

4.12.3 Question Eight - High Estimate

The high estimate for question eight, seen in Table 4.23, remained a moving target during all four rounds. The range began at 35 and decreased to 13 at the end of round four. The standard deviation was decreased to approximately 30 percent of the original value. Member 4 stayed with their original estimate during all four rounds and members 2 and 3 changed their estimates to match closer with the mean and median for each round.

Table 4.23: Question Eight - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	15 to 50	16,50,20,15	25.25	18	16.64081
2	15 to 35	25,35,22,15	24.25	23.5	8.3016
3	15 to 30	25,30,23,15	23	23.5	6.27162
4	15 to 28	25,28,25,15	23.25	25	5.6789

4.13 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, 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.

4.13.1 Question Nine - Low Estimate

The low estimate in question nine, located in Table 4.24, contained only one change by one respondent in all four rounds. Member 2 changed their answer in the second round and no other changes were made. Even with the minor change in the estimate by member 2, the data set remained close with a low standard deviation and a comparatively close range.

Table 4.24: Question Nine - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	.25 to 4	.25,4,1,.3	1.3875	0.65	1.775
2	.25 to 2	.25,2,1,.3	0.8875	0.65	0.81687
3	.25 to 2	.25,2,1,.3	0.8875	0.65	0.81687
4	.25 to 2	.25,2,1,.3	0.8875	0.65	0.81687

4.13.2 Question Nine - Average Estimate

The average estimate for question nine, listed in Table 4.25, had a similar pattern to the low estimate. Members 1 and 4 provided an estimate and never changed their initial estimate. Member 2 changed their initial estimate in the second round and never changed the estimate in the following rounds. Member 3 changed the estimate in rounds

2 and 4. In the last round of the survey, although the range and standard deviation did not noticeably change, almost all members came to an agreement on an estimate.

Table 4.25: Question Nine - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	2 to 6	4,6,2,2.5	3.625	3.25	1.79698
2	2.5 to 4	4,4,3,2.5	3.375	3.5	0.75
3	2.5 to 4	4,4,3,2.5	3.375	3.5	0.75
4	2.5 to 4	4,4,4,2.5	3.625	4	0.75

4.13.3 Question Nine - High Estimate

The high estimate for question nine, located in Table 4.26 below, never changed in range and the change in standard deviation was very minuscule. There was an initial close consensus in the first round and slowly spread out during all four rounds. It was interesting that, even though three out of four estimated eight on the first round, by the end of round four, each member had a different estimate. The standard deviation did decrease due to the closer interval to the mean in the data set.

Table 4.26: Question Nine - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	8 to 12	12,8,8,8	9	8	2
2	8 to 12	12,8,8,8	9	8	2
3	8 to 12	12,9,8,8	9.25	8.5	1.89296
4	8 to 12	12,9,10,8	9.75	9.5	1.70782

4.14 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 KDP. 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.

4.14.1 Question Ten - Low Estimate

Question ten's low estimate, listed in Table 4.27, moved significantly in relation to the range and standard deviation. Member 3 was the only respondent to change their estimate while the other three members left their estimate the same from round one throughout the whole survey.

Table 4.27: Question Ten - Low Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	32 to 100	$32,$40,$100,$50	55.5	45	30.56686
2	32 to 75	$32,$40,$75,$50	49.25	45	18.67931
3	32 to 50	$32,$40,$50,$50	43	45	8.71779
4	32 to 50	$32,$40,$45,$50	41.75	42.5	7.67571

4.14.2 Question Ten - Average Estimate

The average estimate, seen in Table 4.28, initially had a large range of 70 and a relatively large standard deviation which was half of the range. The standard deviation was eventually reduced by round three to 7.5 and most members came to a consensus with one number. Member 2 changed their estimate in the second round and left the estimate the same while member 3 changed their estimate twice.

Table 4.28: Question Ten - Average Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	60 to 130	$60,$50,$130,$75	78.75	67.5	35.67795
2	60 to 100	$60,$60,$100,$75	73.75	67.5	18.87458
3	60 to 75	$75,$60,$75,$75	71.25	75	7.5
4	60 to 75	$75,$60,$75,$75	71.25	75	7.5

4.14.3 Question Ten - High Estimate

The high estimate, listed in Table 4.29, was an estimate that never really came to a consensus. Member 1 chose one number and it was the highest estimate in the responses. The other members changed their estimates, at least once, which approached the mean and median of the most current round. The standard deviation did reduce by almost half and the data range was also reduced by almost half.

Table 4.29: Question Ten - High Estimate By Round

Round	Range	Member 1,2,3,4	Mean	Median	Std Deviation
1	60 to 250	$250, $60,$250,$150	177.5	200	91.42392
2	100 to 250	$250,$100, $200, $250	181.25	187.5	62.5
3	130 to 250	$250,$130,$200,$175	188.75	187.5	50.06246
4	150 to 250	$250,$150,$150,$175	181.25	162.5	47.32423

4.15 Meeting Cost Computation

Combining questions eight, nine, and ten provide the total estimated cost of meetings in the NSSAP 03-01 oversight process. This calculation is located in Table 4.30, seen below. The costs for meetings range from only $56 to $75,000 for one person for each KDP in one program.

Table 4.30: Meeting Estimate for Cost of Oversight for One Person

Member	Meetings-Low	Meetings-Avg	Meetings-High
1	$56	$4,800	$75,000
2	$800	$4,800	$37,800
3	$315	$1,200	$37,500
4	$120	$2,438	$21,000

The numbers provided above only give the cost for one person going to meetings. With these calculations, another computation is needed and that requires the actual number of people attending the meetings. These were provided in an additional question at the end of the Delphi to capture a basic estimate. The results are located in Table 4.31.

Table 4.31: Total Number of Members Present at Meetings

Member #	Low	Avg	High
1	8	25	75
2	5	10	45
3	8	25	75
4	25	55	80

With this additional information, the number of people attending the meeting is multiplied with the total cost of meetings to provide us with a true cost of meetings in the oversight process under the NSSAP 03-01 guidelines. These costs are seen in Table 4.32 and range from $448 to $5,625,000.

Table 4.32: Total Cost of Meetings in Oversight Process

MEMBER	Meeting-LOW	Meeting-AVG	Meeting-HIGH
1	$448.00	$120,000.00	$5,625,000.00
2	$4,000.00	$48,000.00	$1,701,000.00
3	$2,520.00	$105,000.00	$2,812,500.00
4	$3,000.00	$134,062.50	$1,680,000.00

4.16 Summary of Results

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 10 questions provided in the survey and all objectives for the data collection portion were met.

The focus now turns to answering the first research question stated in Chapter 3. This question is to find the cost of oversight for one program's cost of oversight under the NSSAP 03-01 directives. By using the algorithm provided the total amounts are seen below in Table 4.33. The forecasted range for the cost of oversight for one program in one KDP ranges from $27,478 to $8,673,000. These points represent the optimistic and pessimistic views of the total cost of oversight.

Table 4.33: Total Cost of Oversight for One KDP in One Program

Key Decision Point (KDP)			
MEMBER	MDP Low	MDP Avg	MDP High
1	$27,478.00	$534,000.00	$8,673,000.00
2	$74,000.00	$495,000.00	$3,814,500.00
3	$35,895.00	$423,750.00	$4,596,750.00
4	$57,800.00	$593,062.50	$4,222,000.00

Since Table 4.33 shows the cost for only one KDP, by using one of the assumptions stated in Chapter 3, these numbers are simply multiplied by three to provide a forecast for the total cost of oversight for a program operating within the guidelines of the NSSAP 03-01. These are shown below in Table 4.34. The range is $82,434 to $26,019,000.

Table 4.34: Total Cost of Oversight for One Program

Total Program			
MEMBER	Program Low	Program Avg	Program High
1	$82,434.00	$1,602,000.00	$26,019,000.00
2	$222,000.00	$1,485,000.00	$11,443,500.00
3	$107,685.00	$1,271,250.00	$13,790,250.00
4	$173,400.00	$1,779,187.50	$12,666,000.00

Now that each member's estimates have been provided, the information will be placed in statistical software as a database in order to answer the final two research questions. Each respondent will have their estimates entered for each question. This will be compared with other respondents from the theses research conducted by Neal (32) and Rousseau (40). 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. (ie, NSSAP 03-01, DoDD 5000, or C3I)

Once this analysis has been completed, the results and analysis will be presented in Chapter 5 to see if there truly is a difference in the cost of oversight among programs. Along with the comparative analysis, a simulation will be conducted with Monte Carlo simulation techniques. By using the estimates provided by the expert panel members, the additional 10,000 iterations will provide a more accurate picture of the cost of oversight of a program under the NSSAP 03-01.

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 responses. The comparisons are conducted in the manner discussed in the methodology described in Chapter 3. Question one will contain only a qualitative discussion on 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.

The final section will conclude the analysis with the recommendation for future oversight transformation efforts as well as provide any insight, gained from this research, as to whether the goal of transformation realized by the Commission on Space has been achieved. 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) recommendation, to the Defense Systems Acquisition Board (DSAB) approval (including the entire Integrated Program Assesment (IPA) process), what are the five major cost drivers in the oversight process?***

The results for all three oversight processes are listed in Table 5.1 below. DoDD 5000 and C3I drivers focused mainly on issues dealing with the program, itself, not so much on the oversight process. This seems to be due to the oversight process for both are centralized and all aspects for the program are centrally driven and approved. Notice that for the NSSAP 03-01 drivers, they are issues dealing more with lower level problems, such as TDYs, personnel out of the program supporting other programs, or IPAs. The hypothesis gained from this perspective is that when a program is under a decentralized oversight process, the external drivers, such as requirements and other issues are not as big of focus as when a program is in a centralized form of oversight. Although C3I is a new model for oversight, it is still under the guidelines of the basic DoDD 5000 structure and the drivers are noticeably similar. This display then answers research question three and identifies the main cost drivers, as seen by those in the actual programs regulated.

Table 5.1: Cost Drivers for Oversight Processes

Drivers Picked--DoDD 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 to 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/PerDiem costs (Team and support personnel)	5
Drivers Picked--C3I	**Rank**
Lack of functional requirements that are clearly defined and understood	1
Negotiating viewpoints of the various stakeholders…acq strategy re-do	2
The serial process of document approval by the several echelons of oversight	3
The lack of established architectures and the resulting need for unique C4ISP efforts	4
Changing oversight requirements;the way we did things previously not work now due to changing personalities, policy etc.--requires climbing the learning curve again	5

5.3 Question Two

From the PEO recommendation, to the DSAB approval of the KDP, use your professional judgment and estimate how many TDYs are taken by one person to get one program through one Key Decision Point (KDP)/Integrated Program Assessment (IPA) process?

When comparing question two, there were statistical differences for all three oversight processes when comparing C3I and DoDD 5000 with Space oversight. Seen in Table 5.2, at all levels of the forecasts, not one of the estimates were statistically similar to Space oversight under the NSSAP 03-01. When looking at the data, Space was always lower in the estimates for the number of TDYs taken by a person in the program. With this comparison, it is shown that, under NSSAP 03-01, it is perceived that the IPA process actually requires fewer TDYs for each person for each KDP.

Table 5.2: ANOVA for Question Two

Question 2	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0004	0.0038	0.0075
Space vs 5000	0.0001	0.0005	0.0004

5.4 Question Three

Estimate how many people normally go TDY throughout the KDP/IPA process.

In question three, there were not any significant statistical differences when looking for the number of people that actually go TDY in the KDP/IPA process. Table 5.3 shows that, among the different oversight processes, there aren't any differences in the perception that the number of people going TDY has decreased. This is especially interesting when reviewing the C3I process. The expectation would be that, since it is a mostly virtual process, the actual number of people going TDY would decrease, however, when looking at the raw data, it is slightly lower, than DoDD 5000 and Space, but not significant enough to have a statistical difference. The shaded areas on each table represents areas that have no statistical difference.

Table 5.3: ANOVA for Question Three

Question 3	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0811	0.1071	0.1345
Space vs 5000	0.4934	0.3418	0.2323

Fail to reject

5.5 Question Four

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

In trying to capture the cost for each person on each TDY, the results were varied for the different oversight process comparisons. Seen in Table 5.4, the low estimate showed statistical significance in the difference in forecasts while the average showed very little differences, although the average for space and C3I were borderline. For the low estimate, C3Is costs were actually a bit higher than the estimates for space oversight. Comparing the low estimates with the DoDD 5000, the estimates are even lower. The only guess could be the costs increase because the length of the TDY is actually longer, due to the IPA process. This would cause the costs to increase, but the actual number of TDYs, shown above in Table 5.2, to remain lower.

The average costs were statistically similar. The high estimates for cost of each TDY was only different between DoDD 5000 and Space oversight. Again, based on the initial hypothesis that the IPA TDYs are longer, the costs are higher. DoDD 5000 estimates came in actually lower than the Space NSSAP 03-01 estimates.

Table 5.4: ANOVA for Question Four

Question 4	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0008	0.0582	0.1143
Space vs 5000	0.043	0.3136	0.0087

5.6 Travel Computation

Looking at all data points combined for all three theses, Table 5.5 displays the ranges forecasted for the total combinations of the cost of travel in the different oversight processes. Although in the earlier comparisons of travel estimates, space oversight was higher in cost per TDY, the overall range of total costs is lower. This again is hypothesized that due to the IPA process, the cost of each TDY is increased, but the total number of TDYs are decreased, resulting in an overall decrease in total TDY costs. This seems to hold true when actually comparing the total cost for travel among the oversight processes.

Table 5.5: Travel Cost Computations

5000 - Travel			
MEMBER	Travel-LOW	Travel-AVG	Travel-HIGH
1	$336,000.00	$1,152,000.00	$3,840,000.00
2	$576,000.00	$1,728,000.00	$6,480,000.00
3	$28,800.00	$192,000.00	$720,000.00
4	$12,000.00	$100,000.00	$1,250,000.00
5	$18,000.00	$180,000.00	$720,000.00
MEAN	$194,160.00	$670,400.00	$2,602,000.00
STD DEV	$253,711.90	$732,320.15	$2,524,048.34
Space			
MEMBER	Travel-LOW	Travel-AVG	Travel-HIGH
1	$9,750.00	$144,000.00	$648,000.00
2	$30,000.00	$195,000.00	$913,500.00
3	$10,875.00	$150,000.00	$630,000.00
4	$35,000.00	$144,000.00	$792,000.00
MEAN	$21,406.25	$158,250.00	$745,875.00
STD DEV	$12,979.70	$24,662.72	$133,206.84
C3I - Travel			
MEMBER	Travel-LOW	Travel-AVG	Travel-HIGH
1	$36,000.00	$400,000.00	$3,000,000.00
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	$94,500.00	$523,625.00	$2,583,000.00
STD DEV	$97,534.61	$473,355.99	$1,821,086.49

5.7 Question Five

Estimate how many hours are spent on support for the DSAB 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, located in Table 5.6, shows that there were statistical differences across every aspect for each estimate level. Comparing the C3I estimates, due to the virtual nature inherent in the process, the hours for preparation are lower than space oversight. This is assumed to be due to the availability of all documents for oversight on the internet or website. For space oversight, this is not the case and the estimates for low, average, and high are all higher for space than for C3I.

When comparing with DoDD 5000, the case is an extreme opposite. DoDD 5000 process is significantly higher than space oversight. This is assumed to be due to the number of meetings that are required between each level of approval, which is not in the IPA process for space oversight under the direction for the NSSAP 03-01. This is a very significant question that shows how much of an influence the virtual process in C3I can have if possibly introduced in other programs.

Table 5.6: ANOVA for Question Five

Question 5	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0019	0.0012	0.0007
Space vs 5000	0.0071	0.001	0.0005

5.8 Question Six

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

This comparison was split exactly down the center, by oversight process. Shown in Table 5.7, the difference between space and C3I is once again statistically different in all three estimates. However, there are no statistical differences between space and the DoDD 5000 oversight processes. When looking at the raw data, C3I is definitely lower than the other oversight processes when reviewing the number of people involved in the preparation process. Once again, the assumption is based on the availability of the information to everyone involved in real-time and the ability to view that information whenever possible.

Comparing space to DoDD 5000, they are statistically similar due to the necessary meeting preparation for IPA or DAB approval. Although the DoDD 5000 oversight process has an increased number of meetings, the IPA is assumed to still have those meetings, but only in a set timeframe during the IPA. By showing this information, it is hypothesized that the information is still being gathered and prepared in similar manners under DoDD 5000 and the NSSAP 03-01 processes, while C3I enables the real-time review for the approval process, decreasing the number of people needed to prepare for the approval process.

Table 5.7: ANOVA for Question Six

Question 6	**p-Values (.05 significance level)**		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0001	0.002	0.0001
Space vs 5000	0.2225	0.2213	0.1415

5.9 Question Seven

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

Question seven was varied among the three different processes, which is seen below in Table 5.8. Looking at the low estimate first, the level for Space compared with C3I is statistically different. But when compared with the DoDD 5000, there isn't a difference. This is again true for the average estimate. But for the high estimate, the two swap and have statistical differences in different order.

The data reviewed shows that the estimate for the C3I process was higher in the low and average estimates when compared with space and the high estimate was very similar. When reviewing the DoDD 5000 data, the reverse is true. No assumption can be made as to why this occurs, but the statistical differences from the Delphi processes remain.

Table 5.8: ANOVA for Question Seven

Question 7	p-Values (.05 significance level)		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.003	0.0001	0.2178
Space vs 5000	0.6153	0.0746	0.0018

5.10 Personnel Cost Computation

When reviewing the total estimates provided by all three types of oversight, the comparison of total costs for personnel show large value differences. Shown in Table 5.9, the C3I portion is significantly smaller than the NSSAP or DoDD 5000 oversight processes. DoDD 5000 oversight process has the largest range for all three. Ranging from $120,000 to over $24M, personnel costs create a large portion for the cost of oversight in programs under the centralized control of DoDD 5000. Space is estimated lower at $17,280 to $2.4M, but doesn't compare with the C3I estimates of $4,200 to just over $144,000. This shows that using the C3I approach could provide some potential cost savings in the oversight process by placing items in a virtual environment and allowing those who have access the ability to view at their leisure.

Table 5.9: Personnel Cost Computation

5000 - Personnel			
MEMBER	Person-LOW	Person-AVG	Person-HIGH
1	$2,373,600.00	$7,654,400.00	$14,664,000.00
2	$2,250,000.00	$7,312,500.00	$22,440,000.00
3	$182,320.00	$894,300.00	$3,151,260.00
4	$120,000.00	$1,200,000.00	$7,200,000.00
5	$215,000.00	$805,000.00	$2,820,000.00
MEAN	$1,028,184.00	$3,573,240.00	$10,055,052.00
STD DEV	$1,173,086.83	$3,574,565.45	$8,408,165.41
Space Personnel			
MEMBER	Person-LOW	Person-AVG	Person-HIGH
1	$17,280.00	$270,000.00	$2,400,000.00
2	$40,000.00	$252,000.00	$1,200,000.00
3	$22,500.00	$168,750.00	$1,154,250.00
4	$19,800.00	$315,000.00	$1,750,000.00
MEAN	$24,895.00	$251,437.50	$1,626,062.50
STD DEV	$10,293.11	$61,161.80	$582,659.43
C3I - Personnel			
MEMBER	Person-LOW	Person-AVG	Person-HIGH
1	$4,200.00	$25,500.00	$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	$6,570.00	$28,575.00	$124,650.00
STD DEV	$1,596.12	$4,005.31	$23,851.42

5.11 Question Eight

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

This comparison, located in Table 5.10, found one statistical significance when comparing the means in the ANOVA test. The low estimate for the comparison of Space to C3I had 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. It was expected that the IPA process would decrease the number of meetings required, which was the same as expected with the C3I process. This assumption was true, if one only looked at the data, without any statistical testing. Reviewing the data provided in the DoDD 5000 process showed a numerically larger number of meetings in the range provided, but, did not develop a difference when tested at the .05 significance. This will result in a larger dollar figure for the total cost of oversight projected for the DoDD 5000 oversight process, but does not show a statistical difference when compared with the NSSAP 03-01 process for Space.

Table 5.10: ANOVA for Question Eight

Question 8	**p-Values (.05 significance level)**		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0372	0.1248	0.1306
Space vs 5000	0.0667	0.1117	0.0768

5.12 Question Nine

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

The length of meetings was similar in almost all comparisons. The only difference, seen in Table 5.11, is when comparing Space to DoDD 5000 oversight. This was due to DoDD 5000 estimates being a little higher than Space. It wasn't numerically different, but when comparing the means, there was an apparent statistical difference. Otherwise, comparing with the rest of the estimates, nothing significant was noted for question nine.

Table 5.11: ANOVA for Question Nine

Question 9	**p-Values (.05 significance level)**		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0601	1.00	0.6963
Space vs 5000	0.0346	0.3451	0.4016

5.13 Question Ten

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

Question ten was varied among the three different processes, which are seen in Table 5.12. Looking at the low estimate first, the level for Space compared with C3I is statistically different. But when compared with the DoDD 5000, there isn't a difference. This is again true for the average estimate. But for the high estimate, the two swap and have statistical differences in different order.

The data reviewed shows that the estimate for the C3I process was higher in the low and average estimates when compared with space and the high estimate was very similar for all three. When reviewing the DoDD 5000 data, the reverse is true. No assumption can be made as to why this occurs, but the statistical differences from the Delphi processes remain and provide similar results as those found in question seven, which dealt with the similar topic.

Table 5.12: ANOVA for Question Ten

Question 10	**p-Values (.05 significance level)**		
COMPARISON	LOW	AVG	HIGH
Space vs C3I	0.0028	0.0001	0.1008
Space vs 5000	0.1722	0.2536	0.0049

5.14 Meeting Cost Computation

When comparing the actual cost estimate calculations, an interesting point came to light. Shown in Table 5.13, the total cost for meetings was actually lowest in the DoDD 5000 oversight process. More information would be required to make any large assumptions as to why this had occurred, but the assumption that could be made is due to the lower cost per hour of personnel contributing in the meeting process. The other areas for the cost computation come in significantly higher in the DoDD portion when comparing to the other oversight processes. Because of this one factor, the C3I process still looks as though it could statistically come in with a lower cost for meetings than the DoDD 5000 oversight process. The other interesting occurrence is the high costs that were calculated in the C3I process. They were associated with one high point that may have been just an anomaly, but there isn't sufficient evidence to keep this data point out.

Table 5.13: Meeting Cost Computation

5000 - Meeting			
MEMBER	**Meeting-LOW**	**Meeting-AVG**	**Meeting-HIGH**
1	$51,600.00	$397,440.00	$3,384,000.00
2	$34,560.00	$270,000.00	$2,736,000.00
3	$43,756.80	$260,160.00	$2,075,220.00
4	$7,200.00	$128,000.00	$1,800,000.00
5	$15,480.00	$88,320.00	$406,080.00
MEAN	$30,519.36	$228,784.00	$2,080,260.00
STD DEV	$18,747.83	$123,506.69	$1,119,283.55
Space - Meeting			
MEMBER	**Meeting-LOW**	**Meeting-AVG**	**Meeting-HIGH**
1	$448.00	$120,000.00	$5,625,000.00
2	$4,000.00	$48,000.00	$1,701,000.00
3	$2,520.00	$105,000.00	$2,812,500.00
4	$3,000.00	$134,062.50	$1,680,000.00
MEAN	$2,492.00	$101,765.63	$2,954,625.00
STD DEV	$1,495.64	$37,757.05	$1,857,179.46
C3I - Meeting			
MEMBER	**Meeting-LOW**	**Meeting-AVG**	**Meeting-HIGH**
1	$33,600.00	$825,000.00	$14,400,000.00
2	$18,000.00	$112,500.00	$448,000.00
3	$37,500.00	$300,000.00	$2,208,000.00
4	$39,600.00	$257,040.00	$3,686,400.00
MEAN	$32,175.00	$373,635.00	$5,185,600.00
STD DEV	$9,771.51	$311,415.24	$6,283,940.47

5.15 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 IPA process under the NSSAP 03-01 oversight process. These results are shown in Table 5.14. The cost drivers for all oversight processes have been identified. 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.

Table 5.14: Program Cost Computation

5000 - Program			
MEMBER	**Program Low**	**Program Avg**	**Program High**
1	$8,283,600.00	$27,611,520.00	$65,664,000.00
2	$8,581,680.00	$27,931,500.00	$94,968,000.00
3	$764,630.40	$4,039,380.00	$17,839,440.00
4	$417,600.00	$4,284,000.00	$30,750,000.00
5	$745,440.00	$3,219,960.00	$11,838,240.00
MEAN	$3,758,590.08	$13,417,272.00	$44,211,936.00
STD DEV	$4,270,333.53	$13,109,978.82	$35,217,742.48
Space - Program			
MEMBER	**Program Low**	**Program Avg**	**Program High**
1	$82,434.00	$1,602,000.00	$26,019,000.00
2	$222,000.00	$1,485,000.00	$11,443,500.00
3	$107,685.00	$1,271,250.00	$13,790,250.00
4	$173,400.00	$1,779,187.50	$12,666,000.00
MEAN	$146,379.75	$1,534,359.38	$15,979,687.50
STD DEV	$63,337.35	$213,056.30	$6,761,137.82
C3I - Program			
MEMBER	**Program Low**	**Program Avg**	**Program High**
1	$221,400.00	$3,751,500.00	$52,605,000.00
2	$201,600.00	$696,600.00	$3,028,800.00
3	$314,100.00	$2,190,000.00	$13,194,000.00
4	$861,840.00	$4,471,920.00	$25,891,200.00
MEAN	$399,735.00	$2,777,505.00	$23,679,750.00
STD DEV	$311,948.30	$1,682,759.26	$21,431,855.48

The remaining task is summarizing the results is to see if there are any statistical differences among the oversight processes for the total cost of one program through the whole process. The result of this analysis is shown in Table 5.15. The results indicate that, given our assumptions, there is not a statistical difference among the different oversight processes. Even with the large ranges in the estimated cost of oversight for the different processes, they cannot be identified as statistically different.

Table 5.15: 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

The ranges for each process can be seen in Table 5.16, and the overlap in the range numbers explains the failure to find significant differences in the oversight processes. Although not statistically different, the results indicate that each oversight process has its own cost savings potential.

Table 5.16: Total Cost Ranges by Oversight Process within Range

Process	Low Range	Avg Range	High Range
NSSAP	$82,434 to $222,000	$1,271,000 to $1,779,188	$11,443,500 to $26,019,000
C3I	$201,000 to $861,840	$696,600 to $4,471,920	$3,028,800 to $52,605,000
5000	$417,600 to $8,581,680	$3,219,960 to $27,931,500	$11,838,240 to $94,968,000

5.16 Recommendations

To enhance the oversight process and decrease the potential cost of oversight that all three oversight processes posses, it is my recommendation that the process of IPA and C3I be merged into an oversight process that allows approval by an independent board, but information for those meetings and approval processes should be available over a virtual process. This could potentially decrease the above costs, listed in Table 5.16 to a smaller range located in Table 5.17. By combining both processes, the total for potential savings ranges from $40,000 to a little over $74M per program. These funds could be realized either directly or indirectly, either in saved man-hours or actual bottom-line budget savings. Either way, this move has a potential for significant savings to the point that some sort of live program test or feasibility study should be performed.

Table 5.17: Proposed Combined Oversight Process IPA/C3I

Process	Low Range	Avg Range	High Range
Proposal	$43,194 to $140,040	$652,500 to $1,087,988	$7,200,000 to $20,046,000

Although the potential does exist for these cost saving areas, it should also be noted that these changes would require wide structural transformations. The review process would almost become an additional duty, instead of a full-time position. This would raise several questions on the best structure for this merged oversight that has been proposed.

5.17 Follow-on Possibilities

There is a potential for further research in this area. An analysis gathering more panel members and the inclusion of the Ballistic Missile Defense Agency is a possibility that could add even more possibilities of cost savings for the Department of Defense and the oversight of future acquisition processes. It is also important to note that these experts, from all three panels, were mostly from Air Force sources or backgrounds. A excellent follow-on would gather data from other services and compare to this study.

Another option is to gather additional data and utilizing simulation to increase the number of data points collected. By adding the additional data sources, a more effective range of estimates could be achieved. Another possibility is to see if the costs are increased or decreased as programs are delayed in the process. Such as when a program doesn't pass a KDP and must go through the IPA process again.

This research only scratches the surface on the potential research trying to capture the cost of oversight. These funds aren't always budgeted dollars, but do cost the government in direct or indirect costs. Overall, this research provides the basis for the identification for potential cost savings in the acquisition environment to help slow the increasing costs in major weapons system procurement.

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Vita

Lt DeReus graduated from John F. Kennedy High School in Cedar Rapids, Iowa. He entered the military, as an enlisted member, in 1991. Through various assignments, Lt DeReus attended several different universities, between deployments and other operational mission demands. His educational pursuit culminated with earning a Bachelor of Science in Business Administration from the University of Phoenix at Edwards AFB, California, in March, 2000.

Lt DeReus held many assignments where he was an instructor in Aerospace Physiology. He has attended Combat Land Survival, Parachutist Water Survival, Arctic Survival, Army Airborne Parachutist, Army Military Freefall course, and other physiological studies. Lt DeReus performed additional duties as an Operational Support Aircrew Member for High Altitude/Low Opening parachuting missions and gained experience while dealing with all services' special operations attaining over 220 flight hours. He also performed additional duties as a Test Parachutist while at Edwards AFB and achieved over 100 parachuting jumps. It was these experiences that led him to the decision that he wanted to earn a commission through Officer Training School, which he graduated from in August, 2000.

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
For the past 50 years, the military's use of space for our national defense has increased exponentially. The use of space has increased so much that recent events have led to the approval for most space Major Defense Acquisition Programs to fall under their own process of oversight to track and monitor these programs. The largest reason for this change is due to the difference in spending profiles and current acquisition regulations that are not structured to meet these space expenditure plans. The key problem is no one knows, for sure, how much the oversight process actually costs and if one form of oversight is actually statistically better than the other. If the other processes are better, what actually drives the cost for their 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 other oversight processes for the Department of Defense Directive 5000 and the Command, Control, Communication, and Intelligence new virtual process, to discover where the statistical differences are in the cost of oversight. The total costs for all three oversight processes will then provide insight on where the largest cost benefits appear to be, based on data collected, and recommendations will develop a future track for the next generation of oversight processes.

15. SUBJECT TERMS
Cost of Oversight, Total Oversight Cost Drivers, Cost Savings in the Oversight Process
Delphi Method, Cost Savings for Oversight Process

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