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Knowledge-Based Decision Support in Department of Defense Acquisitions

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KNOWLEDGE-BASED DECISION SUPPORT IN DEPARTMENT OF DEFENSE ACQUISITIONS

THESIS

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Abstract

Despite numerous reform efforts over the past 30 years, acquisition programs in the Department of Defense (DoD) continue to experience cost overruns and schedule delays. One contributing factor is the decision-making process used by defense officials. The General Accounting Office (GAO) has stated that 'poor program outcomes are the lack of widespread adoption of a knowledge-based acquisition process within DoD despite polices that support such a process. A knowledge-based business case at the outset of each program would alleviate overpromising on cost, schedule, and performance and would empower program managers.'

Effective decision-making for acquisition programs is very important. It not only affects the performance of a program but could also impact the lives of Airman, Soldiers, Sailors, and Marines protecting our country. Analyzing decision support products is one method to improve the knowledge used during the decision-making process. Therefore, the scope of this research focused on knowledge products supporting decisions made by DoD acquisition officials and their alignment with best practices and their usefulness to decision-makers.

This research found that the required information contained in decision support products is not adequate to provide the knowledge needed to make informed decisions. Recommendations for improving decision support for key knowledge areas will be discussed.

Acknowledgments

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KNOWLEDGE-BASED DECISION SUPPORT IN DOD ACQUISITIONS

Chapter I. Introduction

Changes in the acquisition process in the Department of Defense (DoD) have been on-going over the course of the past three decades. The problem, however, is that most reforms that have been implemented have largely been unsuccessful (Friedman, 2009). The reasons for the failure of acquisition reform are complicated and are due to many different factors. Despite these reform efforts, many programs are still being completed behind schedule and with substantial cost overruns. Even worse, the acquisition process within the DoD has actually become less consistent (Dawn et al., 1998). The end-result is an acquisition system that is facing greater problems and resulting in even more wasted resources for the United States military (Gill, 2001).

One problem that exists for the DoD is that the acquisition process is largely based on external influences as opposed to a genuine knowledge-based approach to acquiring new systems and materials (Ignols and Brem, 1998). What is needed for the DoD acquisition community is to ensure that the right knowledge is captured at key decision points to determine the most effective means by which to acquire new weapon systems. Therefore, this research is designed to investigate what is occurring within the DoD acquisition decision-making process. It is these decisions (most of which are made early in a program's life-cycle) that are causing less than ideal results with regard to weapon system programs being behind schedule, over budget, and at times not performing as planned.

Background

In its most basic form, knowledge-based decision-making is simply the process of collecting and using data and information to gain knowledge that can be used to make informed decisions (Fay, 2007). This process can be a powerful tool in which organizations utilize the synthesis of data and information that will lead to making better decisions. Although used by both public and private sector organizations, there are differences in the ways in which they utilize this process. The differences are normally attributed to the role that these organizations play in society. However, although recognized, the influence of the context in which knowledge-based decision support is made is largely unexplored (Papadakis and Barwise, 1998).

In the private sector, through market research, companies use knowledge-based decision support primarily to make predictions about customer behaviors and expectations. They then attempt to meet those behaviors and expectations with products and services. Companies in the private sector collect large amounts of data about their customers and even the customers of competing companies to understand their needs and desires (Doukidis, Mylonopoulos & Pouloudi, 2004). In other words, most companies in the private sector do not make decisions until they have collected large amounts of data about the people they serve. Then, the decisions made by everyone from company executives to front-line personnel are based on the knowledge that is gained from analyzing the collected data (Vercellis, 2009).

For the private sector, an entire industry exists of companies that do nothing more than collect and analyze data about customer actions, behaviors, and attitudes. Corporations in the private sector typically only make decisions once they have taken the

time to analyze the data and understand how they can best respond to their customers, as well as meet the needs of potential customers to win their loyalty and business (Jones, 1998). The private sector has embraced the concept of knowledge-based decision-making because it provides a means of having a strong foundation from which to operate and from which to determine what changes are needed for the future.

The public sector, however, seems to use the concept of knowledge-based decision-making in a slightly different way as compared to the public sector. Public sector organizations, from the federal government to the state and local levels, use knowledge-based decision-making as a way to determine outcomes from the way in which money and other resources are used in relation to policy initiatives (Metcalfe, 2006). In some respects, the use of knowledge-based decision-making seems to occur more often after resources have been used as opposed to before. For example, data is often collected with regards to how additional spending for education initiatives have impacted test scores, or how many people are provided access to health care services because of additional spending to open free health clinics.

Most public sector organizations, especially at the federal level, are often large and complex. Since the process of knowledge-based decision-making is largely dependent upon the size and complexity of an organization, it can be hard to implement in the public sector (Miller & Berger, 2003). This provides some understanding of why public sector organizations appear to use the concepts of knowledge-based decision-making in a different way as compared to the private sector. This is certainly true in terms of the federal government in which actions and initiatives must be taken for millions of people in different locations and with a variety of different needs. However,

once a decision is made, then data can be collected about the outcomes resulting from the resources that were used. This knowledge is used to determine if the return on investment with regard to the resources that were expended is favorable, which leads to better decision-making in the future.

Regardless of the sector in which it is used, the underlying principle for knowledge-based decision-making is the transfer of knowledge to a group of people or an organization to increase the knowledge that exists about a specific situation, clients, or work processes (Srikantaiah & Koenig, 2008). Additionally, the result of this process is that knowledge has been gained by the organization in question and decisions are based on actual information and data instead of personal opinions or perceptions. The ultimate benefit is the ability to make decisions based on known conditions that positively impact an organization (Salas & Maurino, 2010). This positive impact will allow organizations to better respond to the conditions that exist as opposed to simply trusting that the decisions that are made will meet the needs of the organization.

Research Problem

There is a lack of the adoption of knowledge-based decision-making within the DoD acquisition process. The acquisition process takes into consideration many forms of information products regarding programs both by federal statute and DoD regulation. However, the milestone decisions based on these information requirements have not translated into better program outcomes. Additionally, milestone decisions are normally made when all statutory and regulatory information requirements are satisfied and not based on when critical technology, design, and manufacturing knowledge is attained. As

a result, DoD acquisition programs continue to experience problems with both increased cost and schedule and the degradation of performance and quality.

Research Objective

To address this problem, DoD acquisition officials require improved decision-making information at key program junctures that capture all program goals, objectives, and concerns to facilitate better knowledge-based decisions. Therefore, the objective of this research is to assess the use of knowledge-based decision support in the DoD acquisition process. To address this objective, the research attempted to answer the following investigative questions.

1. What are the critical pieces of information that are required for an informed decision at key decision points in the acquisition process?
2. How does the currently available information (contained in required decision products) compare to what is needed for decisions with regard to technology, design, and production knowledge for each of the key decision points in the acquisition process?
3. What is the effect of this lack of information on DoD acquisition programs?
4. Can this effect be quantified in terms of cost, schedule, and performance?

Methodology

To help answer these investigative questions, a secondary data source was examined and compared with the knowledge required by either federal statute or DoD regulation at key decision points. Both entities were also compared with knowledge-based decision-making best practices identified through the literature review. The data consisted of responses from senior-level Air Force acquisition officials interviewed by

the Air Force Acquisition Chief Process Office regarding the acquisition decision-making process. These interviews helped identify data products used during decision-making and how those products influenced decisions at key milestones. After summarizing the interview data using descriptive statistics, data reduction was accomplished using Microsoft Excel software to perform content analysis and identify themes represented within the interview data. This facilitated the comparison of the data with required knowledge and best practices used with knowledge-based decision-making during the acquisition process.

Thesis Outline

In the chapters that follow, the findings of the in-depth literature review, research methodology and analysis, and results will be presented. The study will establish if the intention and usefulness of required information at key decision points in acquisition programs provides sufficient knowledge to facilitate more informed decisions. It will examine if key decisions are made at the appropriate time within the defense acquisition process. The literature review in Chapter II will provide the context of the DoD acquisition process, the information required by federal statute and DoD regulation, and best practices with regard to knowledge-based decision-making. Additionally, it will provide a comparison of knowledge-based decision-making in the private and public sector. In Chapter III, the methodology and research design will be discussed; this is followed by an analysis of the data in Chapter IV. The final chapter will answer the research questions and provide recommendations for improving knowledge-based decision-making in DoD acquisition programs.

Chapter II. Literature Review

To focus this research effort on the knowledge required to make decisions for acquisition programs at key decision points in the Department of Defense (DoD) acquisition process, the literature review is divided into three parts. The first is an examination of the differences in the acquisition practices in the public and private sector. The second offers a baseline for the statutory and regulatory knowledge requirements of the DoD acquisition system at key milestones. Finally, the third section reviews studies regarding best practices of knowledge-based decision support.

Acquisition Practices: Military versus Private Sector

There are some notable differences in terms of how acquisition efforts work within the DoD and similar efforts in the private sector. Some of these variations are primarily due to the differences in organizational goals. Ferguson and DeRiso (1994) completed a detailed study of software acquisition efforts between the DoD and the private sector in terms of defining program requirements, selecting a contractor (i.e., source selection), test and evaluation, and the development process. Although their research dealt primarily with software acquisitions, the findings are applicable to the acquisition process of traditional weapon systems.

Defining Program Requirements

In terms of defining the requirements for a system, the DoD generates requirements based on the needs of an operational user. This requirements generation process, called the Joint Capabilities Integration and Development System (JCIDS), is

focused on identifying requirements for weapon systems for the entire DoD as opposed to the individual services (CJCSI 3170.01G, 2009). However, in a 2008 study, the General Accounting Office (GAO) found that the process has yet to be effective in this manner. According to the report, nearly 70 percent of the requirements were sponsored by the individual services as opposed to the joint community (GAO, 2008). Additionally, it noted that nearly almost all of these requirements were approved. As a result, there has not been any notable fiscal efficiency gained through the JCIDS process. In fact, the remaining costs of major weapon systems have increased significantly since JCIDS was implemented. Figure 1 depicts the cost remaining versus the annual investment appropriations.

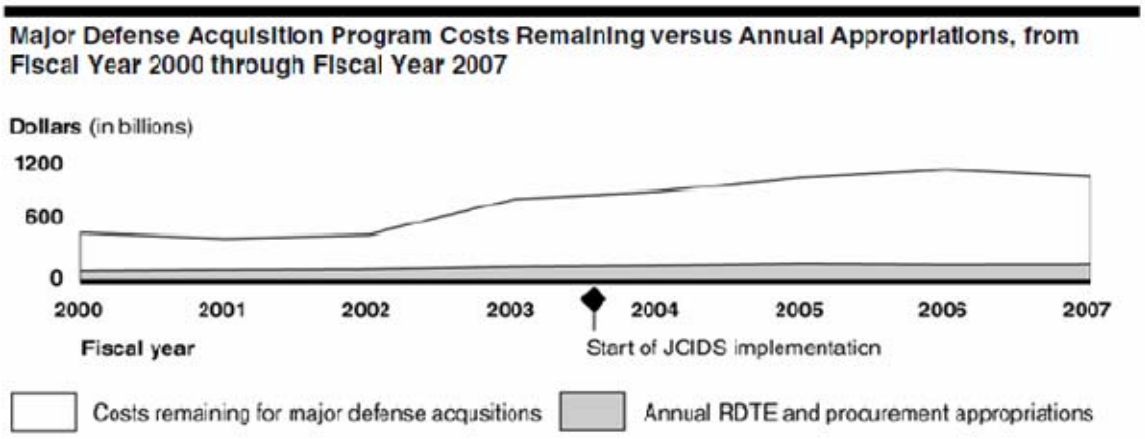

Figure 1. Cost Remaining versus Annual Investment Appropriations (GAO, 2008)

A critical factor within the requirements generation process is the time it takes to validate a requirement. In the aforementioned report, the GAO (2008) found that the average time to validate a DoD requirement was 10 months. In the private sector though, it is not unusual for companies to validate requirements on a quarterly basis (Bate and

Roberts, 2002). The responsiveness associated with validating a requirement can mean the ability to respond to a threat or beating a competitor to market with a new product (Dasarathy, 1985).

Accurately capturing key system requirements early in the acquisition process has a direct impact on the outcome of a program. However, a preponderance of DoD acquisition programs fail to do so. As a result, most of these programs changed key system requirements after the start of development. These changes translated into increased costs and schedule delays (GAO, 2010). In an attempt to reduce changes in requirements, the DoD issued a change in policy requiring programs to hold configuration steering boards to make certain that the effect of cost and performance are considered when making major technical adjustments (GAO, 2010).

Source Selections

Another key difference between the DoD and private sector is the communication with vendors prior to source selection. Within the DoD, the involvement of vendors and contractors is often avoided until a specific vendor or contractor has been chosen, thus reducing the sharing of information and knowledge that is used in the decision-making process. In the private sector, vendors and contractors are encouraged to become involved very early in the process to leverage their knowledge and information (Ferguson and DeRiso, 1994).

In terms of vendor or contract selection, the DoD typically operates by requiring vendors or contractors to compete against each other, rather than collaborate to combine knowledge sets and abilities to win a contract as a unified team. The selection of a vendor or contactor also relies on a very specific set of standards that cannot be changed

or deviated from in any way. If any of the source selection metrics created in advance is not met by a particular vendor or contractor, the vendor or contractor is often removed from the selection process without any consideration regarding whether their knowledge set might be useful for the project. Again, this is different from acquisition efforts in the private sector in which vendors are typically allowed to work together in order to obtain the highest level of knowledge and ability from those that can best serve the project. Private sector vendor or contractor selection also has a selection process that is much less stringent and allows for more flexibility based on the recommendations and information obtained by the source selection team (Ferguson and DeRiso, 1994). Table 1 shows the differences in vendor selection in the private sector and the DoD.

Table 1. Best Practice – Vendor Selection (Ferguson and DeRiso, 1994)

Vendor Selection	
Best Commercial Practice	**Current DoD Practice**
Solicit multiple (but not all) qualified vendors. Encourage teaming with a view to attaining a relationship that covers the entire life cycle and fosters tradeoffs in cost and schedule.	Solicit all possible vendors. Vendor proposals must meet 100% of requirements. Teaming seldom encouraged.; development and maintenance usually separate entities.
Compare vendor history and experience. Maintain long-term relationships.	Can compare previous performance, but normally can't have long-term relationships.
The organization that will be responsible for a system over its full life cycle is heavily involved from the beginning.	Maintenance organization not usually involved in vendor selection process.
Use site visits and demonstrations to gain knowledge of vendor capabilities.	Site visit only by capability evaluation team, or other expert teams. Visits are very structured.
Overall goals: (1) obtain product at reasonable cost as soon as possible; and (2) achieve the business case for the system.	Overall goal: Obtain lowest cost product that rigorously meets all requirements, but be fair.
Relatively few review and approval steps once vendor is selected.	Review and approval process more structured and complex once vendor selected.
Past performance weighted heavily (sometimes primary factor) in selection process.	Past performance considered, but usually only as a minor factor.
More flexibility in vendor selection based on metrics and overall assessment.	Selection of vendor forced by use of predefined metrics for proposal evaluation.
Summary Very different processes with commercial much more flexible but with no requirement for fairness, or to maintain the public trust. Commercial encourages vendors to offer best solution, but solution may not meet 100% of the requirements. Teaming and long-term relationships are more easily accommodated by industry.	

Test and Evaluation

Test and evaluation is the next key knowledge area explored in this research. Like the DoD, leading private sector firms have dedicated test organizations for new products. However, in general, these organizations are aligned under the program manager and testing is often performed in a single facility by the same team members (Ferguson and DeRiso, 1994). The DoD conversely uses independent organizations to test systems (DoD Test and Evaluation Guide, 2005). As such, there is opportunity for gaps in knowledge transfer. Additionally, the GAO (2010) found that programs are not testing prototypes that are production representative before committing to production. In doing so, the maximum benefit of test and evaluation is not realized due to the possibility of changes to the design after production. Figure 2 shows the GAO findings with regard to the number of programs testing a production representative prototype before and after a production decision.

Perhaps the biggest difference in test and evaluation is that the private sector makes less of a distinction between developmental and operational testing (Ferguson and DeRiso, 1994). The reason is two-fold: first, by the time the private sector makes a decision to field a new product, the technology is proven. Second, the cycle time in product development is typically much longer in the DoD. Therefore, more technical risk is assumed early in the life-cycle while anticipating that the technology readiness level will mature.

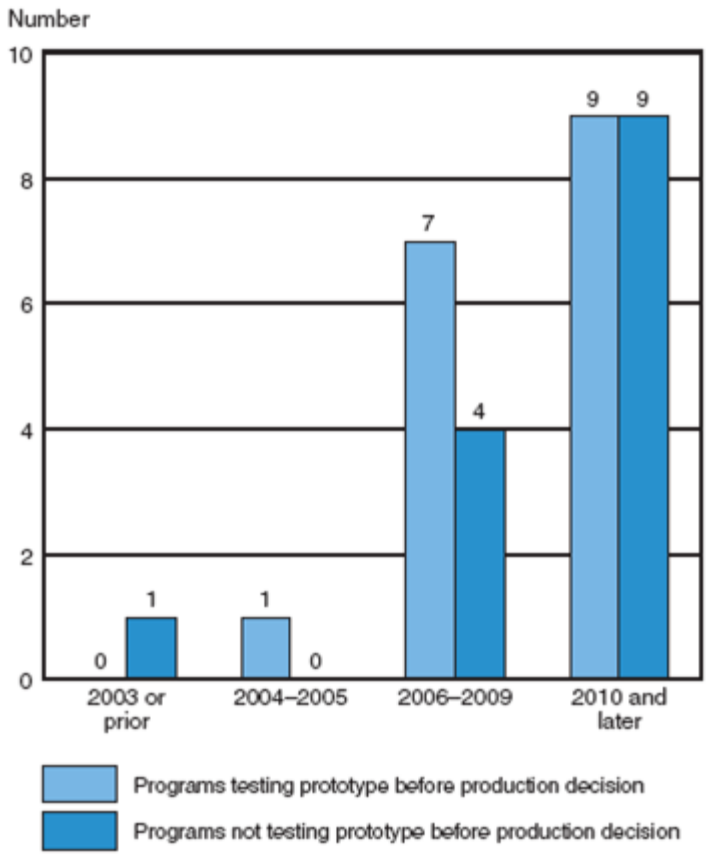

Figure 2. Testing of Production-Ready Prototypes (GAO, 2008)

Development Process Requirements

Another notable difference between the acquisition process within the DoD and the private sector can be attributed to the rigidity of the process for product development. Strict requirements imposed by Congress and the DoD are inflexible and largely based on a single project, rather than understanding existing systems and the impact of future projects that may be implemented. In essence, a large part of the acquisition process is focused on following the process itself and not on how knowledge can be applied to making more informed decisions (Defense Acquisition Performance Assessment, 2006).

Knowledge Requirements of the Defense Acquisition Process

The DoD acquisition process exists to provide a secure and supportable military to maintain our national security strategies (Defense Acquisition Guidebook, 2009). The process is governed by the Federal Acquisitions Regulation (FAR) and implemented by DoD Instruction (DoDI) 5000.02. The DoDI 5000.02 provides the framework in which a program progresses throughout its life-cycle. Figure 3 illustrates the life-cycle framework view of the acquisition process. In addition to the decisions at Milestones A, B, and C (which authorize entrance into the major program phases), there are three other key decision points within this framework that must be made by the Milestone Decision Authority (MDA) (Young, Grimes, and McQueary, 2008). These decision points (also noted in Figure 3) are Materiel Development Decision, Post-Critical Design Review, and Full Rate Production Decision Review.

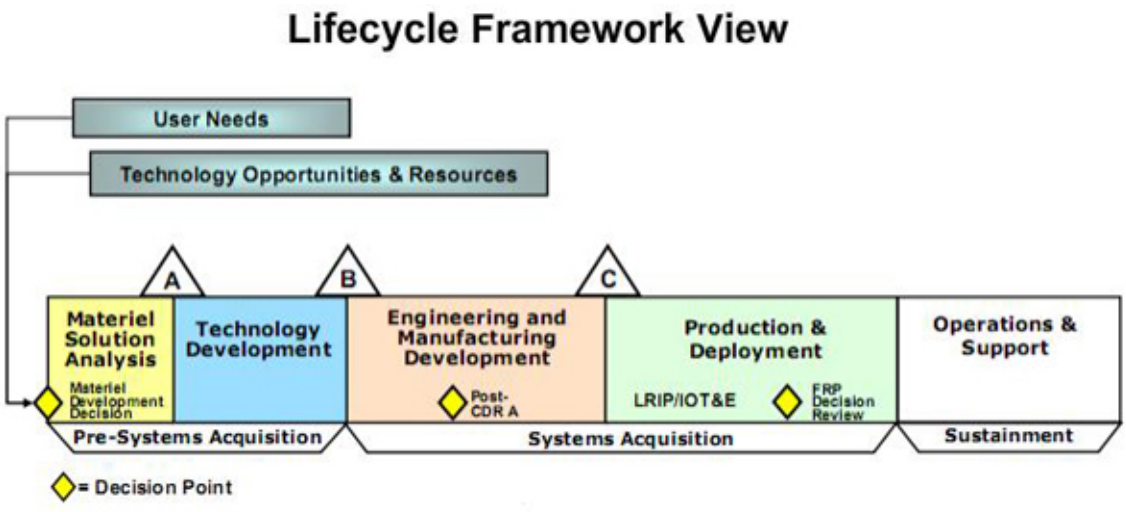

Figure 3. Decision Points in DoD Acquisition Process (DoDI 5000.02, 2009)

The acquisition process itself is initiated by a validated need identified by the military user. The need can stem from a new threat, capability gap, or even a new technological opportunity. For this need to be addressed via the acquisition process, a determination is made whether a Materiel or Non-Materiel Solution is viable. This decision is made at the Materiel Development Decision (MDD) review, which is the formal entry point into the acquisition process and is mandatory for all programs. At this decision point, there is not any statutory knowledge requirement. However, the knowledge required by regulation includes an Analysis of Alternatives and an Initial Capabilities Document.

If a Materiel Solution is deemed the better alternative, the program is authorized to enter the Materiel Solution Analysis (MSA) phase. The purpose of the MSA phase is to review potential materiel solutions and satisfy the entrance criteria for the next program milestone designated by the MDA. The Analysis of Alternatives (AoA) Study Guidance and the Initial Capabilities Document (ICD) provide direction for the activities in this phase. The AoA focuses on identifying and analyzing alternatives, measures of effectiveness, cost, schedule, concepts of operations, and overall risk (Young, Grimes, and McQueary, 2008). The ICD provides the preliminary concept of operations, a description of the capability, the operational risk, and the basis for determining that non-materiel alternatives will not adequately alleviate the capability gap. The MSA phase ends when the AoA has been completed, materiel solution options for the capability need identified in the approved ICD have been recommended, and the phase-specific entrance criteria for the initial review milestone have been satisfied (Young, Grimes, and McQueary, 2008).

The next decision point is the Milestone A review. This decision authorizes entry into the Technology Development phase. The purpose of this phase is to reduce technology risk, determine and mature the proper set of technologies to be included in the system, and demonstrate that the technology performs on prototypes. Table 2 depicts the key statutory and regulatory information required of Major Defense Acquisition Programs (MDAP) for this phase. The complete set of information requirements for Milestone A can be found in Appendix A.

Table 2. Key Milestone A Statutory/Regulatory Information

STATUTORY INFORMATION REQUIRED	**APPLICABLE STATUTE, POLICY, AND OTHER REFERENCES**
Analysis of Alternatives	Subtitle III of title 40, U.S.C., Section 2366a of Title 10
Consideration of Technology Issues	Paragraph (b)(5) of Section 2364 of Title 10, U.S.C.
Independent Cost Estimate	Section 2434 of Title 10, U.S.C.
Milestone Decision Authority Program Certification	Section 2366a of Title 10, U.S.C.
Technology Development Strategy (TDS)	Section 803 of Public Law 107-314
REGULATORY INFORMATION REQUIRED	**APPLICABLE REGULATION, POLICY, AND OTHER REFERENCES**
Initial Capabilities Document	CJCS Instruction 3170.01
Life-Cycle Support Plan	DoD Directive 5250.01
Systems Engineering Plan	DoD Instruction 5000.02
Test and Evaluation Strategy	DoD Instruction 5000.02

The next key decision point is the Milestone B review. This decision authorizes a program to enter the Engineering, Manufacturing, and Development (EMD) phase. The purpose of this phase is to develop a weapon system or an increment of capability. The entrance criteria for this phase depend heavily upon technology maturity, mature/stable

requirements, and full funding. Entrance into EMD also signals the beginning of a formal acquisition program. Table 3 shows both the key statutory and regulatory information required for this decision (Young, Grimes, and McQueary, 2008). The full set of requirements can be found in Appendix B.

Table 3. Key Milestone B Statutory/Regulatory Information

STATUTORY INFORMATION REQUIRED	APPLICABLE STATUTE, POLICY, AND OTHER REFERENCES
Acquisition Program Baseline	Section 2435 of title 10, U.S.C.
Consideration of Technology Issues	Paragraph (b)(5) of Section 2364 of Title 10, U.S.C.
Independent Cost Estimate	Section 2434 of Title 10, U.S.C.
Low-Rate Initial Production Quantities	Section 2400 of Title 10, U.S.C.
Live Fire Test and Evaluation Plan	Section 2366 of Title 10, U.S.C.
REGULATORY INFORMATION REQUIRED	**APPLICABLE REGULATION, POLICY, AND OTHER REFERENCES**
Acquisition Strategy	DoD Instruction 5000.02
Technology Readiness Assessment	DoD Instruction 5000.02
Capabilities Development Document	CJCS Instruction 3170.01
Life-Cycle Support Plan	DoD Directive 5250.01
Systems Engineering Plan	DoD Instruction 5000.02
Test and Evaluation Master Plan	DoD Instruction 5000.02

The EMD phase contains two major elements: Integrated System Design (ISD) and System Capability and Manufacturing Process Demonstration (SD&MPD). The ISD identifies system and system-of-systems functionality and interfaces, completes design for hardware and software, and reduces system-level risk. The SD&MPD reveals the capability of the system to function as designed and be manufactured. In addition to these two efforts, the EMD phase also includes a major decision point: the Post-Critical

Design Review (P-CDR) Assessment. This assessment offers an opportunity to review design maturity (Young, Grimes, and McQueary, 2008).

The next and final key decision point addressed in this research is Milestone C. This milestone authorizes entrance into the Production and Deployment phase. The intent of this phase is to demonstrate that the production system can operate in accordance with the user's requirements. Additionally, this phase demonstrates that the production system can be manufactured (Young, Grimes, and McQueary, 2008). Table 4 shows the key statutory and regulatory information requirements for Milestone C. The full set of requirements can be found in Appendix C.

Table 4. Key Milestone C Statutory/Regulatory Information Requirements

STATUTORY INFORMATION REQUIRED	**APPLICABLE STATUTE, POLICY, AND OTHER REFERENCES**
Acquisition Program Baseline	Section 2435 of title 10, U.S.C.
Consideration of Technology Issues	Paragraph (b)(5) of Section 2364 of Title 10, U.S.C.
Independent Cost Estimate	Section 2434 of Title 10, U.S.C.
Manpower Estimate	Section 2434 of Title 10, U.S.C.
Analysis of Alternatives	Subtitle III of title 40, U.S.C., Section 2366a of title 10
REGULATORY INFORMATION REQUIRED	**APPLICABLE REGULATION, POLICY, AND OTHER REFERENCES**
Acquisition Strategy	DoD Instruction 5000.02
Technology Readiness Assessment	DoD Instruction 5000.02
Capabilities Production Document	CJCS Instruction 3170.01
Life-Cycle Support Plan	DoD Directive 5250.01
Systems Engineering Plan	DoD Instruction 5000.02
Test and Evaluation Master Plan	DoD Instruction 5000.02
Independent Technology Readiness Assessment (if required)	DoD Instruction 5000.02

Knowledge-Based Decision Support Best Practices

The GAO has completed extensive research with regard to knowledge-based decision-making in major system acquisitions. In fact, the GAO (2008) published their findings regarding best practices for developing new products and stated the following:

> Good acquisition outcomes require the use of a knowledge-based approach to product development that demonstrates high levels of knowledge before significant commitments are made. Achieving the right knowledge at the right time enables leadership to make informed decisions about when and how best to move into various acquisition phases. In essence, knowledge supplants risk over time. This building of knowledge consists of information that should be gathered at three critical points over the course of a program. (p.5)

In a 2010 study, the GAO assessed the knowledge attained on 42 major defense acquisition programs (MDAP) at key milestones early in the program's life-cycle (prior to Milestone C). To support the study, the GAO collected data on programs with regard to technology maturity, design stability, and production maturity from August 2009 to March 2010. The study centers on the following three key junctures for knowledge points.

- Knowledge Point 1: Requirements and technological capability are matched
- Knowledge Point 2: Knowledge that design will work as required
- Knowledge Point 3: Knowledge that the design can be produced within cost, schedule, and quality targets

Figure 4 shows these knowledge points in relation to key phases in the product development cycle.

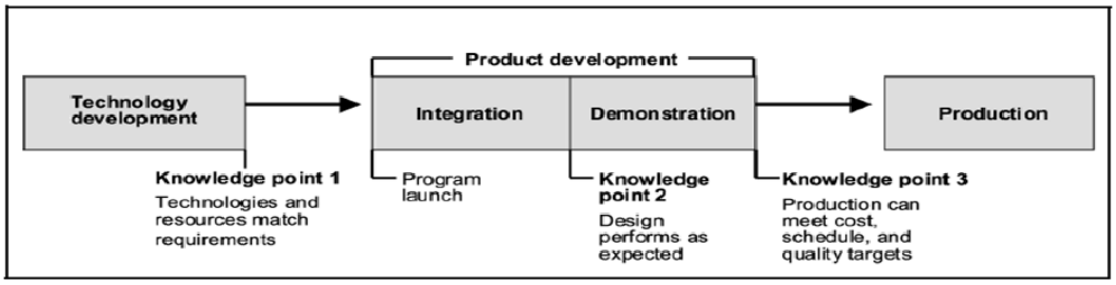

Figure 4. Best Practices in Product Development (GAO, 2008)

The first of these knowledge points suggests that a match should occur between what is needed and what is available in terms of technology, design, and funding. This knowledge point occurs after the completion of the technology development phase. A good gauge of whether a match is made is noting the level of technology maturity at the beginning of the development stage. A match occurs when a program has demonstrated that the critical technologies have been verified to work in their intended environment (GAO, 2008). The GAO (2010) found that programs in general are not conducting systems engineering reviews early in the program to ensure a match between resources and requirements.

The second knowledge point represents the fact that a product's design should be demonstrated to function as planned and meet the requirements that have been established (GAO, 2008). For DoD milestone decision authorities, this means being assured that the system design is stable and will perform in a way that was expected by the user. According to the GAO, program stability should be reached by the halfway point of system development. An indicator of design stability is the completion of at least 90 percent of engineering drawings by the Critical Design Review (GAO, 2008).

Additionally, the engineering drawings and designs should accurately reflect the results obtained from testing the system in question.

This leads to the third knowledge point, which suggests that a product should only be considered reliable when it can be created within the stated costs, schedule, and quality levels. An important indication of whether a product or system is reliable is when it can be created over and over with the same level of performance and reliability (Garrett and Rendon, 2005). To facilitate reliability, a best practice is to make certain that all critical manufacturing processes are in statistical control at the start of production (GAO, 2008). A program should ensure that all critical manufacturing knowledge is attained before entering production. If achieved, then the program will have a stable manufacturing process that will work as intended and meet cost, schedule, and quality objectives. Figure 5 is an example of how the best practices can be used to assess an acquisition program. The desired level (dotted line) is the indicator of where the program should be in terms of best practice. The hypothesis is the closer the program is to the desired level; the more likely the program will be within cost and schedule (GAO, 2010).

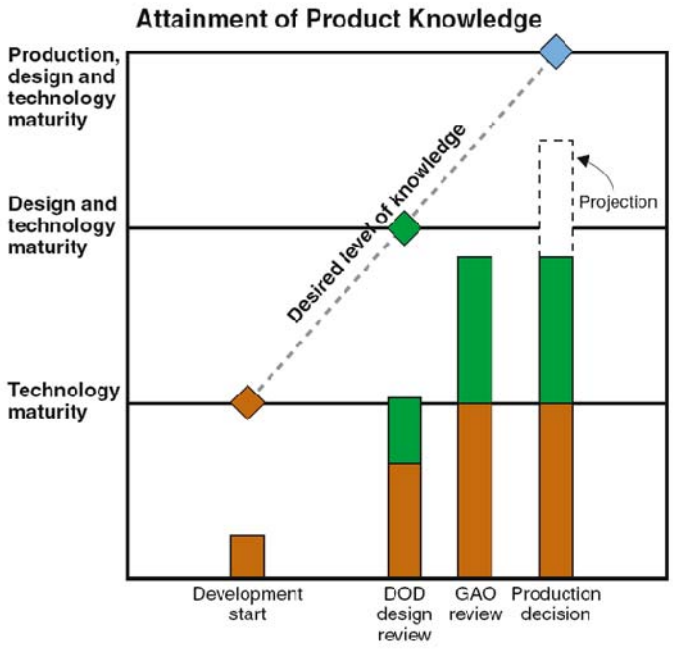

Figure 5. Product Knowledge as Compared with Best Practices (GAO, 2008)

Application of GAO Knowledge Points: National Aeronautics and Space Administration

To apply the knowledge points, the GAO (2005) reviewed and analyzed the National Aeronautics and Space Administration (NASA) project management policies and compared them to the GAO's best practices on knowledge-based decision making. The study was primarily focused on the Goddard Space Flight Center, the Jet Propulsion Lab, Johnson Space Center, and Marshall Space Flight Center. During its investigation, the GAO found NASA deficient in key criteria and decision reviews to fully implement a knowledge-based acquisition framework.

There were, however, some best practices followed. For example, NASA required projects to hold a major decision review before progressing from formulation to implementation. Additionally, projects were required to validate requirements, develop cost and schedule estimates, create preliminary design, and have an approved technology

plan. All of these requirements were in sync with the GAO's Knowledge Point 1: Matching requirements with technology capability. The issue is that NASA does not require the technology used in its projects to be at a high level of maturity at that point. The GAO insists that this increases the risk that requirements will not be met.

Another area found to be deficient was the NASA policy of not specifying the type of reviews that project managers should hold at key points in the product development cycle. The GAO indicated that technical reviews allow decision-makers to acquire key knowledge at critical junctures in the project's development. As a result, the GAO concluded that NASA was increasing the risk of cost and schedule overruns.

The last issue GAO found during its study of NASA was the non-standard use of criteria for indicators of program success at key decision points. This resulted in each center within NASA reporting on different types of project knowledge at key decision points. At the time of the report, NASA had experienced a loss of experienced project managers and system engineers. This loss of key personnel combined with lack of standardized criteria exacerbated the problem (GAO, 2005).

The GAO (2005) made several recommendations to improve NASA management policies. Two recommendations centered on NASA using a knowledge-based acquisition approach to improve its decision-making. As such, it recommended that NASA take the following actions:

1. Require the capture of specific knowledge to be used as criteria for allowing projects to enter implementation and proceed through development and to support informed investment decisions.

2. Institute additional reviews for projects during project implementation, which result in recommendations to the appropriate decision authority.

In response to the GAO findings, NASA issued a revised acquisition policy in 2007. The new policy instituted Key Decision Points (KDP) in the development life-cycle for NASA's space flight programs and ground station projects. Additionally, the policy established a decision authority at each KDP responsible for authorizing the entrance into the next phase. The policy also required new technologies to be sufficiently mature at the preliminary design review (GAO, 2009).

In a follow-up study, the GAO (2009) again reviewed NASA's projects. In this review, the GAO assessed cost and schedule data for 13 programs. They found that 10 of the 13 programs experienced an average cost growth of 13 percent (based on 2008 data) since the GAO review in 2005. The average schedule delay for the 13 programs was 11 months. GAO concluded that in spite of the new policy, the lack of knowledge at key junctures and the continued use of immature technologies continued to contribute to cost growth and schedule delay.

Application of Statistical Decision Model: University of Southern California

The study of the use of knowledge-based decision methodologies in DoD acquisitions, such as the use of statistical tests and models, is an area that has been largely unexplored. A study by Cohen, Rolph, and Steffey (1988) examined the statistical techniques in the design and evaluation of operational test and evaluation. One of the conclusions from that study notes the following:

> For many defense systems, the current operational testing paradigm restricts the application of statistical techniques and thereby reduces their potential benefits by preventing the integration of all available and relevant information for use in planning and carrying out tests and in making production decisions. This paradigm is was noted as the major players in the acquisition process – the program manager, test organization, the contractor, user, and Congress – have

> very different (and sometimes competing) perspectives on how knowledge is applied. As a result, even in those situations where knowledge is available that could be used to make good programmatic decisions; those that are involved in the decision-making process may be pressured to do otherwise. (p.47)

Boehm, Port, Huang, and Brown (2002) created a spatial model that can be used to generate several acquisition models related to user satisfaction, cost, and quality constraints. The models take into account the expectations of key stakeholders, system requirements, system features, and development procedures. The models require a great deal of knowledge from all stakeholders involved in the development process. In their study, this model was used on 26 University of Southern California projects. The results showed that 24 out of 26 projects were successful in terms of meeting cost, schedule, and performance objectives. The importance of these results is that they show that knowledge-based decision support models could possibly be used effectively for DoD acquisitions.

Application of RAND's Decision Framework: National Security Agency

In 2006, the RAND Corporation partnered with the Intelligence Support Systems (ISS) division at the National Security Administration to pilot RAND's Portfolio Management (PortMan) Decision Framework. The framework can be used for Research and Development (R&D) projects or Operations and Maintenance (O&M) projects. The purpose of the model is to assess the Expected Value of a group of actual or proposed projects.

The Expected Value can then be used as knowledge upon which to make decisions that maximize the value of R&D funding for a portfolio. RAND's PortMan model computes the Expected Value of a R&D project from two primary knowledge

factors: value of successful implementation and the probability of successful implementation. The value of successful implementation is based on the value of the capability to the organization and the extent to which the performance potential matches the resources required to achieve the capability. The probability of successful implementation is a measure of the risk associated with implementing an R&D project or sustaining an O&M project (RAND, 2004). The Expected Value (EV) of a project is defined as the Value of Successful Implementation multiplied by the Probability of Successful Implementation.

For this particular study, RAND (2006) developed two different sets of metrics for estimating the Expected Value. They created one set for R&D projects and another set for Operations and Maintenance (O&M) projects. A total of 17 projects were evaluated in the pilot study. To estimate the three factors for the Expected Value, RAND performed a Delphi exercise using the members of the ISS's Senior Leadership Group (SLG). The SLG were senior decision-makers in the ISS organization. Each SLG member was given a series of questions and a ranking scale to provide answers. After several rounds to reach consensus, the answers were converted to a numeric score and averaged to provide values for the Expected Value (RAND, 2006).

The results of the RAND study concluded that the ranking of projects using the decision model was significantly different than the ranking from the ISS methodology, which was based on undocumented metrics. RAND (2006) concluded the following: the RAND PortMan model can be effectively applied to both R&D and O&M portfolio decisions and the model can be used for both near-term (single fiscal year) decisions and as well as long-term decisions.

Chapter III. Methodology

This investigation used a qualitative research methodology to answer the research questions offered in the first chapter. The rationale for using qualitative methods was based on the fact that three different information types were gathered: (1) secondary data consisting of survey responses to open-ended questions, (2) knowledge required by either federal statute or Department of Defense (DoD) regulation at key decision points, and (3) knowledge-based decision-making best practices. The second and third information types were obtained through the literature review.

This chapter includes four main sections. The first section provides an overview of the thesis research methodology. The second discusses the survey effort, while the third section describes how data reduction was performed to analyze content. Finally, the fourth section summarizes the method used to compare information types and identify themes represented within the data by describing the assessment model.

Overall Research Methodology

The overall research approach followed the nine-step framework proposed by Buchanan (1980) as shown in Figure 6. Additionally, Booth, Colomb, and Williams (2003) suggest that an extensive research topic is selected and then confined to develop a manageable thesis statement. In that regard, this research focused on "knowledge-based decision-making," which was then was confined to "knowledge-based decision-making in DoD acquisition." As stated in Chapter I, the following investigative questions were subsequently established.

1. What are the critical pieces of information that are required for an informed decision at key decision points in the acquisition process?

2. How does the currently available information (contained in required decision products) compare to what is needed for decisions with regard to technology, design, and production knowledge for each of the key decision points in the acquisition process?

3. What is the effect of this resulting lack of information on DoD acquisition programs?

4. Can this effect be quantified in terms of cost, schedule, and performance?

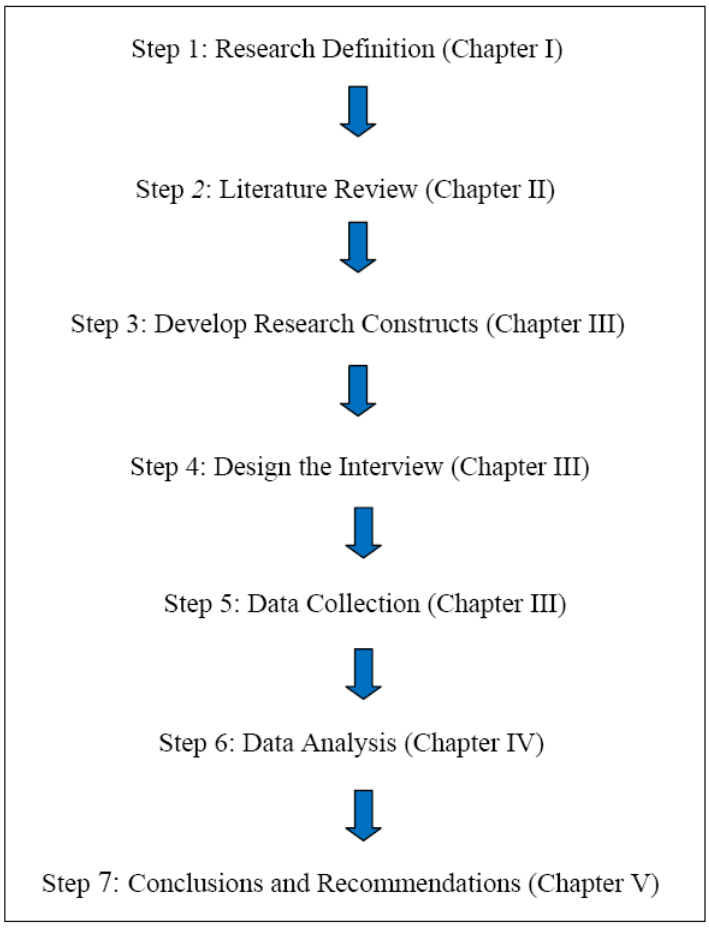

Figure 6. Research Methodology (Buchanan, 1980)

This chapter thus focuses on steps five and six of Buchanan's (1980) framework: data collection and data analysis. Step five (data collection) involved both secondary data and extraction of data from existing documents. Step six (data analysis) consisted of three parallel activities adopted from the analysis framework developed by Miles and Huberman (1994). The framework describes the major phases of data analysis as data reduction, data display, and conclusion drawing and verification. Figure 7 illustrates the data analysis framework.

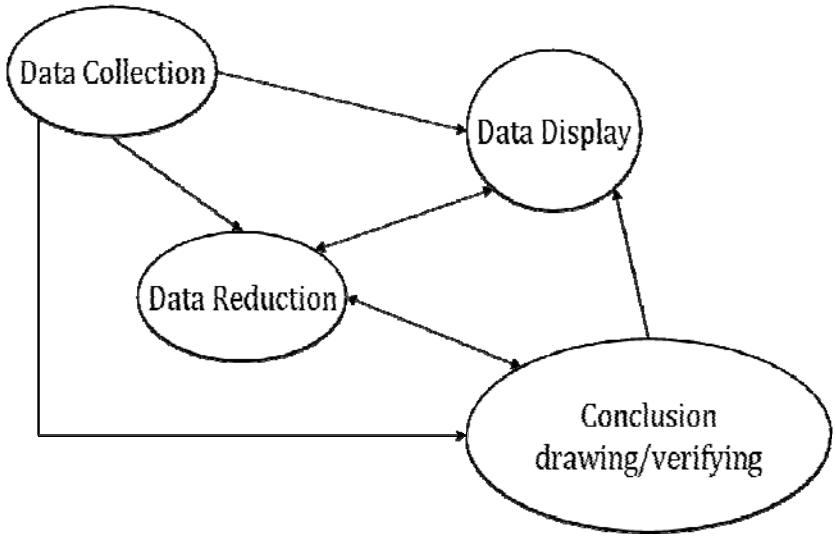

Figure 7. Data Analysis Framework (Miles and Huberman, 1994)

Survey Effort

For this research effort, the survey data was obtained from SAF/ACPO (Air Force Acquisition Chief Process Office). SAF/ACPO, in conjunction with the Center for Reengineering and Enabling Technology (CRET), was charged with reviewing and validating the GAO findings primarily with regard to knowledge-based decision support

and improving the fidelity of acquisition decision-making within the U.S. Air Force. SAF/ACPO chose senior-level personnel from across the Air Force acquisition community. All personal identifiable information was removed from the data before it was used for this research.

Survey Construction

The questions asked during the survey are provided in Table 5. The questionnaire provided to the participants was relatively short. The people solicited for this study are senior acquisition officials with many responsibilities. Providing them with a long and cumbersome interview that required a great deal of time would have likely resulted in few, or possibly no, responses. Furthermore, with a few very direct and relevant questions, it can be possible to get directly to the core of the issues being researched and not have to deal with a great deal of information and data that may have little or no relevancy to the research problem being addressed.

The questions shown in Table 5 were chosen for inclusion in the survey because they allowed the participants to provide information about the type of knowledge that is used in the decision-making process, how other stakeholders are involved in the process, and whether additional knowledge sets would be considered valuable in the acquisition process. These questions provided a means for not only gaining insight into the knowledge set in decision-making process, but also how that knowledge set is used to make decisions.

Table 5. Survey Questions

1. Does your organization have any ongoing initiatives that address GAO findings? If so, what is the initiative and what is its purpose?

2. What major decision product(s) does your organization create? *(A decision product is defined as any object (report, review, plan, document package, database update, etc.) that is used to make an Acquisition Decision. These items include Budget Execution Documentation, Justification Documents, Monthly Acquisition Reports, etc. Items that we are not looking to identify are Weekly Reports, Org Status Reports, etc.)*

3. Who are the customer(s) of these decision product(s)?

4. What decision product(s) do you receive?

5. What are the source(s) or supplier(s) of these products?

6. What feedback does your organization receive from your customer(s)?

7. What feedback does/would your organization give to your suppliers(s)?

8. What acquisition decision(s) does your customer(s) make relative to the decision product(s) your organization provides to them? *(An Acquisition Decision is an event that yields an outcome that has an impact on another organization or ACAT designated program within the Acquisition Lifecycle).*

9. What acquisition decision(s) does your organization make relative to the decision product(s)?

10. What is the intent of the decision product? Does the decision product meet its intended purpose?

11. What information products do you believe that your organization should receive (missing information) that would improve your acquisition decision making process?

12. What information products does your organization receive that are non-value added in the acquisition decision making process?

13. What Regulations and Policies require that your organization creates these products?

14. Do you use an IT System to create/retrieve a decision product? If so, what is its name?

Survey Administration

The survey instrument was sent to the participants with an explanation of the research being conducted and how their assistance would help with the project. The participants were asked to respond to the questions and send the information back to SAF/ACPO. In all instances, the questions were either answered in electronic format and returned to SAF/ACPO via email or answered via teleconference.

Population of Interest

The sample population for this study consisted of 12 acquisition decision-makers in the U.S. Air Force. While this may seem like a relatively low sample, it is much larger than was expected and provides a great deal of information that can be analyzed from within a single acquisition organization. The population size of the ACAT I and II acquisition milestone decision-makers within the Air Force is relatively small. Figure 8 offers a view of the number of Acquisition Category (ACAT) IC and II programs with regard to the milestone decision authorities as of FY09. ACAT I programs are estimated by the Under Secretary of Defense (Acquisition, Technology and Logistics) (USD(AT&L)) to require eventual expenditure for Research, Development, Test and Evaluation (RDT&E) funding of more than $365 million (Fiscal Year (FY) 2000 constant dollars) or procurement of more than $2.19 billion (FY 2000 constant dollars). ACAT II programs are estimated by the DoD Component Head to require eventual expenditure for RDT&E of more than $140 million in FY 2000 constant dollars, or for procurement of more than $660 million in FY 2000 constant dollars.

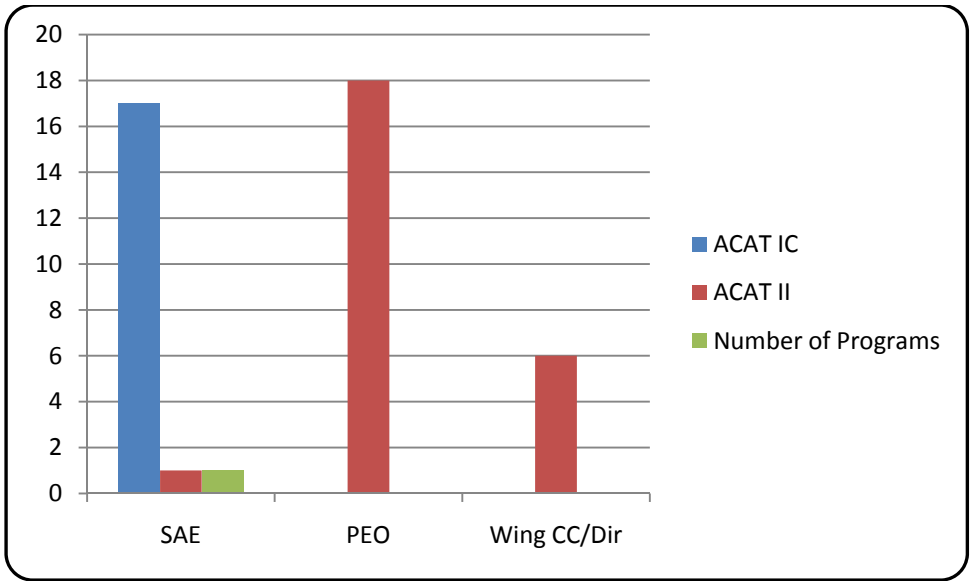

Figure 8. USAF Acquisition Programs by MDA Type (FY09)

The number of Air Force ACAT IC and II programs is 17 and 25, respectively. Of these 42 programs, the 12 participants were the milestone decision authority for 23 programs. What is also important is that the information obtained from these participants was complete in terms of answering all of the questions in the questionnaire. In addition, the participants often included their own comments or opinions. It should be noted that the actual people completing the surveys were individuals that are the decision-makers within their respective acquisition organization and not support personnel. All of the respondents were civilians or military members of the rank O-6/GS-15 or above.

Data Reduction and Content Analysis

Within the Miles and Huberman (1994) framework, the researcher used Microsoft Excel as a means for data reduction to analyze content for all three sets of data. The first set of data analyzed was the program knowledge products required by either federal

statute or DoD regulation at Key Decision Points. The initial step was to create a matrix that captured all knowledge products and indicated whether each one was required by statute or regulation; the matrix also indicated to which Key Decision Point the knowledge product is applicable. Table 6 shows a sample of the matrix.

Table 6. Program Knowledge Product Matrix

ACAT APPLICABILITY						PROGRAM KNOWLEDGE	KEY DECISION POINT APPLICABILITY				
ID	IC	IAM	IAC	II	III		MDD	A	B	C	FRP
R	R	R	R	R	R	ACQUISITION STRATEGY (AS)			X	X	X
R	R	R	R	R	R	ACQ DECISION MEMORANDUM (ADM)		X	X	X	X
R	R	R	R	R	R	ACQ INFORMATION ASSURANCE STRATEGY		X	X	X	X
R	R	R	R	R	R	AFFORDABILITY ASSESSMENTS			X	X	
S	S	S	S	S	S	ANALYSIS OF ALTERNATIVES (AoA)		X	X	X	X

The next data reduction technique was to align the knowledge products to one (or more) of five key program parameters: Requirements, Cost, Schedule, Technical Performance, and Funding. This enabled the researcher to group the knowledge support products according to the area in which they provide decision support. It also facilitated the elimination of knowledge products that did not support one of the aforementioned program parameters. Table 7 shows a sample of the Knowledge Products and their alignment with five key program parameters.

Table 7. Knowledge Products Alignment with Knowledge Areas

ACAT APPLICABILITY						PROGRAM KNOWLEDGE	APPLICABLE KNOWLEDGE AREA					
ID	IC	IAM	IAC	II	III		REQUIREMENTS	COST	SCHEDULE	TECHNICAL PERFORMANCE	FUNDING	STRATEGY
R	R	R	R	R	R	CAPABILITY PRODUCTION DOCUMENT (CPD)	X			X		
S	S	S	S	S	S	CLINGER-COHEN ACT (CCA) CONFIRMATION COMPLIANCE				X		
S	S	S	S	S	S	CLINGER-COHEN ACT (CCA) CERTIFICATION COMPLIANCE				X		
S	S	S	S	S		CONSIDERATION OF TECHNOLOGY ISSUES				X		

The next data reduction technique was performed on both the Knowledge Products and the GAO's knowledge-based decision-making best practices. This technique helped the researcher align the knowledge products with best practices according to the GAO: technology maturity, design stability, and production maturity. Since the Knowledge Points are limited to requirements, design, and technical aspects of programs, this alignment helped the researcher further reduce the number of knowledge products to use in the research. Table 8 shows how Knowledge Products are aligned with Knowledge Points.

Table 8. Alignment of Knowledge Products and Knowledge Points

PROGRAM KNOWLEDGE	APPLICABLE KNOWLEDGE AREA						Alignment with Knowledge Point #1	Alignment with Knowledge Point #2	Alignment with Knowledge Point #3
	REQUIREMENTS	COST	SCHEDULE	TECHNICAL PERFORMANCE	FUNDING	STRATEGY			
CAPABILITY PRODUCTION DOCUMENT (CPD)	X			X				X	X
CLINGER-COHEN ACT (CCA) CONFIRMATION COMPLIANCE				X					
CLINGER-COHEN ACT (CCA) CERTIFICATION COMPLIANCE				X					
CONSIDERATION OF TECHNOLOGY ISSUES				X			X	X	X

The final data reduction techniques were performed on the answers from the questionnaire. The respondents were asked 14 total questions, but only three questions were applicable to this research. However, the respondents' answers to the remaining 11 questions were taken into consideration for recommendations made at the conclusion of this research. The following three questions were used for this research:

1. What is the intent of the decision product? Does the decision product meet its intended purpose?

2. What information products do you believe that your organization should receive (missing information) that would improve your acquisition decision-making process?

3. What information products does your organization receive that are non-value added in the acquisition decision-making process

The answers to these questions were analyzed and all comments that referred to any decision support product were extracted and aligned with the appropriate decision product.

For the first question, the assumption made for this research was if the knowledge product cannot meet its intended purpose, then it also cannot effectively support decisions based on its intended purpose. Question 1a (What is the intent of the decision product?) was not used unless the comments supported answers given in other questions. Question 1b solicited a binary response ("YES" or "NO" unless the respondent left this answer blank) and the responses were recorded in the matrix. Table 9, on the following page, shows a sample of the respondents' answers to Question 1b.

Table 9. Knowledge Products Aligned with Survey Results (Question 1b)

PROGRAM KNOWLEDGE	Respondent #1 Product Center CV Q1: Meets it Intent?	Respondent #2 DAO Q1: Meets it Intent?	Respondent #4 DAO Q1: Meets it Intent?	Respondent #5 SPM Q1: Meets it Intent?	Respondent #6 SPM Q1: Meets it Intent?	Respondent #7 SPM Q1: Meets it Intent?	Respondent #8 PEO Q1: Meets it Intent?	Respondent #9 Wing Director Q1: Meets it Intent?	Respondent #10 SPM Q1: Meets it Intent?	Respondent #11 Wing Director Q1: Meets it Intent?	Respondent #12 Wing CC Q1: Meets it Intent?
CAPABILITY PRODUCTION DOCUMENT (CPD)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
CLINGER-COHEN ACT (CCA) CONFIRMATION COMPLIANCE	YES	YES	NO	NO			YES		NO		
CLINGER-COHEN ACT (CCA) CERTIFICATION COMPLIANCE			NO	NO			YES		NO		
CONSIDERATION OF TECHNOLOGY ISSUES	NO	NO	NO		NO	NO	NO	NO	NO		

Questions 2 and 3 offered the respondents the opportunity to share which knowledge products they thought are missing and those which are non-value added, respectively. Question 2 captured the knowledge products that could improve their decision-making abilities. There were very few responses in this area. The researcher compared this list of knowledge products with those mandated by law or regulation. If it was listed and required by law or regulation, then the answer was ignored. Question 3 solicited the non-value added knowledge products in the acquisition process. If any knowledge product was listed as non-value added by the majority of the respondents (seven or more) and not required by law or regulation, then that knowledge product was not included in this research.

Comparison of Information Types

Miles and Huberman (1994) describe data reduction activity as the process of choosing, simplifying, and changing the data that is obtained in the research process. To analyze the data and help answer the research questions, a scoring assessment matrix was

created. This assessment focused on the relationship of the information required by statute and regulation to key program parameters: requirements, cost, schedule, performance, and program funding. It also took into consideration the responses from the questionnaire that addressed the importance of the decision support information.

Assessment Model

The assessment was accomplished at six key decision points in the acquisition process: Materiel Development Decision, Milestone A, Milestone B, Post Critical Design Review – A, Milestone C, and the Full Rate Production Decision Review. This assessment used a scoring schema to rate the decision support for each decision. In addition to reducing the data, this research altered some responses without changing the intent of the individual surveyed. This was accomplished to make data more manageable.

The assessment model is based on four criteria statements. Each statement has three possible criteria responses. To assess each area based on the responses, a score was assigned to each response. If the response was 'YES', then a '+1' was scored for that particular statement. If the response was 'NO', then a '-1' was scored for that particular statement. If the response was 'Not Applicable', then a '0' was scored for that statement. Table 10 shows the statements, responses, and corresponding scores. Table 11 shows an example of the scoring schema for one Decision Support Product (DSP).

Table 10. Knowledge Assessment Criteria Statements and Responses

Criteria Statements	Criteria Responses	Scoring
Decision support product is required by Statute and/or Regulation	YES, NO, and Not Applicable	YES – +1 NO = -1 Not Applicable = 0
Decision support product is aligned with Knowledge Point		
Decision support product meets its intended purpose per respondents		
Decision support product is identified as needed information by respondents to make decisions		

Table 11. Knowledge Area Assessment Scoring Example

Knowledge Area: Program Requirements						
Decision Support: Scope Evolution Document (changes in requirements)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	-1	-1	-1	-1	-1	-1
Decision support product is aligned with a Knowledge Point	0	0	0	0	0	0
Decision support product meets its intended purpose per respondents	-1	-1	-1	-1	-1	-1
Decision support product is identified as needed information by respondents to make decisions	1	1	1	1	1	1
	-1	**-1**	**-1**	**-1**	**-1**	**-1**

Decision support products selected for the knowledge assessments were based on the products most frequently used by the decision-makers responding to the questionnaire. Each decision support product was rated in accordance with the score for each knowledge area. Each decision support product can score a maximum of 4 points and a minimum of -4 points, where positive numbers indicate better decision support. Table 12 shows the scoring schema for decision support products.

Table 12. Scoring Schema for Assessment Model

	Score	Assessment
GREEN	2.50 – 4.00	Decision Support Product is available and provides adequate information to make informed decision
YELLOW	0.01 – 2.49	Decision Support Products are either not applicable or more information is needed to make informed decision
RED	- 4.00 – 0.00	Additional decision support is needed

The last step in using the model is to assess each knowledge area based on the individual decision support products. This research used a quantitative method to assign scores. The score for each knowledge area was computed by averaging the individual scores of the decision support products. Table 13 provides an example of a knowledge area assessment.

Table 13. Example of Knowledge Area Assessment

Knowledge Area: Program Requirements	1.5
Decision Support : Capabilities Documents	4
Decision Support: Scope Evolution	-1

The next activity of the data analysis framework is verification and validity. Miles and Huberman (1994) stated that in this phase, the data should be tested for creditability and validility. In this phase, as Miles and Huberman (1994) suggest, before

drawing conclusions from the data, the research must again consider what the analyzed data mean and then assess the implications toward the research question. In reviewing the data, the researcher consistently asked the following question: does this research method make sense? In this case, the researcher purposely kept the methods simple and easy to understand. Also, any assumptions were clearly and distinctly indicated in the research.

The final step is addressing what Miles and Huberman (1994) calls the pragmatic validity. Although formed in the academic setting, qualitative research should be one that can be extended to other environments. The researcher sought to focus on ensuring that the research conducted can be utilized outside of the academic environment.

Chapter IV. Data Analysis

The intent of this chapter is to present the analysis of the data gathered during this research. As previously discussed, the data was derived from three separate sources. All three were used to create an assessment model for knowledge areas supporting the six major decision points in the Department of Defense (DoD) acquisition process. Decision support products in the following six knowledge areas were assessed: program requirements, cost, schedule, performance, funding, and strategy. The knowledge support assessment results were based on the statutory/regulatory requirement, answers provided by acquisition decision makers with regard to how well the products met their intended purpose and if the product was needed to make decisions, and the alignment of the knowledge products with best practices. The subsequent sections present the analysis in greater detail.

Knowledge Area: Program Requirements

The first knowledge area assessed in this research was program requirements. The Initial Capabilities Document (ICD), Capability Development Document (CDD), and Capability Production Document (CPD) are the primary capability documents that provide decision support in this knowledge area. These documents capture the requirements for which an acquisition program is based. Decisions made in the acquisition process should support filling the capability gap being addressed in the capability document. Figure 9 shows the interrelationship of the requirements process and the acquisition process.

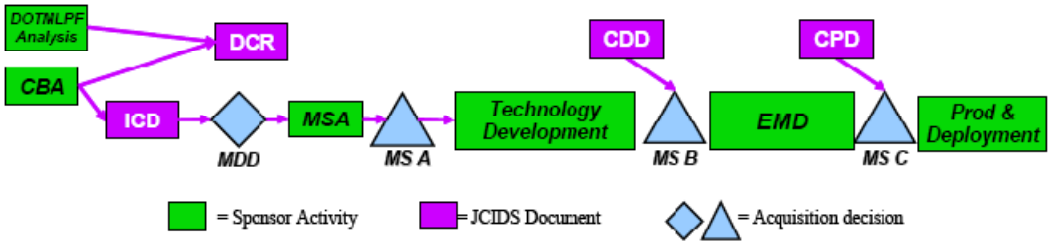

Figure 9. Interrelationship of the Requirements Process and the Acquisition Process (Defense Acquisition Guidebook, 2009)

Capability Documents

Since the knowledge contained within capability documents serve as the basis for acquisition efforts, it was an area that was expected to score well in the assessment. Capability documents are required by regulation at every major decision point in the acquisition process. Nine respondents indicated that requirements documents met their intended purpose. However, two stated that it is not always clear if the capability documents (in particular the Initial Capability Document) are compliant with the DoD Architectural Framework (DoDAF). The DoDAF is a reference model to organize the enterprise architecture (EA) and systems architecture into complementary and consistent views. In addition, although compliancy is required, the benefit of being compliant is not well understood in the acquisition community. In their comments, the respondents stated that the acquisition community is typically not an active participant in the requirements generation process because it is not transparent to them how the systems being acquired fit into the overall DoD framework.

Capability documents scored an average of 4 (out of a max score of 4) for this knowledge area. This score reflects the importance, availability, and use of requirements

in making decisions in the acquisition process. Requirements documents ranked as the number one decision support product for knowledge support in this research. This indicates that the products are available and provide useful information that is used to make decisions in the program requirements knowledge area. Table 14 shows the results of the scoring in by each decision point.

Table 14. Capability Documents Knowledge Assessment

Knowledge Area: Program Requirements						
Decision Support: Capabilities Documents (ICD, CDD, and/or CPD)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	1	1	1	1	1	1
Decision support product is aligned with a Knowledge Point	1	1	1	1	1	1
Decision support product meets its intended purpose per respondents	1	1	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	1	1	1	1	1	1
	4	4	4	4	4	4

Scope Evolution

Scope evolution is the next decision support document supporting the program requirement knowledge area. Scope evolution documents capture changes in program requirements prior to Milestone B (particularly before a program is formally baselined with an Acquisition Program Baseline (APB)). This knowledge support was referred to by nine respondents. All nine indicated that stability of capability requirements (performance or quantity) is critical to program success as changes in requirements impact program cost and schedule. There is no statutory or regulatory document required

for a scope evolution document. However, all changes to Key Performance Parameters in the APB (established after Milestone B) are tracked by all MDAP programs.

Three respondents indicated an issue with changes in requirements prior to Milestone B. The issue is that changes to requirements after a program has started are costly. Additionally, one respondent stated that the "appetite for the latest and greatest technology is eating our lunch, when a lesser, more mature technology is sufficient." This is consistent with the results of a RAND Corporation study conducted in 2006. For every type of ship they studied, the price escalation rates ranged from 7 to 11 percent annually between 1950 and 2000. For every type of aircraft that was examined, the price escalation rates ranged from 7 to 12 percent annually between 1974 and 2005. Since the average annual inflation rate between 1965 and 2004 was 4.7%, RAND (2006) concluded that the price growth above the inflation index stemmed from the desire for more capabilities.

Four respondents suggested that more programs follow an incremental acquisition strategy that locks program requirements at Milestone A. They went on to state that any change (increase) in requirements should be acquired through separate increments. This approach is limited, however, to the manner in which the capabilities are required by the user. For example, capability documents may not separate requirements into increments, thus forcing the acquisition community to acquire most if not all capabilities for a program at once.

Scope evolution documents scored an -1. This low score is not indicative of the value of the knowledge product, but rather an indication that the knowledge is not required by statute or regulation. This score indicates that more knowledge is needed to

support decisions in this knowledge area. These decision support documents are aligned with both Knowledge Point 1: Requirements and Technology Capability are Matched and Knowledge Point 2: Design will work as required. Table 15, on the following page, shows the scoring of this assessment area.

Table 15. Scope Evolution Knowledge Assessment

Knowledge Area: Program Requirements						
Decision Support: Scope Evolution Document (changes in requirements)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	-1	-1	-1	-1	-1	-1
Decision support product is aligned with a Knowledge Point	0	0	0	0	0	0
Decision support product meets its intended purpose per respondents	-1	-1	-1	-1	-1	-1
Decision support product is identified as needed information by respondents to make decisions	1	1	1	1	1	1
	-1	**-1**	**-1**	**-1**	**-1**	**-1**

Knowledge Area: Program Cost

This knowledge area focuses on program cost for DoD major acquisition programs. There are many documents used by the individual services that support this knowledge, including the initial proposals submitted by industry partners. In addition, each service produces a cost estimate usually referred to as the Service Cost Position. However, this research focused on the two documents that are mandated by statute or regulation: the Independent Cost Estimate and the Affordability Assessment.

Independent Cost Estimate

The Independent Cost Estimate (ICE) estimates the full life-cycle cost for a MDAP; required by statute, it is prepared by the Director of Cost Assessment and

Program Evaluation (DCAPE). The ICE is required at Milestones A, B, and C. The ICE was commented on by 11 respondents. All indicated that the document supported decisions, but nine acknowledged that cost estimating is an issue for MDAPs. The issue as directly stated by seven respondents is that costs are routinely underestimated.

These statements are supported by a 2008 RAND study pertaining to the sources of cost growth in MDAPs. In the study (RAND, 2008), 68 programs were examined over the previous 30 years. They found that after adjusting for changes in the quantity of systems produced, costs grew by 46 percent on average over the estimate at development approval (Milestone B). Since the respondents stated that this decision support document was historically underestimated, the product was assessed as not meeting its intent. Overall, the ICE was assessed with a score of 2. Table 16 shows the scoring of this decision support product.

Table 16. Independent Cost Estimate Knowledge Assessment

Knowledge Area: Cost						
Decision Support: Independent Cost Estimate (ICE)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	1	1	0	1	0
Decision support product is aligned with a Knowledge Point	0	1	1	0	1	0
Decision support product meets its intended purpose per respondents	0	-1	-1	0	-1	0
Decision support product is identified as needed information by respondents to make decisions	0	1	1	0	1	0
	0	**2**	**2**	**0**	**2**	**0**

Affordability Assessment

The next document, which is required at Milestones B and C, assessed in the program cost knowledge area is the Affordability Assessment. The intent of this document is to demonstrate that the program's projected funding and manpower are practical and attainable. This knowledge support area was addressed by ten respondents, all indicating that it met its purpose. Seven respondents' comments were focused on the staffing level of program offices prior to Milestone B, which is when major acquisition efforts are designated as programs. The comments suggested that Pre-Milestone B programs are ill-equipped to be successful at this stage because the staffing level is too low in comparison to the workload. For this reason, it was recommended that this document be mandated for Milestone A. Table 17 shows the scoring of this decision support product.

Table 17. Affordability Assessment Knowledge Assessment

Knowledge Area: Cost						
Decision Support Product: Affordability Assessment	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	-1	1	0	1	0
Decision support product is aligned with a Knowledge Point	0	0	1	0	1	0
Decision support product meets its intended purpose per respondents	0	0	1	0	1	0
Decision support product is identified as needed information by respondents to make decisions	0	0	1	0	1	0
	0	**-1**	**4**	**0**	**4**	**0**

Knowledge Area: Program Schedule

This research assessed two key documents supporting the schedule knowledge area. The first document is the Integrated Master Schedule (IMS). The IMS is an integrated, networked schedule containing all the details necessary to accomplish the

work specified in the Integrated Master Plan (IMP), which is the second document assessed. Since both documents are closely related, both were be assessed together. While the IMS is not required by statute or regulation as a standalone document in the acquisition process, both the acquisition strategy and the APB address schedule parameters for MDAPs.

Integrated Master Schedule

All 12 respondents commented on program schedule. Eleven specifically stated that it is a value-added document for the decision-making process. However, four respondents made comments indicating that the government is too dependent on the defense partners for "detailed schedule information." Two of these comments were based on experiences in which schedule risks were not reported by the contractor until they became issues for the government. Additionally, five respondents indicated that IMS information is, at times, too complex to be used to make decisions.

Integrated Master Plan

The IMP is the next document that supports the schedule knowledge area. Like the IMS, it is not required by statute or regulation. The IMS is an event-based plan detailed in a hierarchy of work events. None of the respondents made comments specifically with regard to the IMP. However, nine made mention of a program's critical path, which was determined to be a key information source for making decisions. Since the IMP contains all program tasks, this research inferred that the respondents deemed the IMP as meeting its purpose. Both the IMS and IMP are aligned with Knowledge Point 3: Design can be produced within, cost, schedule, and quality targets. Table 18 shows the scoring for these decision support products.

Table 18. Integrated Master Schedule/Plan Knowledge Assessment

Knowledge Area: Schedule						
Decision Support Product: Integrated Master Schedule/Plan	**Materiel Development Decision**	**Milestone A**	**Milestone B**	**Post-Critical Design Review A**	**Milestone C**	**Full Rate Production Decision Review**
Decision product supporting this knowledge area is required by Statute and/or Regulation	-1	-1	-1	-1	-1	-1
Decision support product is aligned with a Knowledge Point	1	1	1	1	1	1
Decision support product meets its intended purpose per respondents	1	1	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	1	1	1	1	1	1
	2	2	2	2	2	2

Knowledge Area: Technical Performance

Six decision support products were assessed for program performance: Systems Engineering Plan (SEP), Consideration for Technology Issues, Test and Evaluation Strategy (TES), Independent Technology Readiness Assessment (ITRA), Technical Readiness Assessment (TRA), and the Test and Evaluation Master Plan (TEMP). All six of these documents are required by either statute or regulation. For purposes of this research, the ITRA and the TRA will be considered the same document and scored similarly. Similarly, Test and Evaluation Strategy (TES) and the Test and Evaluation Master Plan (TEMP) were considered together.

Systems Engineering Plan

The System Engineering Plan (SEP) is the next knowledge support document assessed for this research. The SEP's purpose is to guide programs in their systems engineering approach, while providing a documented technical foundation for the program. It documents key technical risks, processes, resources, and metrics associated with the program. The SEP was commented on by all 12 respondents. All indicated that

it was a document that met its intent in supporting decisions. However, only three respondents felt that the SEP provided information that was needed to make decisions.

Eight respondents felt that the most important attribute of the SEP is the success criteria for the technical reviews. These comments aligned well with the best practices found by the GAO (Knowledge Point 2: Design can be work as required), which uses the percentage of engineering drawings completed or projected for completion by the Critical Design Review as one critical success factor. Four respondents made comments regarding the standardization of the SEP. They stated that the lack of a mandated format made it difficult to use for making program decisions. Table 19 shows the scoring for this knowledge support document.

Table 19. Systems Engineering Plan Knowledge Assessment

Knowledge Area: Technical Performance						
Decision Support: Systems Engineering Plan	**Materiel Development Decision**	**Milestone A**	**Milestone B**	**Post-Critical Design Review A**	**Milestone C**	**Full Rate Production Decision Review**
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	1	1	1	1	0
Decision support product is aligned with a Knowledge Point	0	1	1	1	1	0
Decision support product meets its intended purpose per respondents	0	1	1	1	1	0
Decision support product is identified as needed information by respondents to make decisions	0	-1	-1	-1	-1	0
	0	**2**	**2**	**2**	**2**	**0**

Consideration for Technology Issues

Consideration for Technology Issues is the second decision support document assessed for this area. It is required by statute at Milestones A and B. The law mandates that programs provide documentation regarding the use of relevant technologies. Therefore, programs must address whether or not relevant technologies exist. They also

must prove the rationale for choosing to not use technologies if they exist. Lastly, the program must document existing relevant technologies that will be incorporated into the program.

Ten respondents commented on this knowledge support product. Eight stated that this document did not add value to the decision-making process. Of those eight, six stated that the intent of the document is captured in other required documentation. Two respondents stated that they did not understand the purpose of the document. As a result, this document was considered to be one that did not meet its intent. Furthermore, this knowledge support document is not aligned with any of the Knowledge Points. Table 20 shows the scoring for this area.

Table 20. Consideration for Technology Issues Knowledge Assessment

Knowledge Area: Technical Performance						
Decision Support Product: Consideration for Technology Issues	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	1	1	-1	0	0
Decision support product is aligned with a Knowledge Point	0	-1	-1	-1	0	0
Decision support product meets its intended purpose per respondents	0	-1	-1	-1	0	0
Decision support product is identified as needed information by respondents to make decisions	0	-1	-1	-1	0	0
	0	**-2**	**-2**	**-4**	**0**	**0**

Technology Readiness Assessment

The next decision support documents supporting the technical performance area were the Independent Technology Readiness Assessment (ITRA) and Technology

Readiness Assessment (TRA). Both documents have the same intent. The difference is that the Weapons Systems Acquisition Reform Act (WSARA) of 2009 allows the Director of Defense Research and Engineering (DDR&E) to, in addition to the TRA, require an additional independent assessment of the technology readiness.

The law also required DDR&E to develop a knowledge-based standard against which Technology Readiness Levels (TRLs) can be assessed. The law mandated the integration of risk of critical technologies at key stages in the acquisition process. The TRA is required at Milestone B and at Milestone C. Nine respondents commented on the TRA, with all comments indicating that the decision support document met its intended purpose and that the information provided by the document was needed to make decisions. Table 21 shows the scoring for these documents.

Table 21. Technology Readiness Assessment Knowledge Assessment

Knowledge Area: Technical Performance						
Decision Support: Technology Readiness Assessment	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	-1	1	1	1	0
Decision support product is aligned with a Knowledge Point	0	1	1	1	1	0
Decision support product meets its intended purpose per respondents	0	1	1	1	1	0
Decision support product is identified as needed information by respondents to make decisions	0	1	1	1	1	0
	0	**2**	**4**	**4**	**4**	**0**

Test and Evaluation Strategy/Test and Evaluation Master Plan

The last two documents supporting this knowledge area are the Test and Evaluation Strategy (TES) and the Test and Evaluation Master Plan (TEMP). The intent of both documents is very similar. The TES describes the approach for test and

evaluation for programs prior to Milestone B. The TEMP, which evolves from the TES, documents the overall structure and objectives for the test and evaluation program beyond Milestone B. Both documents are required by regulation. All 12 respondents made comments indicating that these documents met their respective purpose. However, only five indicated that they were needed to make decisions. Four of the five stated that test and evaluation results, rather than the plan itself, was useful in making decisions. These documents are aligned with Knowledge Point 2: Design will work as required. Table 22 shows the assessment for these documents.

Table 22. Test and Evaluation Knowledge Assessment

Knowledge Area: Technical Performance						
Decision Support: Test and Evaluation Master Plan/ Test and Evaluation Strategy	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	1	1	1	1	1
Decision support product is aligned with a Knowledge Point	0	1	1	1	1	0
Decision support product meets its intended purpose per respondents	0	1	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	0	-1	-1	-1	-1	-1
	0	**2**	**2**	**2**	**2**	**1**

Knowledge Area: Funding

The next knowledge area deals with program funding. Like the cost knowledge area, there are several different products supporting this knowledge area. Most of the funding products produce similar information; therefore, this research focused on only two decision support documents: the Milestone Decision Authority (MDA) certification at Milestone A and the Non-Advocate Cost Assessment, which is a document primarily used by the Air Force acquisition community.

Milestone Decision Authority Certification

The MDA certification memorandum is required by the Weapons Systems Acquisition Reform Act (WSARA) of 2009 for all MDAPs at Milestone A. The WSARA required the MDA to sign a memorandum for record that certifies the following program attributes:

1. Program fulfills an approved ICD, executed by competent entity.
2. Analysis of Alternatives (AoA) has been performed, and cost estimate is complete.
3. If the program exceeds 25% of the cost or schedule target prior to Milestone B, then program termination must be considered.

At the time of the survey, the WSARA of 2009 was not signed into law. However, all 12 respondents had knowledge of the upcoming law and provided comments. For this reason, the answers provided may have been skewed since their answers may not have been based on factual information regarding MDA certification. All 12 respondents felt this 'Nunn-McCurdy' like process was being conducted too early in the program life. One respondent stated that in the early stages of the acquisition process, scope is still being defined based on funding, cost, technology maturity, and initial requirements; therefore, the program should not be baselined. Another respondent said this will lead programs to artificially inflate their cost and schedule estimates in order to avoid breaching the threshold. None of the respondents indicated that this document added any value to the decision-making process. This document is aligned with Knowledge Point 3: Design can be produced within cost, schedule, and quality targets. Table 23 shows the scoring for this decision support document.

Table 23. Milestone Decision Authority Certification Knowledge Assessment

Knowledge Area: Funding						
Decision Support: MDA Certification (2366a)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	1	0	0	0	0
Decision support product is aligned with a Knowledge Point	0	1	0	0	0	0
Decision support product meets its intended purpose per respondents	0	-1	0	0	0	0
Decision support product is identified as needed information by respondents to make decisions	0	-1	0	0	0	0
	0	**0**	**0**	**0**	**0**	**0**

Non-Advocate Cost Assessment

The Non-Advocate Cost Assessment (NACA) is an analysis of a program's cost, price, and technical risk. The primary assessment compares the cost of a program with the program's FYDP budget and assesses whether the program can be successful within its cost targets. It is prepared by an independent organization. Ten respondents stated that they use NACAs when making decisions, which indicates that the document meets its intended purpose. The NACA is aligned with Knowledge Point 3: Design can be produced within cost, schedule, and quality targets. Table 24 shows the scoring for this decision support product.

Table 24. Non-Advocate Cost Assessment Knowledge Assessment

Knowledge Area: Funding						
Decision Support: Non-Advocate Cost Assessment (NACA)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	-1	-1	-1	-1	-1	-1
Decision support product is aligned with a Knowledge Point	1	1	1	1	1	1
Decision support product meets its intended purpose per respondents	1	1	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**

Knowledge Areas: Program Strategy

The decision support documents supporting this knowledge area are those that provide the overall strategy that will achieve the cost, schedule, and technical performance objectives of the program. These documents are the Technology Development Strategy (TDS), Acquisition Strategy, Acquisition Program Baseline (APB), and the Life-Cycle Support Plan (LCSP). All four documents are required by either statute or regulation.

Acquisition Strategy

The first decision support product in this knowledge area is the Acquisition Strategy. The Acquisition Strategy is the all-inclusive plan that provides the acquisition approach and describes the overall strategy for the program management team to manage risks to meet program goals. The Acquisition Strategy is required by regulation for Milestone B and beyond. This document was commented on by all of the respondents that it met its purpose. Additionally, nine made comments indicated that this document provided essential knowledge in making decisions. This document is aligned with Knowledge Point 3: Design can be produced within cost, schedule, and quality targets. Table 25 gives the assessment score for the Acquisition Strategy.

Table 25. Acquisition Strategy Knowledge Assessment

Knowledge Area: Program Strategy						
Decision Support: Acquisition Strategy	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	0	1	1	1	1
Decision support product is aligned with a Knowledge Point	0	0	1	1	1	0
Decision support product meets its intended purpose per respondents	0	0	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	0	0	1	1	1	1
	0	0	4	4	4	3

Technology Development Strategy

The TDS, which is required by statute, is the document that guides acquisition efforts in the Technology Development phase. Its function is very similar to the Acquisition Strategy. All 12 respondents offered indications that it met its intent in supporting the decision-making process. Additionally, seven of the respondents stated that TDS should be updated more frequently within the Technology Development stage. Four of the seven reasoned that if a technology is proven to be not mature enough to meet cost and schedule parameters, then tradeoffs need to be made as soon as possible to avoid cost and schedule overruns. The TDS supports Knowledge Point 1: Requirements and Technology Capability are matched. Table 26 shows the assessment for this knowledge area.

Table 26. Technology Development Strategy Knowledge Assessment

Knowledge Area: Program Strategy						
Decision Support: Technology Development Strategy	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	1	0	0	0	0
Decision support product is aligned with a Knowledge Point	1	1	0	0	0	0
Decision support product meets its intended purpose per respondents	1	1	0	0	0	0
Decision support product is identified as needed information by respondents to make decisions	1	1	0	0	0	0
	3	4	0	0	0	0

Acquisition Program Baseline

The next assessed document which supports the program strategy knowledge area is the Acquisition Program Baseline (APB). The establishment of program goals is required by statute beginning at Milestone B. The purpose of the APB is to document program goals in terms of cost, schedule, and technical performance. These goals are made of up of an objective value and a threshold value for each Key Performance Parameter (KPP) or Key System Attribute (KSA). Eleven of the 12 respondents commenting on the APB indicated that it added value to the decision-making process, thus meeting its intent. Nine respondents made comments that the APB is needed to make decisions. The APB is aligned with Knowledge Point 3: Design can be produced within cost, schedule, and quality targets. Table 27 provides the assessment score for the APB.

Table 27. Acquisition Program Baseline Knowledge Assessment

Knowledge Area: Program Parameters						
Decision Support: Acquisition Program Baseline (APB)	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	-1	1	1	1	1
Decision support product is aligned with a Knowledge Point	0	0	1	1	1	1
Decision support product meets its intended purpose per respondents	0	0	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	0	0	1	1	1	1
	0	-1	4	4	4	4

Life Cycle Support Plan

The last document supporting the program strategy area is the Life Cycle Support Plan (LCSP). The LCSP documents the program's strategy to achieving performance-oriented product support capability. The LCSP is required by DoD Directive 5000.01 to "implement performance-based logistics strategies that optimize total system availability while minimizing cost and logistics footprint." Although life-cycle sustainment planning begins earlier in the acquisition process, the LCSP is mandated by Milestone B.

The LCSP was commented on by 11 of the respondents, indicating that it met its intent. Eight stated that the LCSP contained information that could be useful in making decisions. However, three acknowledged that the information in the LCSP was actually seldom used to make decisions. Four of the respondents made statements suggesting that logistical planning should play a larger role in the overall acquisition strategy for programs. However, they felt that the acquisition community lacks the right skills to effectively plan for logistical activities. This decision support document does not directly align with any of the GAO Knowledge Points. Table 28 shows the assessment for the LCSP.

Table 28. Life Cycle Support Plan Knowledge Assessment

Knowledge Area: Strategy						
Decision Support: Life Cycle Support Plan	Materiel Development Decision	Milestone A	Milestone B	Post-Critical Design Review A	Milestone C	Full Rate Production Decision Review
Decision product supporting this knowledge area is required by Statute and/or Regulation	0	0	1	1	1	1
Decision support product is aligned with a Knowledge Point	0	0	-1	-1	-1	-1
Decision support product meets its intended purpose per respondents	0	0	1	1	1	1
Decision support product is identified as needed information by respondents to make decisions	0	0	0	0	0	0
	0	0	1	1	1	1

Overall Assessment of Knowledge Areas

The last step in using the model is to assess each knowledge area based on the individual decision support products. This research used a quantitative method by averaging the individual scores of the decision support products. Table 29 shows the assessment results.

Table 29. Assessment of Knowledge Areas

Knowledge Area: Program Requirements	1.5
Decision Support : Capabilities Documents	4
Decision Support: Scope Evolution	-1
Knowledge Area: Cost	**2.165**
Decision Support Product: Independent Cost Estimate	2
Decision Support: Affordability Assessment	2.33
Knowledge Area: Schedule	**2**
Decision Support: Integrated Master Schedule	2
Decision Support: Integrated Master Plan	2
Knowledge Area: Technical Performance	**2.54**
Decision Support: Systems Engineering Plan	2
Decision Support: Consideration for Technology Issues	2.67
Decision Support: Technology Readiness Assessment	3.5
Decision Support: Test and Evaluation Strategy/Test and Evaluation Master	2
Knowledge Area: Funding	**1**
Decision Support: MDA Certification (2366a)	0
Decision Support: Non-Advocate Cost Assessment	2
Knowledge Area: Program Strategy	**2.875**
Decision Support: Acquisition Program Baseline	3.25
Decision Support: Acquisition Strategy	3.75
Decision Support: Technology Development Strategy	3.5
Decision Support: Life Cycle Sustainment Plan	1

Chapter V. Conclusions and Recommendations

Cost overruns and schedule delays have plagued Major Defense Acquisition Programs (MDAPs) within the Department of Defense (DoD) for decades. There are several factors that impact an acquisition program's performance, including the decisions made by defense officials. This research focused on one aspect of decision-making: knowledge support. Secondary interview data, assessments of knowledge support documents, and how these documents align with best practices for knowledge-based decision-making helped address the investigative questions posed by this research.

Results

This research posed four investigative questions. By exploring previous research, gathering and analyzing data, and drawing conclusions, this research has answered those questions. The research outcomes are presented for each question.

What are the critical pieces of information that are required for an informed decision at key decision points in the acquisition process?

The research answered this investigative question by establishing which documents were needed to make decisions. The required information, according to the respondents, was considered to be stated in products that adequately addressed one of six key knowledge areas of an acquisition program: Requirements, Cost, Schedule, Technical Performance, Funding, and Strategy. This research focused on 17 decision support documents that directly supported these knowledge areas. However, based on the feedback from respondents, two documents were eliminated. The Milestone Decision

Authority (MDA) Certification and the Consideration for Technology Issues were not considered value-added to the decision-making process. Table 30 shows the list of critical decision support products.

Table 30. Critical Decision Support Products

Capabilities Documents
Scope Evolution
Independent Cost Estimate
Affordability Assessment
Integrated Master Schedule
Integrated Master Plan
Systems Engineering Plan
Consideration for Technology Issues
Technology Readiness Assessment
Test and Evaluation Strategy
Test and Evaluation Master Plan
Non-Advocate Cost Assessment
Acquisition Program Baseline
Acquisition Strategy
Technology Development Strategy
Life Cycle Support Plan

How does the currently available information (contained in required decision products) compare to what is needed for decisions with regard to technology, design, and production knowledge for each of the key decision points in the acquisition process?

This investigative question dealt with the alignment of the DoD acquisition process with best practices identified by the General Accounting Office (GAO) (2008). The research indicated that there is in fact an alignment of knowledge mandated with the GAO Knowledge Points. For every Knowledge Point, there are decision support

products required by law or regulation aligned to it. Additionally, this research has concluded that alignment with this best practice has not always translated into better program performance.

Best practices in decision support outside of the knowledge products should also be considered. For example, one metric the GAO uses to assess program knowledge is the average percent of design drawings completed by the Critical Design Review. Although readily available, this data is not required by statute or regulation for any decision support product. Since the format of most required documents is not dictated, it is possible that this data is captured. Therefore, the alignment of the knowledge cannot be determined conclusively.

What is the effect of lack of key information on DoD acquisition programs?

This research defined key information on DoD acquisition programs in two ways. The first were the instances in which key information is defined by best practices. As previously mentioned, the GAO (2008) uses metrics to assess program knowledge. As such, knowledge supporting these metrics can be considered key information per best practices. However, this research did not specifically address the alignment of decision support documents and the information supporting the metrics. Therefore, the effect of the lack of key information supporting the GAO metrics is unknown.

The second definition of key information is the knowledge contained in decision support products determined by decision-makers as being needed to make decisions. In this regard, if key information is missing, then the effect is simply that decision-makers cannot make a well-informed decision. As an example, the research identified the Scope Evolution Document as key missing information. At least one comment from the

respondents indicated that information in this document could be used to make better decisions regarding tradeoffs in terms of cost, schedule, and technical performance. *Can this effect be quantified in terms of program cost, schedule, and technical performance?*

It is not clear if missing information can be quantified in terms of cost, schedule, and technical performance as there are so many factors that impact these program parameters. The literature review did reveal that National Aeronautics and Space Administration (NASA) implemented policy supporting the GAO's best practices in knowledge-based decision-making and the results showed there were no improvements in cost and schedule for those projects.

Recommendations

Based on the information that has been reviewed, it is possible to make several recommendations to improve the use of knowledge-based decision-making in DoD acquisitions. These recommendations are based directly on the information obtained from the participants completing the surveys used in this study, as well as from the information obtained by reviewing literature. It is important to note that these recommendations are not intended to imply that the DoD acquisition process is completely inefficient or should be completely changed. Instead, these recommendations are made as a way to improve the decision-making process and to bring about greater efficiency in the work that is done to acquire new systems for the DoD by its acquisition teams, suppliers, and other stakeholders.

Recommendation #1

The first recommendation is to further this study by exploring ways to improve the score of the knowledge areas. This can be accomplishing by focusing on the drivers for the low scores for decision support products. For example, the Non-Advocate Cost Assessment (NACA) scored well in all areas with the exception of it not being mandatory for major reviews. In this case, it means that it is considered valuable for decision-makers but it has not been mandated. By mandating this knowledge product, it ensures that all decision-makers will have access to valuable knowledge when making decisions.

Recommendation #2

The second recommendation is to use specific program metrics at reviews to support decisions. For example, one metric the GAO recommends for the Critical Design Review is the percentage of design drawings that are complete. This metric captures the stability of the design. The literature review indicated that the higher the percentage of drawings that are complete, the higher the probability of the design being capable of meeting performance requirements. Additionally, a stable design in the early stages of the development cycle reduces the risk of design changes. The respondents to the survey also recommend another metric: changes in requirements (Scope Evolution). This metric captures the stability of requirements, which helps keeps cost and schedule within goals.

Recommendation #3

The next recommendation is that decision authorities should have more freedom to request specific types of decision products. Aside from the decision products that are required by statute and regulation, decision authorities should have the freedom to request additional decision products when they believe that the information contained in

those products would be useful for a key decision. This freedom to have access to additional decision products, or even decision products that are not routinely used or made available to acquisition teams, would help to overcome the feelings that exist about the lack of information when making a major decision for a program.

In addition to the decision authority, allowing other functional members of the review board to specify decision products would also be of benefit. Rather than decision products being shared between stakeholders that are viewed as being useless and not even being thoroughly read, or even read at all, the ability to request specific decision products would likely result in all stakeholders taking the documents that they receive more seriously and using the information contained in those products in a more efficient manner.

Recommendation #4

The next recommendation is to mandate a template for use during decision briefings of major milestones. This template would contain a specific recommendation for the milestone decision supported by knowledge within the mandated knowledge support product. For example, the senior engineering functional would make a specific recommendation to the decision authority with regard to technical performance. This recommendation would be based on the knowledge gained from documents like the Systems Engineering Plan and Independent Technology Readiness Document. This would accomplish two important tasks. First, it would ensure the decisions are being based on knowledge that is available and that mandated knowledge products are being reviewed. Secondly, it would ensure that the decision support product is being thoroughly reviewed for knowledge that can be used to make program decisions.

Recommendation #5

Finally, it is recommended that the DoD create a standardized means by which decision products across the department can be created and stored for use by all programs, regardless of Acquisition Category (ACAT) level. One of the issues raised by data collected from the participants in this study is that there is no standardized means by which to create and store decision products. Instead, information is simply received and stored in whatever way a specific team member may believe is best. This creates a situation where efficiencies cannot be realized because programs are unable to share information used to make decisions.

The creation or adoption of a single Information Technology system to standardize the process of creating and storing decision products would help make the use of decision products more engrained in the culture of the DoD. Having a standardized process to handle decision products would be an indication to acquisition teams that decision products are no longer viewed as something that can be read and then forgotten about in the future. Instead, decision products could be collected and team members could easily access the information contained in those products and gain a feeling that the products are genuinely important and should be taken seriously.

Limitations

As with any research effort, this effort has limitations. The respondents to the survey represented only the service's acquisition community. Secondly, there is little established research in this area. As such, the researcher does not have a point of reference for the findings. Additionally, since some data sets were limited to the Air

Force, the findings may not be applicable to other organizations within the DoD. Another limitation is the fact that the researcher had to interpret the meaning of some responses. This involved a combination of deductive and inductive analysis, which may or may not have led to the true meaning of the submission by the individuals surveyed. The final limitation is the aforementioned sample size of 12. Statistically, it is not a significant number, but it represents a significant portion of the milestone decision authorities for the Air Force.

Summary

Decision-making for acquisition programs is very important. The decisions that are made not only affect the performance of a program but could also impact the lives of Airman, Soldiers, Sailors, and Marines protecting our country. Analyzing the decision support products is one method to improve the knowledge that is used to make decisions. If these recommendations are put into place, the researcher believes that the acquisitions process within the DoD would indeed be improved. While these recommendations may seem relatively simplistic, they are based on actual issues that have been addressed by active members of Air Force acquisition teams. By working to improve the efficiency of the decision-making process, it will lead to better decisions for programs.

Appendix A: Statutory Requirements for Milestone A

INFORMATION REQUIRED FOR MILESTONE A	APPLICABLE STATUTE, POLICY, AND OTHER REFERENCES
Analysis of Alternatives	Subtitle III of title 40, U.S.C. Section 2366a of Title 10, U.S.C.
Clinger-Cohen Act Compliance (All IT–including National Security Systems (NSS))	Subtitle III of title 40, U.S.C.
Consideration of Technology Issues	Paragraph (b)(5) of Section 2364 of Title 10, U.S.C.
Cooperative Opportunities (part of TDS)	Paragraph (e) of Section 2350a of Title 10, U.S.C.
Data Management Strategy (part of TDS)	Section 2320 of Title 10, U.S.C.
Independent Cost Estimate	Section 2434 of Title 10, U.S.C.
Market Research	Section 2377 of Title 10, U.S.C. Paragraph (e)(2) of Section 644 of title 15, U.S.C.
Milestone Decision Authority Program Certification	Section 2366a of Title 10, U.S.C. DoD Instruction 5000.02
Submission of a DD Form 1494 and Certification of Spectrum Support	Sections 305 and 901 through 904 of title 47, U.S.C. Section 104 of P.L. 102-538 Part 2 of OMB Circular A-11
Technology Development Strategy	Section 803 of Public Law 107-314

Appendix B: Regulatory Requirements for Milestone A

INFORMATION REQUIRED FOR MILESTONE B	APPLICABLE REGULATION, POLICY, AND OTHER REFERENCES
Acquisition Decision Memorandum	DoD Instruction 5000.02
Acquisition Information Assurance Strategy (All IT– including NSS)	DoD Instruction 8580.1 DoD Instruction 5000.02
DoD Component Cost Estimate (as required by Component Acquisition Executive for MDAP)	DoD Instruction 5000.02
Exit Criteria	DoD Instruction 5000.02
Initial Capabilities Document	CJCS Instruction 3170.01
Item Unique Identification Implementation Plan	DoD Instruction 8320.04
Life-Cycle Signature Support Plan	DoD Directive 5250.01
Net-Centric Data Strategy (Approach summarized in TDS)	DoD Directive 8320.02
Program Protection Plan	DoD Instruction 5200.39
Systems Engineering Plan	DoD Instruction 5000.02
Test and Evaluation Strategy	DoD Instruction 5000.02

Appendix C: Statutory Requirements for Milestone B

INFORMATION REQUIRED FOR MILESTONE B	APPLICABLE STATUTE, POLICY, AND OTHER REFERENCES
Acquisition Program Baseline (APB)	Section 2435 of title 10, U.S.C.
Alternate Live Fire Test and Evaluation (LFT&E) Plan	Section 2366 of title 10, U.S.C.
Analysis of Alternatives	Subtitle III of title 40, U.S.C. Section 2366a of title 10, U.S.C.
Benefit Analysis and Determination	Paragraph (e) of Section 644 of title 15, U.S.C.
Clinger-Cohen Act (CCA) Compliance	Subtitle III of title 40, U.S.C.
Competition Analysis (part of Acquisition Strategy)	Section 2469 of title 10, U.S.C.
Consideration of Technology Issues	Paragraph (b)(5) of Section 2364 of Title 10, U.S.C.
Cooperative Opportunities (part of Acquisition Strategy)	Paragraph (e) of Section 2350a of title 10, U.S.C.
Core Logistics Analysis/Source of Repair Analysis (part of Acquisition Strategy)	Section 2464 of title 10, U.S.C. Section 2466 of title 10, U.S.C.
Data Management Strategy (part of Acquisition Strategy)	Section 2320 of title 10, U.S.C.

Independent Cost Estimate (ICE)	Section 2434 of title 10, U.S.C.
Industrial Base Capabilities Considerations	Section 2440 of title 10, U.S.C.
LFT&E Waiver from Full-up, System-level Testing	Section 2366 of title 10, U.S.C.
Low-Rate Initial Production Quantities	Section 2400 of title 10, U.S.C.
Manpower Estimate	Section 2434 of title 10, U.S.C.
Market Research	Section 2377 of Title 10, U.S.C. Paragraph (e)(2) of Section 644 of title 15, U.S.C.
Milestone Decision Authority Program Certification	Section 2366b of title 10, U.S.C. DoD Instruction 5000.02
Military Equipment Valuation	Public Law 101-576, SFFAS 6
Programmatic Environmental, Safety and Occupational Health Evaluation (PESHE)	Sections 4321-4347 of title 42, U.S.C. E.O. 12114
Replaced System Sustainment Plan	Section 2437 of title 10, U.S.C.
Selected Acquisition Report	Section 2432 of title 10, U.S.C. Section 2445d of title 10, U.S.C.
Submission of a DD Form 1494 and Certification of Spectrum Support	Sections 305 and 901-904 of title 47, U.S.C. Section 104 of Public Law 102-538 Part 2 of OMB Circular A-11

Appendix D: Regulatory Requirements for Milestone B

INFORMATION REQUIRED FOR MILESTONE B	APPLICABLE REGULATION, POLICY, AND OTHER REFERENCES
Acquisition Decision Memorandum	DoD Instruction 5000.02
Acquisition Information Assurance Strategy	DoD Instruction 8580.1 DoD Instruction 5000.02
Acquisition Strategy	DoD Instruction 5000.02
Affordability Assessment	DoD Instruction 5000.02
Capability Development Document	CJCS Instruction 3170.01
Chief Information Officer Confirmation of CCA Compliance	DoD Instruction 5000.02
Corrosion Plan	DoD Instruction 5000.67 DoD Instruction 5000.02
Cost Analysis Requirements Description (CARD)	DoD Instruction 5000.02
Defense Acquisition Executive Summary	DoD Instruction 5000.02
DoD Component Cost Estimate	DoD Instruction 5000.02
Exit Criteria	DoD Instruction 5000.02
Technology Readiness Assessment	DoD Instruction 5000.02

Information Support Plan (ISP) (All IT–including NSS)	DoD Directive 4630.05 DoD Instruction 4630.8
Initial Capabilities Document	CJCS Instruction 3170.01
Item Unique Identification Implementation Plan	DoD Instruction 8320.04
Life-Cycle Signature Support Plan	DoD Directive 5250.01
Life-Cycle Sustainment Plan (part of Acquisition Strategy)	DoD Instruction 5000.02
Net-Centric Data Strategy (Approach detailed in ISP)	DoD Directive 8320.02
Operational Test Agency Report of Operational Test and Evaluation Results	DoD Instruction 5000.02
Preliminary Design Review Report	DoD Instruction 5000.02
Program Protection Plan	DoD Instruction 5200.39
Spectrum Supportability Determination	DoD Directive 4650.1
System Threat Assessment Report (STAR)	DoD Instruction 5000.02 DoD Directive 5105.21
Systems Engineering Plan	DoD Instruction 5000.02
Technology Readiness Assessment	DoD Instruction 5000.02
Test and Evaluation Master Plan	DoD Instruction 5000.02

Appendix E: Statutory Requirements for Milestone C

INFORMATION REQUIRED FOR MILESTONE C	APPLICABLE STATUTE, POLICY, AND OTHER REFERENCES
Acquisition Program Baseline (APB)	Section 2435 of title 10, U.S.C.
Analysis of Alternatives	Subtitle III of title 40, U.S.C. Section 2366a of title 10, U.S.C.
Benefit Analysis and Determination (applicable to bundled acquisitions only if no MS B)) (part of Acquisition Strategy)	Paragraph (e) of Section 644 of title 15, U.S.C.
Clinger-Cohen Act (CCA) Compliance (All IT–including National Security Systems (NSS))	Subtitle III of title 40, U.S.C.
Competition Analysis (Depot-level Maintenance $3M rule) (part of Acquisition Strategy) (If No MS B)	Section 2469 of title 10, U.S.C.
Consideration of Technology Issues	Paragraph (b)(5) of Section 2364 of Title 10, U.S.C.
Cooperative Opportunities (part of Acquisition Strategy)	Paragraph (e) of Section 2350a of title 10, U.S.C.
Core Logistics Analysis/Source of Repair Analysis (part of Acquisition Strategy)	Section 2464 of title 10, U.S.C. Section 2466 of title 10, U.S.C.
Data Management Strategy	Section 2320 of title 10, U.S.C.

Independent Cost Estimate (ICE)	Section 2434 of title 10, U.S.C.
Industrial Base Capabilities Considerations (part of Acquisition Strategy)	Section 2440 of title 10, U.S.C.
Manpower Estimate (reviewed by the office of the Under Secretary of Defense for Personnel and Readiness)	Section 2434 of title 10, U.S.C.
Milestone Decision Authority Program Certification (If Program Initiation)	Section 2366a of title 10, U.S.C. Section 2366b of title 10, U.S.C. DoD Instruction 5000.02
Military Equipment Valuation (part of Acquisition Strategy)	Public Law 101-576 Statement of Federal Financial Accounting Standards No. 6
Programmatic Environmental, Safety and Occupational Health Evaluation (PESHE) (Including National Environmental Policy Act (NEPA) / Executive Order (E.O.) 12114 Compliance Schedule)	Sections 4321-4347 of title 42, U.S.C. E.O. 12114
Submission of a DD Form 1494 and Certification of Spectrum Support (applicable to all systems/equipment that use the electromagnetic spectrum while operating in the U.S. and its possessions)	Sections 305 and 901-904 of title 47, U.S.C. Section 104 of Public Law 102-538 Part 2 of OMB Circular A-11

Appendix F: Regulatory Requirements for Milestone C

INFORMATION REQUIRED FOR MILESTONE C	APPLICABLE REGULATION, POLICY, AND OTHER REFERENCES
Acquisition Decision Memorandum	DoD Instruction 5000.02
Acquisition Information Assurance Strategy (All IT–including National Security Systems (NSS))	DoD Instruction 8580.1 DoD Instruction 5000.02
Acquisition Strategy	DoD Instruction 5000.02
Affordability Assessment	DoD Instruction 5000.02
Capability Development Document	CJCS Instruction 3170.01
Chief Information Officer Confirmation of CCA Compliance	DoD Instruction 5000.02
Corrosion Plan	DoD Instruction 5000.67 DoD Instruction 5000.02
Cost Analysis Requirements Description (CARD)	DoD Instruction 5000.02
Defense Acquisition Executive Summary	DoD Instruction 5000.02
DoD Component Cost Estimate	DoD Instruction 5000.02
Exit Criteria	DoD Instruction 5000.02
Independent Technology Readiness Assessment	DoD Instruction 5000.02

(if required by the office of the Director, Defense Research and Engineering)	
Information Support Plan (ISP) (All IT–including NSS)	DoD Directive 4630.05 DoD Instruction 4630.8
Initial Capabilities Document	CJCS Instruction 3170.01
Item Unique Identification Implementation Plan	DoD Instruction 8320.04
Life-Cycle Signature Support Plan	DoD Directive 5250.01
Life-Cycle Sustainment Plan (part of Acquisition Strategy)	DoD Instruction 5000.02
Net-Centric Data Strategy (Approach detailed in ISP)	DoD Directive 8320.02
Operational Test Agency Report of Operational Test and Evaluation Results	DoD Instruction 5000.02
Preliminary Design Review Report	DoD Instruction 5000.02
Program Protection Plan (for programs with critical program information) (includes Anti-Tamper Annex) (also summarized in the Acquisition Strategy)	DoD Instruction 5200.39
Spectrum Supportability Determination (applicable to all systems/equipment that use the electromagnetic spectrum in the U.S. and in other host nations)	DoD Directive 4650.1

System Threat Assessment Report (STAR) - validated by Defense Intelligence Agency (DIA) for ACAT ID programs) - validated by DoD Components for ACAT IC programs - Programs on the DOT&E Oversight List require a STAR regardless of ACAT designation	DoD Instruction 5000.02 DoD Directive 5105.21 DIA Directive 5000.200 DIA Instruction 5000.002
Systems Engineering Plan	DoD Instruction 5000.02
Technology Readiness Assessment	DoD Instruction 5000.02
Test and Evaluation Master Plan	DoD Instruction 5000.02

Appendix G: Questionnaire

SAF/ACPO & The Center for Reengineering & Enabling Technology (CRET)

FROM: SAF/ACPO- CRET

SUBJECT: Acquisition Knowledge Based Decision Support (AKBDS)

REF: SAF/AQX Memo dated 18 Mar 09

SAF/AQ is addressing key findings from GAO-08-467SP "Defense Acquisitions, Assessments of Selected Weapon Programs" which calls for DoD elements to develop an improved and consistent knowledge-based decision making approach within the acquisition community.

A team led by the CRET has been established to review and validate these GAO findings and improve the fidelity of acquisition decision making within SAF/AQ by developing and executing a disciplined knowledge-based approach for making key acquisition decisions.

The OPR for this effort is Mr. John Coakley SAF/ACPO (**John.Coakley@pentagon.af.mil**). He can be directly contacted at (703) 253-5617. CRET contacts: Mr. Anthony Caruso (**acaruso@dsdlabs.com**) or Mr. Steve Felosa (**sfelosa@dsdlabs.com**). Both can be directly contacted at 304-842-9870. Please direct questions to the above individuals.

As POC for your organization, our team needs collaborate with you on an initial 45 - 60 minute teleconference prior to 22 April 09. **Please respond with your preference on date and time.** We are looking for your support to assist the AKBDS team in documenting your organization's actions supporting key decisions and how you report those decisions. This will help us define and record the current decision making process. Capturing this data will provide the foundation of a disciplined, knowledge-based approach for decision making and information sharing. Assistance for this phase of the effort will include participation in the form of surveys, teleconferences, and minimal face-to-face meetings through June 2009.

The purpose of these desired collaborative interactions are two-fold:

(1) To identify the decision products that your organization creates and submits to a customer. This customer then uses the product(s) as the basis or a tool in an Acquisition Decision (Review, Event, etc.).

(2) To identify the decision products that your organization receives from another organization. Your organization then uses the product(s) as a tool for the basis of an Acquisition Decision (Review, Event, etc.).

To help us in our discussions – the below questions are areas we would like to discuss with you:

- **Does your organization have any ongoing initiatives that address GAO findings? If so, what is the initiative and what is its purpose?**

- **What major decision product(s) does your organization create?** *(A decision product is defined as any object (report, review, plan, document package, database update, etc.) that is used to make an Acquisition Decision. These items include Budget Execution Documentation, Justification Documents, Monthly Acquisition Reports, etc. Items that we are not looking to identify are BURPS, Weekly Reports, Org Status Reports, etc.)*
- **Who are the customer(s) of these decision product(s)?**
- **What decision product(s) do you receive?**
- **What are the source(s) or supplier(s) of these products?**
- **What feedback does your organization receive from your customer(s)?**
- **What feedback does/would your organization give to your suppliers(s)?**

- **What acquisition decision(s) does your customer(s) make relative to the decision product(s) your organization provides to them?** *(An Acquisition Decision is an event that yields an outcome that has an impact on another organization or ACAT designated program within the Acquisition Lifecycle).*
- **What acquisition decision(s) does your organization make relative to the decision product(s)?**
- **What is the intent of the decision product? Does the decision product meet its intended purpose?**

- **What information products do you believe that your organization should receive (missing information) that would improve your acquisition decision making process?**
- **What information products does your organization receive that are non-value added in the acquisition decision making process?**
- **What Regulations and Policies require that your organization creates these products?**
- **Do you use an IT System to create/retrieve a decision product? If so, what is its name?**

2

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Vita

Clifton Hicks was born in El Dorado, Arkansas. He graduated from Union High School in 1993 and entered undergraduate studies at Southern University – Baton Rouge, LA. He earned a Bachelor of Science degree in Mathematics from the university and was commissioned through the Reserve Officer Training Corps, Detachment 310, Louisiana State University, in May 1997.

His first assignment was to Arnold Engineering Development Center, Arnold AFB, Tennessee. While there, he served as the Operations Manager in the maintenance engineering section. His next assignment was to Grambling State University, where he served as the Commandant of Cadets and Recruiting Officer for AFROTC Detachment 311. In 2003, he transitioned to Wright Patterson AFB, where he as a project manager for B-1 Systems Group at Aeronautical Systems Center (ASC), Wright Patterson AFB. He also served as a PEO Action Officer for the Long Range Strike Systems Wing in the ASC Commanders Action Group.

In August 2005, he entered the Research and Development Management Program, Graduate School of Engineering and Management, Air Force Institute of Technology. Following graduation, Major Hicks joined the Office of the Assistant Secretary of the Air Force for Acquisition (Acquisition Integration) at the Pentagon.

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14. ABSTRACT

Despite many reform efforts over the past 30 years, the Department of Defense (DoD) acquisition programs continue to experience cost overruns and schedule delays. One contributing factor is the decisions made by defense officials. The General Accounting Office (GAO) has stated that 'poor program outcomes are the lack of widespread adoption of a knowledge-based acquisition process within DoD despite polices that support such a process. A knowledge-based business case at the outset of each program would alleviate overpromising on cost, schedule, and performance and would empower program managers.'

Decision-making for acquisition programs is very important. The decisions made not only affect the performance of a program, but also could impact the lives of our Airman, Soldiers, Sailors, and Marines, who protect our country. Analyzing the decision support products is one method to improve the knowledge that is used to make decisions. The scope of this research focuses on knowledge products supporting decisions made by DoD acquisition officials and their alignment with best practices and their usefulness to decision-makers.

This research concluded that decision support improvements are needed in the several knowledge support areas.

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