AIR FORCE PROJECT RISK MANAGEMENT – THE IMPACT OF INCONSISTENT PROCESSES

THESIS

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Abstract

On the surface, the majority of Air Force units appear to be executing some form of project risk management (PRM). Deeper investigation exposes many of the PRM practices currently in place to often be ad hoc, and as such, have the potential to poorly inform decisions when risk data is escalated to the enterprise levels of the Air Force. Resultantly, there is inconsistency between the PRM processes practiced by Air Force units. This inconsistency is an indication of risk mishandling at the project level and erroneous risk data provided at the enterprise levels of the Air Force. It may be the case that PRM process inconsistency could be attributed to ambiguous direction, cognitive biases, flawed practices, and inadequate tools. To investigate whether this is the case, a pool of twenty subjects who represented a wide slice of Air Force acquisitions personnel were interviewed to provide insight to the underlying phenomenon causing inconsistent and deficient Air Force PRM. Specifically, the data collected was sorted and analyzed for trends and patterns concerning current Air Force PRM practices. The information from the research study can be used as a launch point to focus corrective efforts and changes on the sources of the problems identified.

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Eric J. Perez

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AIR FORCE PROJECT RISK MANAGEMENT INCONSISTENCY AND POTENTIAL SOLUTIONS

I. Introduction

Background

The study of project risk management (PRM) is a mainstay within the mandatory educational framework studied by Air Force acquisitions officers. As an Air Force acquisitions officer, the author has received Air Force PRM training and has been directly involved with practicing PRM within multiple Air Force programs. On a basic level, the practice of PRM is akin to a person's innate instinct to avoid pain and seek pleasure. Comparatively, with regard to decisions within project development, people instinctively seek to mitigate the impact of risks and capitalize on opportunities to obtain organizational success. However, upon further study, it became evident to the author that complex Air Force acquisitions programs necessitate a proactive and structured approach to risk management. If implemented properly, PRM becomes the backbone for decision-making and uncertainty management.

Per firsthand observations made by the author in the Air Force acquisitions environment, the subject of this thesis is concerned with ineffective Air Force PRM. Specifically, if PRM practices at the project level are inconsistent, then subsequent macro or enterprise level decisions will be misinformed. It is likely that PRM processes are inconsistently practiced by units in the Air Force because of ambiguous direction, cognitive biases, flawed practices, and inadequate tools; this would be evidence of project risk mishandling and leads to misinformed decisions at the Air Force enterprise levels.

Problem Statement

As with any process, there is a natural evolution of refinement between initial implementation and a state of optimum performance. PRM in the Air Force is not an exception, and continuous assessment must be made to either maintain or achieve an optimum state of performance. Analysts at the RAND Arroyo Center for research and development established a simple approach to controlling the maturation of a process, referred to as velocity management, which has been adopted and proven successful for the U.S. Government (RAND, 2001). Simply put, velocity management is a method that iteratively defines a process and then uses measurements of performance to drive process improvement. PRM in the Air Force must be similarly scrutinized. A "measurement" of current Air Force PRM performance may substantiate the author's observations of poor Air Force PRM performance and assumptions that inconsistencies are to blame. Regardless of whether the author's assumptions are validated or not, a study to evaluate Air Force PRM and the resulting data will be essential to improving a process that is critical to the decisions made at the enterprise level. To this end, the study will investigate the assumption that the root cause for the observed lack of PRM effectiveness is the combinatory effect of several factors. These factors are articulated below.

Ambiguous Direction. Although there seems to be a general basic understanding of an Air Force PRM concept, divergence is evident in multiple crucial areas. Because the Air Force has a uniquely high rate of military leadership turnover and often integrates many different personnel types together to form acquisition teams, there exists a diverse set of professional backgrounds. Diversity has the potential to bring innovation and knowledge to project development, but it can also fragment concepts like PRM where congruency is needed. For instance, an integrated product team (IPT) can consist of active-duty military, government civilian, and contractor representatives who may all have a different source of training and directives for the execution of PRM. Officially published guidance and documentation can be used to normalize a single framework for conducting PRM in Air Force acquisitions.

Although the Air Force does have publications that direct and guide PRM, their combined ambiguity makes them a weak point of leverage. As will be argued by the author, debates regarding how Air Force PRM publications should be interpreted are not uncommon. Additional sources of instruction extraneous to the Air Force, often sponsored by contractors, add to the ambiguity and can completely sideline Government directives. A lack of clear Air Force PRM guidance and instruction leads to a varying array of PRM methods and practices across the Air Force; those with the strongest voice for a particular PRM method usually prevail. Stakeholders are averse to inconsistent and debatable processes, and the concept of PRM is blamed instead of the cause. As such, stakeholder confidence and buy-in must be achieved before a process can flourish.

Biases. Because PRM is not a definitive process, but instead is one that is based on subjective estimation, there exists susceptibility to various inconspicuous influences. For clarity and insight into the underlying phenomenon, it is effective to categorize influences into witting and unwitting biases. A witting bias in terms of its effect on PRM includes risk assessment data that is skewed in order to fulfill an agenda other than the pursuit of accuracy. For instance, reporting high risks will most often equate to time-consuming oversight and micromanagement that doubly becomes a risk in and of itself. It is the author's experience that a program manager who is already under pressure to meet cost, schedule, and performance restraints will be inclined to project the least risk as possible. Another example comes as the result of a lack of buy-in to the process altogether. Often referred to as pencil whipping, risk managers may be inclined to make risk estimations with little to no effort given towards achieving accuracy. With no concern for accuracy, there are probably no reservations in skewing the data to report favorably. Though the examples provided seem alarming and deceptive, the author has witnessed unwitting bias to be the most prominent and detrimental to PRM accuracy.

Groups, teams, even whole organizations are susceptible to falling under the spell of group behavioral patterns without being aware. When working together, a group of individuals can increasingly diverge from rationality until an outsider or hindsight bears truth to their reality. A common example of this trend is called groupthink, which is defined as the tendency for group members toward converging opinions about the adoption of a certain course of action in a given decision situation (Janis, 1972). The author has experienced firsthand how a group can collectively allow agreeability to overpower rationality for several reasons, such as the persuasion of strong personalities, tendency to have an overly optimistic outlook, and an apathetic desperation for resolve. The logical outcome of groupthink is that undetected influences caused by a behavioral phenomenon tend to proliferate until little to no one is left to see the error.

Human behavior will persist to affect the good judgment of any Air Force team working towards a common goal. The practice of PRM is especially susceptible, because predicting the future is highly subjective, erroneous patterns of reason are not definitively evident.

Flawed Practices. Air Force PRM, just like any other process, always has potential to improve. The concern should not be whether or not the process is currently perfect. Instead, the concern should be aligned with the pursuit of perfection through strategic change. On one hand, it is the author's opinion that the Air Force practices that are consistent have grown stale and unimproved despite identified deficiencies. On the other, the practices that may be effective are not consistently used and therefore do not contribute to an enterprise level assessment. The author has gained insight into how competing companies proposed to conduct PRM in collaboration with the Air Force. One of three approaches to PRM were characteristically submitted for consideration by various companies include the following: a) PRM practices proposed were different than Air Force practices and deemed by the source selection team as better; b) PRM practices proposed were the same as Air Force practices, and; c) PRM practices were different than Air Force practices and deemed by the source selection team as better and a method to mesh with standardized Air Force PRM was provided. In essence, the Air Force is falling behind industry best practices despite having previously set the benchmark for PRM. This is especially ironic when one considers that in earlier years, Air Force missions to spearhead complex programs like space access and missile defense necessitated effective systems engineering which devolved a keen focus on PRM.

There are, however, organizations within the Air Force that are going beyond the current stagnant standards and pursuing homegrown best practices. Most commonly, the author has observed nonstandard PRM practices to be the result of and influenced by the multitude of Air Force industry partners involved with any given program. The pursuit to improve and learn from others is undoubtedly a step in the right direction. However, a multitude of different influences results in a multitude of different processes that ultimately forms fragmented data when aggregated for an enterprise level assessment.

Inadequate Tools. In the pursuit of global superiority, the U.S. Air Force involves itself with new and complex acquisitions and development. The consequent risk and management of that risk is equally as complicated and therefore necessitates tools to augment the process. Having worked directly in the field of study, the author is only aware of one tool used by the Air Force, Active Risk Manager (ARM), and is described by the Space and Missile Systems Center Risk Management Process Guide as, "The Air Forces current standard tool to manage program risks" (Conrow 2014, p. 25). The inadequacy is not due to there being only one tool observed since ARM strives to be a suite of tools. Rather, it is the suitability of ARM that seems to be lacking.

Lack of suitability observed by the author, is evidenced directly by its limited to virtually non-existent use at the CGO level when working on multiple complex, high-risk, critical Air Force systems. More specifically, there was non-availability of ARM to those involved with PRM at the CGO level and a lack of features designed to manage risks as opposed to just reporting. An analysis of risk management tools described ARM as an expensive, standalone system with limited and awkward interfaces (Langbein, 2005). It is possible that the high cost of licensing contributes to the non-availability of ARM at the CGO level. Consequently, the needs of the limited group using ARM at the executive level might be driving utility design to favor the ability to report risks rather than manage them. Furthermore, the complexity of the tool itself is overbearing when considering the workload of a systems engineer or program manager at the CGO level. Though very capable, ARM is better suited for a dedicated PRM SME, which is a position rarely available. Negatives aside, ARM is an excellent starting point to develop a less complex and more affordable add-in that lends itself to PRM at the CGO level.

In order to increase PRM effectiveness in the Air Force, deficiencies with the current processes must be first be identified and then studied. The assumptions made thus far about the contributors to the observed PRM deficiencies will be investigated in terms of a set of questions. In this effort, the following five questions will serve as the framework for this thesis:

- Is project risk management (PRM) inconsistently practiced in the U.S. Air Force?
- What parts of the PRM processes across the Air Force tend to be inconsistent?
- How do inconsistencies in Air Force PRM processes lead to inaccurate risk assessments?
- How do inconsistent PRM assessments impact executive RM?
- What contributes to Air Force PRM inconsistencies?
- What steps can be taken to address contributors to inconsistent PRM across the Air Force?

Research Methodology

There are multiple variables that shape the PRM practices used in the Air Force; the method used to identify what contributes to the PRM inconsistencies observed must account for this complex environment. For example, the author suspects that the most insight will come from investigating PRM practices, DoD directives, organizational philosophy, and mission characteristics. However, limiting the scope of the investigation may miss key data. The literature and author’s experiences on PRM inconsistencies will drive initial assumptions and a starting point for an explanation, but the research method used by this study must impartially seek a full and complete answer from the field of study. To that end, this project will use a qualitative grounded theory methodology to collect and analyze interview data from a number of research subjects.

The initial information found in the literature review will be combined with the findings from the research data that will be analyzed for contributors to PRM inconsistency and the extent of their impact. To do so, the grounded theory research method used in this project must take data from multiple sources, be amiable to new data, and be able to assess validity. All considering, a qualitative data gathering technique by way of interviewing experts involved with Air Force acquisitions will be best suited to discover the underlying phenomenon that leads to inconsistent PRM.

The interviews conducted must elicit the data needed to identify all and any contributors to Air force PRM inconsistency through strategic questioning techniques and interviewing style. The interview question set, also termed a schedule, will be semi-structured. In other words, the schedule will consist of questions inspired by the author's initial observations and findings in the relevant literature while also assuming an open-ended format to allow respondents to lead into discussions beyond the initial assumptions. Ideally, interviews will be conducted in person but when not possible, communication via telephone may be necessary to reach key subject matter experts (SME). Building rapport is one approach that will be used to elicit valid information from subjects and is assumed by the author to be easier achieved in person versus telephone communication. However, the subjects slated for interviewing will be able to relate to the author in terms of Air Force camaraderie, the acquisitions profession, and the specific rigors of PRM deficiencies. Commonalities in this regard are advantageous in building rapport and will work to overcome any lack of in-person availability. When a sufficient amount of raw data is collected, it will be processed and analyzed for validity and consistency.

Processing raw data from the interviews will require an analytical approach to uncover themes that explain PRM inconsistency. Namely, the approach that will be used is termed grounded theory, in which case the initial explanation derived from the author's experiences and review of the literature will be compared to the data collected from the field of study for a more complete answer. This approach is interested in the aspect of the problem as it relates to project risk management teams and the processes and tools they are bound to. The complexity experienced by the author in Air Force acquisitions is predicted to translate through to the responses received in the interviews. Once themes are developed from the data, the themes may contradict or further bolster the author's initial explanation. Regardless, the risk of bias will be acknowledged and emphasis will be placed on validating the data for the most accurate and complete depiction of the underlying phenomenon as possible.

Assumptions/Limitations

The subjective nature of PRM and qualitative research leaves potential for bias and differing interpretations by the subjects interviewed and by the researcher. By design, semi-structured interviews and open-ended questioning gives free reign for subjects to express their views. While doing so gives an opportunity for new ideas to be generated, there is also a greater potential for bias. To identify and correct for bias, it will be important to consider the backgrounds and points of view of the subjects interviewed. All things considered, it is important to note that the researcher is not immune to the same bias and must also refrain from being influenced by the subjects interviewed. The researcher must endeavor to achieve an objective assessment of the data. In addition to correcting for bias, the researcher must contend with interpreting differing interpretations provided by the subjects interviewed. In other words, there is the potential that accounts perceived to be different are in actuality converging on the same phenomenon. That said, sifting through interview data and identifying themes from the conjecture is central to forming an accurate explanation for the inconsistent PRM observed.

To effectively and thoroughly search for relevant themes within the data, the data collected from interviews must be as complete as possible. The researcher must consider that the same bias proposed as a contributor to inconsistent PRM also has the potential to take affect during the interview process. In short, the subjects being interviewed may be inclined to skew or retain data that would adversely affect their project, reputation, and/or organization. In anticipation of this, the subjects slated for interview will be informed that all identifiers will be deleted from the data, and pseudonyms will be used. In addition, many of the SMEs available to the researcher for in-person interviews will come from classified programs and backgrounds who will be unable to divulge, or even acknowledge, information that might be germane to the research study. Although the data needed is expected to be unrelated to classified information, subjects will be reminded not to disclose classified information.

Implication

If executed consistently, PRM has the potential to be the backbone for all critical decision making across the Air Force. Short of full potential, the author has made observations working directly in the Air Force acquisitions field that evidence PRM deficiencies. In order to form a plan for improvement, deficiencies have to first be identified and confirmed. If articulated clearly and thoroughly grounded by SMEs directly in the field of study, the research results outlined in this thesis should influence change. Subsequently, the proposed solution and recommendations for further study will be a starting point for Air Force leadership to build a plan for improvement.

II. Literature Review

Chapter Overview

To develop a solution that requires change, it is crucial to first identify and understand where you are to determine how to get to where you want to be. To this end, it must be stated that the author has observed multiple organizational changes within the Air Force as reactionary and aimless instead of grounded in facts and due process. Indeed, creating a change strategy that achieves the intended effects begins with understanding the root cause(s) of problems with the current process. Working directly in the field of study, the author suspects that the cause for inconsistent PRM across the Air Force can be attributed to ambiguous direction, biases, flawed practices, and inadequate tools. Further investigation must be done to sufficiently explain the lack of consistency observed. To this end, literature will be reviewed to gain further insight to the observations made and to discover any new data that might provide further explanation. Leveraging valid literature germane to Air Force PRM deficiencies will be critical to the development of a viable solution for change.

In order to identify what drives the current Air Force PRM processes, it is necessary to consider DoD and USAF direction on the matter by examining corresponding publications. This is a natural starting point since compliance with such documentation is a common understanding and expectation in the USAF. That said, attempts at compliance with USAF documents do not imply the publications are necessarily followed or they can be intuitively followed. From the results of an extensive study that assessed the PRM practices applied to 127 various projects, Raz, Shenhar, &

Dvir found that RM practices are in their infancy with room to grow (2002). Concurrently, the improvement of PRM practices is contingent on the improvement of USAF RM publications. However, the abundance and recent proliferation of publications mandating PRM implementation evidences a bona-fide need. As an example, a company grade officer (CGO) in the USAF is subjected to the direction of seven official publications, each of which attempt to set the standard for risk management practices (AF Policy Directive 90-9, AFI 90-901, AFMC Instruction 90-902, AFMC Pamphlet 63-101, DoD 5000.2-R, Air Force Pamphlet 63-128, Air Force Instruction 90-802). Local policy and guidance set by a CGO's immediate organization and different sources of training and education encouraged by the Air Force additionally adds to the magnitude of guidance to be followed.

Beyond USAF publications, the literature reveals many sources which address factors that influence the effectiveness of RM to achieve the best course of action. An increasing number of case studies are emerging that purport RM has resulted in success and a lack of RM has led to poor results. Consequently, the lessons learned from the case studies are bolstering support and growth of USAF RM. Yet at first consideration, the title of "risk management" could lead some to assume a narrow scope. On the contrary, an increasing number of organizations are realizing the value of RM as a disciplined method to make decisions and consider opportunity trade-offs. The increasing momentum behind USAF RM provides an opportunity to identify causes of RM ineffectiveness and fine-tune RM processes.

Risk Management Concepts

When considering only the literal meaning of the term, *risk management,* it could be assumed RM is a practice strictly involving the management of a ‘‘hazard, chance of bad consequences, loss, exposure to chance of injury or loss’’ (Concise Oxford Dictionary, 2011). However, further investigation reveals a broader interpretation. For instance, the UK Association for Project Management (APM) describes risk, as it applies to RM, as “an uncertain event or set of circumstances that, should it occur, will have an effect on the achievement of the project’s objectives (APM Risk Management Specific Interest Group 2010, p. 16).” Similarly, the US Project Management Institute (PMI) describes RM as “an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective” (Nicholas & Steyn 2012, p. 127). At a basic level, risk management definitions upheld by their respective sources as cardinal tend to converge on a singular definition, but diverge in terms of process and technique. For instance, while the APM and PMI definitions give leeway to account for opportunity, Air Force Pamphlet (AFP) 63-128 only considers the negative aspect of RM when defining a risk as “a future event that, if it occurs, may cause a negative outcome or an execution failure in a program within defined performance, schedule, and cost constraints” (Secretary of the Air Force 2014, p. 84). The Space and Missile Systems Center (SMC) Risk Management Process Guide cites the risk definition from AFP 63-128 and additionally encourages consideration of potential opportunities but does not acknowledged opportunity as the reciprocal of RM (Conrow, 2007). Similarly, Kahneman and Tversky (1979) support the notion that consideration of opportunity is not necessarily the “dual, mirror, or mirror image of risk” (p. 17).

Sources consistently describe the main elements of RM as the consideration of a future event that has a potential probability and impact. The Department of Defense Risk Management Guide for Defense Acquisition Programs best captures the most representative definition of RM as

> future uncertainties relating to achieving program technical performance goals within defined cost and schedule constraints. Defined by (1) the probability of an undesired event or condition and (2) the consequences, impact, or severity of the undesired event, were it to occur (Deputy Assistant Secretary of Defense for Systems Engineering 2014, p. 3).

On the other hand, an issue or crisis refers to an occurrence in the present tense or a risk that has been realized (Deputy Assistant Secretary of Defense for Systems Engineering, 2014). In contrast, the AFP 63-128 stands apart from the rest of the literature as it does not differentiate between an issue and problem, stating that, “an issue has a likelihood (probability)=1, consequence (impact) > 0, and a past, present, or future time frame” (Secretary of the Air Force 2014, p. 85).

As concepts and practices move beyond the basic elements and become more detailed, it is necessary to specify the type and application of the risk being referenced. This specification is necessary because there exist several types of RM based on application. The Defense Systems Management College[1] (DSMC) RM Guide for DoD Acquisitions observed that, “the Services differ in their approaches to Risk Management. Each approach has its strengths but no one approach is comprehensive” (Defense Acquisitions University 2001, p. 3). In regards to Air Force risk management, there are

[1] Co-located with DAU Headquarters at Fort Belvoir, Virginia, the Defense Systems Management College (DSMC) is chartered to provide education for the DoD Acquisition, Technology & Logistics (AT&L) workforce across the globe.

three distinct classifications observed within the extant literature: Health (ESOH)/Air Force Occupational Safety & Health (AFOSH), Operational Risk Management (ORM), and Project Risk Management (PRM). Furthermore, Air Force PRM can be considered a level that is intended to populate the DoD enterprise or macro risk management level. The literature does not specifically differentiate between a distinct project PRM level and an Enterprise RM level; however, a hierarchal existence of these levels is implied. As such, the focus of this thesis will be on Air Force PRM and its impact on DoD enterprise risk management.

Air Force PRM applies to the cradle-to-grave development of a project. The Challenger disaster drove rigor in process based risk analysis which began to emerge formally in the early 1990's (Altabbakh, Murray, Grantham, & Damle, 2013). The majority of AF publications on the topic of PRM are consistent in describing an iterative RM process. Specifically, DoD 5000.2R captures the most representative list of the RM process steps in order as "planning, assessment (identification and analysis), handling, and monitoring" (Under Secretary of Defense 2001, p. 71). It is common to encounter terminology inconsistencies between publications, and it is the case that these inconsistencies ultimately lead to office debates. The DoD 5000.2R attempts to account for this by noting how risk identification and analysis should be included in the assessment phase. Indeed, Air Force Pamphlet (AFP) 63-128 identifies the same process as DoD 5000.2R but clarifies ambiguity surrounding the risk-handling step when stating that

> the Life Cycle Risk Management (LCRM) process model expands the title of this step from "Risk Mitigation Planning" in the Risk Management Guide for DoD Acquisition to "Risk Handling Planning and Implementation" to recognize that

> most of these options address handling risk in a manner other than mitigating (i.e. eliminating or reducing) it (Secretary of the Air Force 2014, 84).

The Space and Missile Center (SMC) Risk Management Process Guide also aligns with AFP 63-128 by directly citing the pamphlet for its own definition (Conrow 2014, p. 10). The educational textbook titled *Project Management for Engineering, Business and Technology* from PMI's Project Management Body of Knowledge (PMBOK), a benchmark for the DoD and industry, describes a very different version of the RM process as, "identify, assess, plan risk response, and track and control" (Nicholas & Steyn, 2012).

Within the LCRM process, the risk-handling step provides an opportunity to take action towards limiting the effects of the identified risk. The literature consistently describes risk-handling as a set of options, yet the literature differs on the options listed. One representation of the majority of the literature regarding risk handling comes from the Air Force Pamphlet 63-128 which lists the risk handling options as "accepting, monitoring, transferring, mitigating (or controlling), and avoiding" (Secretary of the Air Force 2014, p. 84). The pamphlet clarifies a common point of ambiguity in terminology by identifying that controlling a risk is synonymous with mitigating a risk. In contrast, AFMC Pamphlet 63-101 lists changing the program as an option that is preferable to risk avoidance, risk acceptance and risk assumption (Sawdy, 1997). On the other hand, PMI PMBOK encourages risk reduction instead of risk mitigation and adds contingency planning as an option (Nicholas & Steyn, 2012). The inconsistencies between said publications lead to ambiguity and confusion for those responsible for project risk management in the United States Air Force.

Evolving Need for Air Force Risk Management

To a degree, the claim could be made that managing risk is already an intuitive part of life. RM is implemented several times a day without thinking of it as a formal process (Ourada, 2013). Haussermann (2006) adds that “every time we cook a meal, walk down the street, ride a bike, drive our car, participate in sports, watch television, purchase a product or decide where to live we are choosing the best course of action for a specific given situation” (p. 7). For these simple events, a drawn-out process to conclude the proper course of action is not necessary. However, as the Air Force evolves and becomes more complex, the best decisions about the future become less intuitive.

PMI PMBOK lists the causes for higher project risk complexity as: uniqueness; team inexperience; ambiguous concept of risk and unknowns; use of an unusual approach; developing a system while furthering technology at the same time; developing and testing new equipment systems, or procedures; and operating in an unpredictable or variable environment (Nicholas & Steyn, 2012). It is the author’s experience that these characteristics are indicative of Air Force acquisitions development and necessitates bon-a-fide PRM process rigor. Evidence in alignment with this position can be found in a white paper authored by the Under Secretary of Defense for Acquisition, Technology, and Logistics in 2013 entitled *Better Buying Power 3.0.* This paper emphasized the priority to improve leaders’ ability to understand and mitigate project risk. Specifically, the Under Secretary of Defense states, “successful product development requires understanding and actively managing program risks. Acquisition professionals may debate the best approach for managing risk, but they agree that effective qualitative and quantitative risk, issue, and opportunity management are critical to a program's success" (Kendall 2013, p. 31).

There are also case studies revealing a trend that lack of risk management often leads to disaster. One of the most notable cases as it relates to space operations and the Air Force is the January 1986 explosion of the Space Shuttle Challenger 73 seconds after liftoff (Altabbakh et al., 2013). Though unfortunate, these events drove the adherence and refinement of PRM. With growing acceptance of RM as a value added discipline, RM has emerged as a popular subject area in acquisitions academia. Various recognized institutions and RM experts introduced forms of project risk management: examples include the work of Boehm (1991), Fairley (1994), Dorofee et al. (1996), the Project Management Institute (PMI, 1996), Kliem and Ludin (1997) and Chapman and Ward (1997). One notable example is found in the work of Couillard (1995) who investigated different project management approaches with the objective of reducing the influence of risk and increasing the likelihood of project success. Ward (1999) also studied how project context and participant characteristics influence implementation of project risk management processes. Shenhar and Dvir (1996) proposed a typological theory of projects based on two dimensions: technological uncertainty and system scope (or complexity). These efforts to formalize and refine RM practices by the aforementioned authors are a sign of improvement as well as necessary first steps. However, the stove-piped creation of direction and guidance by various entities has led to inconsistency even though improvement has and continues to be made. That said, instruction and guidance available to Air Force Company Grade Officers is currently ambiguous and fragmented.

Air Force Project Risk Management Guidance and Directives

As a company grade officer in the United States Air Force, this author has been required to provide risk management on numerous projects and has wrestled with identifying a comprehensive location and source for risk management guidance and instruction. The Defense Acquisition University community of practice (CoP)[2] strives to "provide the Risk Community with a Risk Management-focused website and companion-linked DoD/DAU Risk Guidebook that is the first source to which a novice or experienced practitioner will go to get answers and obtain a pulse on the state of Risk Management" (COP Risk Management Section Editor; need CAC to find). The CoP makes a valid attempt to consolidate RM data, but only succeeds in reiterating ambiguity created by redundant DoD and USAF publications. Another website, touted just as official as the Defense Acquisition University's COP website, is Acqnotes[3]. AcqNotes attempts to categorize the relative DoD Risk Management documentation into categories of instruction, manuals, directives, and guidance, but does not specify which particular set of documents trumps which or is most relevant where overlap occurs.

The DSMC sponsored a working-group that investigated RM Policy in the DoD and determined that RM policy contained in the DoDD 5000.1 is "not comprehensive and structured approaches, when they exist, are similar to the DoD's approach to Risk Management" (Defense Acquisition University 2001, p. 3). The working-group also recommended that "techniques in the DoD 5000.2-R be expanded, using the Defense Acquisition Desk-book as the expansion means, in order to provide comprehensive

[2] This document can be retrieved from https://acc.dau.mil/communitybrowser.aspx.

[3] This document can be retrieved from http://acqnotes.com.

guidance for the implementation of risk management policy" (Acquisition University 2001, p. 3). The Defense Acquisition Guidebook (DAG), also referred to as the Desk-book, is consistently recommended as the primary guide for DoD acquisitions and addresses what DoD Risk Management is and how to execute it, as well as an overview on multiple other sets of instruction, manuals, directives, and guidance publications. Contrarily, the Department of Defense Risk Management Guide for Defense Acquisition Programs claims that "program Managers (PM) are responsible for managing risk in accordance with the mandatory requirements contained in the DoD Instruction (DoDI) 5000.02, "Operation of the Defense Acquisition System," and are required to outline their risk management strategy in accordance with the Systems Engineering Plan (SEP) Outline (2011)" (Deputy Assistant Secretary of Defense for Systems Engineering 2014, p. 1). Regardless of how one interprets the recommendations and mandates within the literature, the number of RM frameworks developed contributes to an overall uncertainty regarding the essential components of RM (Lundqvist, 2014).

Although not required, DoD and USAF publications consistently recommend the development of a project or unit level Systems Engineering Plan (SEP) with a section dedicated to RM that defers greater detail to a separate risk management plan (RMP). The SEP and RMP provide an opportunity to interpret the convoluted RM publications and tailor a RM approach that is unique to the organization. Implementing a SEP and RMP also lends itself to a definitive process and consistency at the project or unit level. However, because the unit level RM documents are based on the ambiguous higher-level Air Force publications, there is inconsistency between organizations. The 2012 Acquisition, Technology, and Logistics article by Mercado, Schwartz, and Ivie, supports this view with the observation that, in regards to AF RM, "process inconsistencies were leading to inefficiency and confusion" across the board (p. 22). Bolstering the need for consistency, Haussermann (2006) makes the point in his article that standardization is the most necessary requirement for a successful risk management plan. There are two consequences that result from this inter-organizational inconsistency. First, active duty Air Force CGOs change organizations as often as every two years or at least every four years. Considering the turnover rate, it is inefficient for CGOs to relearn, just as it is inefficient for the organization to reteach unique RM processes at such a frequent rate. Along these same lines, changes will be induced upon the organization receiving the frequent influx of new CGOs who will attempt to impose their previously learned styles of RM. Second, macro level risk management, specifically referred to as enterprise risk management (ERM), will be based on inconsistent comparisons between units, which can lead to erroneous decision-making. Based on these facts, it can be argued that the effectiveness of enterprise risk management relies on consistent unit level PRM where consistency is sensible and necessary. In other words, higher-level PRM guidance must find a balance between mandating the correct amount of restrictiveness to promote enterprise level PRM consistency without restricting units from tailoring their unit-level PRM plans to accommodate unique missions and operations.

Risk Assessment Methods

Accuracy in risk assessment (i.e., identification and analysis) is the bedrock to not only achieving RM consistency between organizations, but also to carry out an effective RMP within an organization. Ideally, using one method for risk assessments would contribute to consistency; however, this approach would be unrealistic considering that every mission and effort is unique. For this reason, there are a multitude of techniques prescribed for AF project RM in the literature ranging from quantitative to qualitative and from simple to complex. As an example, Gilb (2002) outlines a variety of risk assessment tools that lend themselves to complex projects, although the methods described by Snyder and Buede (2000) are more suitable for smaller projects. PMI's PMBOK provides a more encompassing list of nine different approaches by which to assess project risk succeeding in covering all approaches mentioned elsewhere in the literature as well as providing the most thorough instruction (Nicholas & Steyn, 2012).

Despite the number of options proposed, the author has only observed one risk assessment method that is consistently used in the field; this method is commonly referred to as a risk-cube or risk-matrix. Siefert (2007) describes that among the multiple ways developed to track and manage risks, "perhaps the most common method is the use of the ubiquitous, basic "Risk Cube" (p. 18). It is possible that the risk cube approach is common because it intuitively assesses the severity of a risk on the basis of probability and impact between an X and Y-axis. The NASA Systems Engineering Handbook defines this approach similarly as the "5x5 risk matrix methodology," which they go on to describe as a sufficient way to "combine qualitative and semi-quantitative measures of likelihood with similar measures of consequences" (NASA, 2007, p. 46). However, the NASA handbook also warns that there are several drawbacks, including "the fact that combinatorial interactions among multiple risks are not accounted for, the impact of aggregate risks is not addressed, uncertainty quantification is lacking, and general over-simplicity," concluding that the method, "falls short in providing context behind each risk" (NASA, 2007, p. 52). History has shown the consequences of overlooking the aggregate impact of smaller risks. For instance, the chemical plant accident at Bhopal, India was due to 30 separate risks, and the Chernobyl disaster was due to 6 errors that when considered individually were trivial and ignored, but jointly were high impact (Nicholas & Steyn, 2012). In his article *Transforming Project Risk Management into Project Uncertainty Management*, Chapman (2001) also criticizes that the over simplification of risk matrix estimates of impact and associated probability results in unnecessary uncertainty. In alignment with Chapman, Cioaca (2011) further warns that true interpretation of comparisons in a risk matrix must take into consideration the risk attitude and subjective judgments used by those who constructed it. Simply stated, inputs to risk matrices and resulting outputs require subjective interpretation. Resultantly, Cioaca (2011) suggests, "that risk matrices should be used with caution and only with careful explanations of embedded judgment" (p. 81-82). Although the risk cube is popular and commonly considered best practice, "there has been very little empirical evidence from studies showing its actual efficacy in managing risks" (Cox, 2008, p. 497). The DSMC Risk Management Guide for DoD Acquisition (Fourth Edition) suggests that instead of faulting the risk-cube method, individuals should consider that in most cases, "risk scales are actually just raw (uncalibrated) ordinal scales, reflecting only relative standing between scale levels and not actual numerical differences" (Defense Acquisition University 2001, p. 24). Though it may be convenient and simple to blame a method or tool for inconsistency, and though the method or tool used may be a contributor, there exist a deeper root cause. This is because the very essence of risk management is based on predicting the future (which is always difficult at best) and drawing on assumptions that often leave vast opportunity for subjectivity. Indeed, qualitative methods breed subjective inputs and can hardly be avoided, even on the most technical efforts. On the basis of this, it may be the case that the risk-cube exacerbates the inherent subjectivity of RM.

Altabbakh et al. (2013) would argue that risk matrices are not to blame for risk assessment error, as "engineering managers should note that there is no one single perfect model for risk assessment" (p. 24). Rather, whenever there is risk and uncertainty, there is subjectivity. Cargill and Moore (2013) also support this line of thought when noting that

> Bias gets introduced not through flaws in any of the methods but through bias in the assumptions and factors used in the analysis. Thus, we need to delve more deeply into opinion, bias, and subjectivity, and how these factors influence our risk and uncertainty assessments. The pertinent question becomes, what do we need to address this subjectivity? (p. 30)

Subjectivity gives leeway to bias, and a majority of the literature reviewed recognizes bias as the root cause of risk assessment error, and by extension, risk management ineffectiveness. Ultimately, biases can lead to undesired consequences, including inaccurate project estimates (Flyvbjerg, 2006). Specifically, the author has identified twenty-two notable biases outlined by the literature and has sought to provide clarity through categorization based on cause and effect. Among the twenty-two notable biases, two of the most important categories based on cause were cognitive and incentive bias and two of the most important categories based on effect were optimism and pessimism bias.

Cognitive Effects on Risk Management

There is a natural underlying apprehension to risk management. Cargill and Moore (2013) contend that, "under conditions of commitment and optimism for the future, no one likes to recognize risk" (p. 31). General reluctance towards PRM can be only partially overcome by mandating or forcing the endeavor. PRM data and actions will still occur, but a lack of intrinsic motivation will ultimately result in a lack of effectiveness throughout the process; a phenomenon often referred to as, 'trash in, trash out.' Behaviorally, the author has observed a resulting bias to underestimate likelihood and/or impact of risk yielding in overly optimistic assessments. For instance, Cargill and Moore (2013) point out that, "there is a natural tendency to be aggressive with assumptions early in a program to make the program appear attractive" (p. 30). The literature dovetails with the author's career observations that those qualified to assess risk are also team members whose interests are aligned with projecting confidence in project success. Presenting an assessment that conveys that the project is in trouble can lead to cancellation of funds or even a cancellation of the project itself. At a minimum, it will bring unwanted attention in the form management oversight and/or reporting which further taxes the team's resources and energy that should instead be devoted to the actual risks. It would make sense to assume that high-risk attention would result in aid in the form of additional resources and support; however, it is the author's experience that there is little that can be done by external audiences once the high risk has been identified other than exacerbate the risk itself. Baram (2003) captures this phenomenon as impedance to good risk assessment due to "conflict of interest and bias by project managers toward reporting good news" (p. 2). Similarly, many engineers do not want to admit there are any risks associated with the project, and many program managers do not want to present negative aspects of their program to higher management or the customer (Kasperson & Kasperson, 1996). As a result, incentive biases to avoid the pressure and interference from external audiences strategically results in an overly optimistic risk report and ultimately transcends to mishandling risk.

A key bias that has proven detrimental is the failure to recognize and mitigate risks that have a very high impact and a very low probability of occurrence. Pate-Cornell (2015) acknowledge the oversight of this type of risk and refer to it as a black swan or perfect storm. Pate-Cornell (2015) also describes these risks using the same terminology and explains that they are "sometimes dismissed after the fact as having been unimaginable before they happened" (p. 65). There is a cognitive tendency to subconsciously dismiss these risks due to their low probability and a conscious incentive to avoid expending precious resources for the same reason. In fact, Trope, Liberman, and Wakslack (2007) use the term optimism bias to describe this phenomenon and contend that it is evidenced across a broad range of different contexts. For example, people tend to underestimate their likelihood of having a heart attack (Avis, Smith, & McKinlay, 1989), being involved in a car accident (McKenna, Stainer, & Lewis, 1991), being the victim of crime (Perloff & Fetzer, 1986), and having an unwanted pregnancy (Burger & Burns, 1988). Investigations revealed that the siting of the Fukushima Daiichi reactors and a 5.7 magnitude tsunami design criterion was chosen despite the knowledge that earthquakes of magnitude greater than 8 (and the large tidal waves that came with them) had occurred several times in recorded history (Pate-Cornell & Cox, 2014). It could be argued there was another related bias in effect known as a disproportionate weighting of recent events, or in the case of the reactors, a recent lack of earthquake activity (Protiviti, 2014). The biases mentioned, which include weighting of recent events, optimism bias, and failure to acknowledge the probability of a "perfect storm" or "black swan" are related as errors in assessing the evidence at hand.

Similar to the concept of optimism bias is a phenomenon known as the planning fallacy, which refers to overly optimistic performance of the project management team (Buehler, Griffin, & Ross, 1994). The planning fallacy involves the genuine belief that a project or effort will not take as long, cost as much, and/or will produce a better product than what actually comes to fruition. The root cause of the resulting oversight is the underestimation of risk factors that trigger the poor performance. It can be deduced from these facts that planning fallacies contribute to a commonly stated problem throughout the space system design community that severe deficiencies exist within system cost and schedule estimating methodologies (Reeves, Eveleigh, Holzer & Sarkani, 2013).

Cognitive bias, in contrast with incentive based conscious bias, occurs deeper in the subconscious where it can take effect unrealized and is therefore harder to detect and find fault. The literature most commonly attributed cognitive error to groupthink, which is defined as a pattern of thought characterized by self-deception, forced manufacture of consent, and conformity to group values and ethics (Merriam-Webster, 2008). The Air Force Risk Identification, Integration and "illities" Guide notes that with respect to groupthink, the "literature from the field of cognitive psychology generally suggests that people often have difficulty in characterizing the relative risks of various activities appropriately (possibly due to 'group-think'), thereby resulting in underestimation of their effects" (2008, p. 5). Protiviti (2014) more specifically identifies contributors to groupthink such as “not-invented-here bias” and “confirmation bias.” Though not necessarily espoused as often, many other sources framed groupthink as the end result of the many other cognitive biases. This is logical considering that a risk management team would tend to experience the same cognitive bias factors and, thus, be persuaded as a group thereby triggering groupthink as, “conformity to group values and ethics” (Merriam-Webster).

Groupthink is not reported in the literature as definitively favoring an underestimation or overestimation of risk. However, many of the cognitive bias factors that *lead* to groupthink tend to either lead to an underestimation or overestimation of risk. For instance, simply adding more detail to a risk description can make the scenario more vivid and thus more likely when, on the contrary, knowing more detail lowers its probability by definition (Pate-Cornell, 2015). This is reminiscent of the affect heuristic; that is to say, absence of proof is not proof of absence. Pate-Cornell (2015) and Protiviti (2014) also identify a cognitive bias phenomenon, termed as confirmation bias, where evidence is truncated or interpreted in a way that confirms one's preconceptions. Per investigations, confirmation bias was one of the root causes for the 2011 accident in the Fukushima Daiichi nuclear reactor disaster (Pate-Cornell, 2015). Both Pate-Cornell (2015) and Cargill and Moore (2013) agree that anchoring belief bias has proven detrimental as a subset of confirmation bias. Pate-Cornell (2015) identifies the broadest range of biases amongst the literature to include not-invented-here bias, dominate personalities, overreliance on numbers, framing effect, availability heuristic, hindsight, the ostrich effect, getting along and disregard for contrary information. Pate-Cornel

(2015) effectively provides evidence and an understanding for the chaos that cognitive biases induce on risk management.

A bias that is always imminent is the potential to erroneously skew risk handling toward doing too much or too little. Too much risk handling is often sought after as the optimal goal but it does not come without the expense of precious resources and time. Being too conservative with risk handling as a way to conserve precious resources and time can leave a project facing the full brunt of accepting the risks, while doing too much can overtax available resources. The literature alludes to finding the appropriately balanced handling strategy unique to each risk by recommending multiple handling methods; accepting, monitoring, transferring, mitigating (or controlling), and avoiding (Secretary of the Air Force 2014, p. 84). The Department of Defense Regulation 5000.2R directs that the risk handling "strategy shall explain how the risk management effort shall reduce system-level risk to acceptable levels" (p. 27). Nicholas and Steyn (2012) provide an alternate perspective where risk should be accepted only when avoiding, reducing, or transferring exceeds the benefits.

Failure to find this balance due to an error in judgment is minuscule compared to a group, or in many cases, an entire organizational culture that is skewed towards either risk avoidance or risk-taking (Protiviti, 2014). Although the U.S. Air Force is very large, and not every unit and mission is the same, the literature alludes to an overall risk averse culture. For example, Greiner, Dooley, Shunk, and McNutt (2002) launched a comprehensive study that conducted interviews with key members of the multi-functional Air Force Corporate Structure (AFCS) charged with making decisions regarding resource allocation against all Air Force activities, including weapon systems acquisition programs. In response to an open-ended question regarding flaws, AFCS representatives interviewed, 28 percent described a system that seems to be risk averse in nature. This finding suggests that the other 72 percent of those interviewed would consider the system to not be risk adverse in nature.

Although trying to eliminate risk seems like a noble cause, "the prime symptom of "trying to eliminate risk" is micromanagement: excessive controls, unrealistic documentation requirements, and trivial demands for the authorization of everything which can stifle innovation" (Nicholas & Steyn, 4^{th} ed 2012, p. 374). Per Aronstein and Piccirillo (2012), being overly risk averse "forces a company into a plodding, brute force approach to technology, which can be far more costly in the long run than a more adventurous approach where some programs fail but others make significant leaps forward" (p. 79-80). The author has experienced a risk averse culture in the Air Force Space program. Due to the nature of space access, risk management termed mission assurance in the USAF space community should have a lower than average tolerance for risk. However, the notion of mission assurance was taken to such an extreme by upper management that mission cost and schedule overruns were the only outcome assured. Project team members, having direct involvement with the effort, were often best suited to make risk management trade-off decisions but were often overridden by senior management. Thus, a major challenge for an organization implementing ERM is to ensure that senior management decision-making is contingent on business managers throughout the firm and takes proper account of the risk-return tradeoffs (Stulz, 2006).

Risk Management Process Solutions

As identified previously, there is disagreement between sources designated as official Air Force RM publications. There exist websites that attempt to centralize and organize these documents, which admittedly adds convenience for accessing PRM resources, but neither delineates applicability or precedence of overlapping publications. The contradiction found in official Air Force PRM publications is counterproductive to process consistency. Furthermore, the number of risk management publications in other military branches found in contradiction provides an analogous inconsistency at the enterprise level of PRM. The solution may be to comply with Air Force Instruction 33-360 (2013), which states that "all publications must be at least as restrictive as the higher headquarters publication they implement and must not contradict the higher headquarters publication" (p. 42). Subsequently, the next step would be to require industries under government contract to report risks consistent with government assessment measures. Mattice (2013) explains that, "industry shouldn't feel like the forgotten stepchild, however, as government agencies are themselves highly fragmented into what many refer to as "silos of excellence" " (p. 22). It is the author's experience that most companies under a contract with the government implement their own homegrown risk management processes as opposed to attempting to decipher DoD instruction and parallel their practices with the Air Force. This may be effective for the company and the effort they have been contracted for, but it adds yet another layer of inconsistency when consolidated and compared at the enterprise level. Synchronizing government risk management guidance and directives will correct and standardize how the planning portion of risk management is executed at the project levels.

After correcting Air Force documentation, the next challenge will be to actually achieve effective and consistent risk management. Baram (2003) proposes a method of project management oversight as an

> established practice where a review by an independent (non-project personnel) is prepared to examine the “risk status” of the project (time, cost, and profit) at selected points in time, and possibly explore potential hidden problems that should be addressed and proactively reported to the top management (p. 1).

This approach directly addresses the dilemma identified by Kasperson and Kasperson (1996) in which program managers and engineers are reluctant to report unfavorable risk to upper management and customers for fear of deleterious consequences. Baram (2003) describes motives as to why program managers and engineers are reluctant to provide bad RM reports, as well as issues of reactive versus proactive reporting, lack of experience, non-objective reporting, and internal politics and purports the project management oversight method as the panacea. Yet several immediate concerns with project management oversight come to mind. For instance, an organization would have to be willing and able to dedicate a person to a project oversight position. Perhaps implementing such a position would seem distrustful and work against team or organizational cohesion.

In consideration of another RM process solution, Greiner et al. (2002) identified a lack of effective tools available for the execution of risk management through a series of structured interviews of key members of the multi-functional Air Force Corporate Structure (AFCS). The AFCS is the key unit charged with making decisions regarding resource allocation against all Air Force activities, including weapon system acquisition programs. The tools sought after to fill the void and improve Air Force Risk

Management were defined as “those products or processes that provide the decision maker with a structured and interactive approach to accessing and interpreting data, with a primary goal of increasing the objectivity within the decision making process” (Greiner et al., 2002, p. 129). The literature evidences a disconnect caused by a PRM tool void but Air Force Instruction 63-101/20-101, designates Active Risk Manager (ARM) as the “current standard tool to manage program risks” (2013, p. 25). Perhaps the issue is not a lack of tools, rather, ARM could be inadequate per the definition provided by Greiner et al. (2002).

Langbein (2005) evaluates ARM as focused on qualitative risk analysis as an expensive, standalone system with limited or awkward interfaces to other project management software applications. It is the author’s experience that ARM is also too expensive to distribute to program managers and/or systems engineers who are charged with the responsibility of risk management and, due to its complexity, necessitates a dedicated ARM expert. Though there are not any additional direct assessments of ARM’s effectiveness within the literature, improvement areas can be logically deduced. For instance, ARM is further limited because it cannot interface with simple tools (Langbein, 2005). The Author can confirm that Microsoft Office tools are prolific and consistently used to include presentations to stakeholders using Microsoft PowerPoint. In addition, modeling is implemented using Visio and/or a Department of Defense architecture framework (DoDAF) program. The takeaways are that ARM has better potential to be used if it is simple like the tools currently used (Tiwana & Keil, 2004) and can interface with these tools, as the objective would not involve replacing them. To be effective, ARM would need to be applicable to the project and enterprise levels of RM, and its internal functions would restrict the user to compliance with USAF and DoD publications even while remaining flexible enough for applicability across various types of projects. However, the author is in agreement with the Husby, Brede, and Tendal (1996) article on the perspective that “software tools are very useful and time saving but success comes from the project’s team’s use of these tools and a commitment to the risk management process and not just from the tools” (p. 15-17).

In terms of tools, another deficiency can be deduced from the literature regarding the Air Force’s creation of DoDAF views. Despite the author’s use of various DoDAF programs in the Air Force, there has yet to exist a DoDAF framework that accounts for risk attributes in design and modeling. Once management begins treating risk as a system attribute the process of risk management will enter a new era (Dagli, 2007). In regards to the latest DoDAF version 2.02, the DoD Deputy Chief Information Officer describes that DoDAF conformance is achieved when, “the data in a described architecture is defined according to the DM2 concepts, associations, and attributes” (p. 1).

Summary

Review of the literature provides an understanding of the need and intent behind Air Force PRM. Trends were identified which define a general approach to Air Force PRM but diverge where consensus is critical. Ambiguity combined within DoD and Air Force publications seems to be a foundational point of failure in regards to the successful execution of PRM. From a macro level, consistent data is key to forming enterprise strategy. Additional contributors to the failure Air Force PRM were considered based on evidence found in the literature and the author’s observations in the field of study. The case studies presented provide further support to some of the contributors but there is still a lack of data to confidently determine the underlying phenomena. Effective risk management is essential to the continued success of complex systems; contrarily, if not executed properly, it can be the false safety blanket that leads to catastrophe. Subsequently, the field of study must be queried in pursuit of complete data.

III. Methodology

Chapter Overview

Based on the author's experiences and the literature reviewed, a working explanation can be formed to articulate inconsistent PRM across the Air Force. However, there are critical aspects to the explanation that require further support. Through inductive reasoning, it can be assumed that the phenomenon occurring in comparable settings also applies not only to AF PRM groups and their projects, but also to a lack of specificity concerning the Air Force environment. For example, a portion of the projects referenced in the literature, though strongly comparable, were not actual Air Force projects.

To garner the support and instill the confidence necessary to drive corrective action, research will be employed directly in the field of study to further investigate inconsistent Air Force PRM. Due to the multitude of variables and subjective nature of the study, a qualitative research approach will be used to gather data. The grounded theory method is a type of qualitative research that will anchor the previous explanations in data gathered from interviews conducted directly in the field of study. The interview protocol (see Appendix A) will be designed to impartially allow the underlying phenomenon behind inconsistent PRM to emerge through the subject's answers. In this effort, a technique referred to as coding will be used to process the data for patterns and themes that evidence the underlying phenomenon. Overall, the research strategy accounts for the complex nature of Air Force PRM and anticipates an equally complex set of data from which to derive an explanation for the inconsistencies observed.

Overarching Methodological Approach

The evidence that reveals why risk management is implemented a certain way, and the resultant decisions and actions thereafter, trace back to the complex cognitive processes of risk managers and those who influence the process. It is then necessary to understand the relationship between tools and processes from the users' perspective to assess effectiveness and deficiency. That said, effectiveness of tools and processes can be measured by what degree they effectively meet the intended purpose. For instance, a process on paper can appear thorough and objective but is useless if the intended users choose not to use it. A qualitative study to explore how risk managers employ processes and tools will reveal what currently works and what does not. The patterns and trends identified will help direct further iterations of tools and processes towards effects-based risk management. To better understand the patterns and trends within risk management, a qualitative grounded theory methodological approach will be used to gather and analyze data.

John Creswell notes that "*qualitative research* begins with assumptions, a worldview, the possible use of a theoretical lens, and the study of research problems inquiring into the meaning individuals or groups ascribe to a social or human problem" (2007, p. 37). Following suit with Creswell's description and through the supporting literature, a "problem" has been defined, "assumptions" have been made about the cause, and it is necessary to validate those assumptions by "inquiring" those individuals who are involved with the RM tools and processes. Complexity is another factor that drives the decision for a qualitative research approach (Creswell, 2007). Even though the assumptions thus far are logically grounded in the literature and the author's experience, they are compounded, based on a multitude of interrelated variables that create the deficiencies observed. Consequently, the understanding of the issues at hand will most likely be complex and full of detail (Creswell, 2007). Creswell explains that "this detail can only be established by talking directly with people, going to their homes or places of work, and allowing them to tell the stories unencumbered by what we expect to find or what we have read in the literature" (2007, p. 40). Obtaining data from several sources, including individuals and publications, is an established qualitative data gathering technique (Creswell & Clark, 2011). Evidence gathered from different sources have been analyzed for codes or themes. It is important to realize and avoid the potential for the literature reviewed and the author's experiences to influence the data gathering and analysis process.

In qualitative research validity is more of the primary concern than reliability, as validity is used to determine whether information provided by research subjects is accurate and credible (Lincoln & Guba, 1985). The challenge with qualitative inquiry of the cognitive processes from the users' perspective is drawing out and capturing true accounts of their motives and understandings within the risk management process. In other words, the users' cognitive phenomenon must be drawn out and espoused in a manner to promote as much accuracy and trueness as possible. In this effort, consideration must be given to the possibility of intentional and unintentional deviations from reality. As evidenced by the literature, bias is a factor to be considered when analyzing risk management and information gathered from the community has the potential to carry the same characteristics. In addition, considering that the very nature of risk management is based on assumptions, accounts from the risk management community have the potential to contain unintentional erroneous data. As explained later in this chapter, controls must therefore be put into place to identify and omit noncontributing data.

Specific Methodological Technique

Qualitative research can cater to a diverse range of studies of varying form, technicality, complexity, and social discipline (Creswell, 2007). Among the many techniques described in the literature to tailor qualitative research to a specific study, five were considered: Narrative Analysis, Phenomenology, Ethnography, the Case Study, and Grounded Theory (Creswell, 2007). Comparatively, the approaches considered all begin with a research problem from which research questions are formed in an effort to explain an underlying phenomenon. Data is then gathered and analyzed for evidence that may answer the research question(s). Specific to this thesis, the problem identified is a lack of consistency in Air Force risk management, and the research question seeks to identify the contributors to that phenomenon. The data gathering process was initiated by analyzing the literature germane to the stated problem and keyed in on a set of potential contributors to Air Force RM inconsistency outlined in Chapter 2. The subsequent qualitative research technique will extract information from the domains where the contributing phenomenon exists to either bolster or disprove what was evidenced by the literature. The five qualitative techniques considered endeavor to collect data from the domain of study; that said, the use of interviews, observations, documents, and audiovisual materials are the primary forms of data collection with respect to the aforementioned five techniques (Creswell, 2007). However, the five fundamentally differ in their foci and is thus the basis for the author's decision on which technique to implement for the research. That said, the author concluded that the grounded theory technique is best suited to determine the contributors to the inconsistency in Air Force RM.

The objective of using the grounded theory technique is to verify the assumptions made from the literature discussed in Chapter 2, especially with respect to information taken directly from the Air Force domain of risk management. The selection criteria for choosing the grounded theory technique accounted for the study's focus, type of problem best suited for design, discipline background, and unit of analysis (Creswell, 2007). In line with Creswell's criteria and specific to the grounded theory technique, the "focus" will be "developing a theory grounded in data from the field" (Creswell, 2007, p. 78) of Air Force project risk management. The "type of problem best suited for design [is] grounding the theory in the views of participants" (Creswell, 2007, p. 78) in the form of interviews taken from Air Force project risk management key personnel. The discipline background will draw from sociology as it relates to project risk management teams and the processes and tools they are bound to (Creswell, 2007). Lastly, it is the case that the grounded theory technique is best used for "studying a process, action, or interaction involving many individuals" (Creswell, 2007, p. 78) which, in the current instance, applies to the study of interaction between many Air Force project risk management individuals and the risk management processes and tools.

Participants

One of the suggested methods to gather data from the field involves inquiry in the form of interviews from those key persons or groups germane to the study and theory being investigated. Creswell (2007) specifies that data from the field should be especially grounded in the, "actions, interactions, and social processes of people" (p. 63).

Specific to the grounded theory technique, the target audience should be those that have experienced the process and are therefore affected by and/or affect the underlying phenomenon (Creswell 2007).

The Risk Management Guide for DOD Acquisition states that “since risk can be associated with all aspects of a program, it is important to recognize that risk identification is part of the job of everyone and not just the program manager or systems engineer” (DOD 2006, p. 1). However, in the author’s experience, Air Force program managers are the most involved with leading project risk management and are furthermore required to do so. For this reason, the author identified Air Force program managers for interviews. In order to mitigate potential bias, it is necessary to investigate if indeed Air Force program managers implement risk management as observed and required. It is also possible, especially in larger programs and projects, that program managers are accompanied by a systems engineer and/or risk management subject matter experts (SME) who may be more directly involved with implementing system engineering techniques and tools. Initially targeting program managers is, in essence, a top-down or macro level approach that is expected to lead to interviews of more technically focused risk management positions when they exist. Inquiry of systems engineers and risk management SMEs would offer invaluable insight given their more direct focus on risk management processes and tools.

It is also important to understand the relationship between the systems engineer and program manager when the two positions exist simultaneously. The Air Force directs its program managers to “establish, use, and maintain an integrated risk management process” (DOD 2006, p. 26) among many other responsibilities to include the management of cost, schedule and performance. The Defense Acquisition Guidebook addresses both roles when stating that "effectively managing risks helps the Program Manager and Systems Engineer develop and maintain a system's technical performance, and ensure realistic life-cycle cost and schedule estimates" (DAU 2013, p. 140). It is the author's experience that a dedicated program manager is required, and that systems engineers are assigned as necessary. Otherwise, in the absence of a systems engineer, the program manager becomes dual hatted and oversees systems engineering functions. It would be insightful to track the relationship between the dual-hatted-program-manager versus a dedicated-systems-engineer model in terms risk management performance. It would also be insightful to investigate the role of SMEs when possible. It is the author's experience that dedicated project risk management SMEs tend to be contractors who introduce techniques and practices originating from their respective companies. In this respect, it would be insightful to obtain their views on their company's project risk management approach versus the Air Force's approach and subsequent methods for integration.

It could be argued that persons holding roles and positions at higher levels in the risk management hierarchy should be queried for their perspective. For instance, it can be deduced that, since Air Force enterprise level risk management depends on project level risk management input, it would be insightful to obtain the views of enterprise risk managers. However, the focus is on the phenomenon that contributes to inconsistent risk management assessment at the project level. The confirmation therefore is a predecessor to an investigation on the affects of inconsistent project risk management on enterprise risk management. Although enterprise risk managers most likely have prior knowledge or indirect insight of the project level of risk management, the most applicable and direct insight will be obtained from program managers, systems engineers, and associated SMEs at the Air Force project level of risk management.

Because the success of Air Force projects and programs are dependent on effective communication, it will be feasible to identify and contact program managers, systems engineers, and associated SMEs for interviews. It is necessary to be able to identify positions within programs in order to cross-communicate between projects and integrated project teams (IPT). For this reason, it is the author's experience that positions and associated contact information is often made available. However, it is also the author's observation that, due to security concerns, position and contact information is often restricted to those authorized or with access to the restricted networks holding the information. Furthermore, the means to make contact and communicate with those who hold positions for or within the military is restricted in the same way. Information restrictions in this regard will not be a hindrance because the author, who will be the only person conducting interviews, is an active duty member of the Air Force who has authorized access to the networks holding the necessary contact information.

Two methods will be used to identify and contact program managers, systems engineers, and associated SMEs for interviews. The first method will utilize the Air Force Portal to find DOD websites with organizational charts and contact information. Phone calls will be the preferred method of contact. When phone numbers are not available, the Air Force global contact list found on Microsoft Outlook, which is a standard and prolific DOD emailing system, will be used to look up both email and phone number(s) associated with names. The second method will use the direct references of those the author has and currently works with.

Data Collection Process

The interviews by which subjects are queried are considered by many sources both an art and a science to promote an account that is accurate, can be trusted, and is credible (Creswell, 2007; Creswell & Plano Clark, 2011; Lincoln & Guba, 1985). For instance, in the literature, interviews have been described as an encounter (Goffirum, 1967), a social performance (Goffman, 1959), a face-to-face interactionary performance (Babbie, 1992, 1998), and creative interaction (Douglas, 1985). In this respect, consideration is given to more than just the set of questions and answers to achieve notable data. Field research, such as conducting interviews, is often divided into two phases: getting in and analysis (Shaffir et al., 1980). That said, one of the first considerations upon initial contact of the targeted subjects, other than coordination of a start time, is the medium through which communication will take place. An interview conducted in person is preferred because face-to-face interaction allows nonverbal cues to be perceived by the interviewer and used to pace the query and influence the proper direction of discussion (Berg & Lune 2012). However, because the targeted sample will represent different units and missions across the Air Force, the majority of the subjects will not be locally available to support in-person interviews. Air Force personnel are geographically dispersed around the world in order to support global omnipresent military operations. As a primary example, the author, who will be the only person conducting interviews, must overcome the restrictions imposed by an Air Force deployment. Considering that a large enough pool of subjects may not be available on a small forward deployed operating base, the author will need to reach out via phone to conduct a portion of the subject's interviews.

In addition to giving consideration to the logistics surrounding the interview, a determination must be made about which interviewing technique to employ. Three techniques were considered: the standardized (i.e., formal or structured) interview, the unstandardized (i.e., informal or non-directive) interview, and the semi-standardized (i.e., guided semi-structured or focused) interview (Babbie, 1995; Denzin, 1978; Frankfort-Nachmias & Nachmias, 1996; Gorden, 1987; Nieswiadomy 1993). The semi-standardized interview technique was chosen as the best approach considering the subject matter and audience, as it lies between the extremes of completely standardized and completely unstandardized interviewing (Berg & Lune 2012). On one hand, the questions are queried in a systematic and consistent order, but on the other hand, the interviewer is allowed the freedom to digress and probe far beyond the answers to the prepared and standardized questions (Berg & Lune 2012). Conducting interviews in person and using the semi-standardized technique gives the interviewer the flexibility to capitalize on opportunities to probe for a better understanding of the underlying phenomenon.

Because there is flexibility built into the semi-standardized interviewer approach, open-ended questions can be used to solicit descriptive answers that will set the stage for further question formulation. As suggested by Selltiz et al. (l959), Spradley (1979), Patton (1980), and Polit and Hungler (1993), the development of a set of interview questions, also termed a schedule, will begin with an outline that lists all the broad categories relevant to the study. Four broad categories will be used to form the initial outline: source of risk management requirement and process; emphasis on having a risk management process and source of that emphasis; actual contribution of the RM process in handling risks and the subsequent positive effects, and; the causes to risk management ineffectiveness. The preliminary listing of categories helps to conceptualize the general format of the schedule. The schedule is located in Appendix A of this thesis.

After an outline and broad categories of questions have been established, sets of specific questions relevant to each category will be developed. The type of questions developed plays an important role in the interviewer's strategy to obtain full and accurate data pertaining to the study. The four types of questions identified in the literature were essential questions, extra questions, throwaway questions, and probing questions (Berg & Lune 2012). In accordance with the purpose described in the literature, throwaway questions will be used at the beginning of the interview to develop rapport, set the pace, allow for change in focus, draw out a complete story from research subjects, and cool out the subject if necessary (Becker, 1963; Goffman, 1967). Because the Air Force is a close-knit community and the interviewer is an Air Force member and the subject will at least be affiliated with the Air Force, it will be natural to discuss job title, role, mission, and the like. Job related questions meet the objectives stated in the literature for throwaway questions and establishes common ground between the interviewer and subject. The trust and report that ensues will lead to more complete and accurate answers. Additionally, job related information, when compared to subsequent information in the interview, is likely to reveal an insightful pattern and may not have to be thrown away after all. After the subject's general occupational background and experience has been discussed and rapport and common ground has been establish, essential questions will be asked.

While throwaway questions will only exist in the initial portion of the survey, each category thereafter will begin with essential questions intermixed with probing questions followed by extra questions. "Essential questions exclusively concern the central focus of the study" (Berg & Lune 2012, p. 75) and will serve to elicit specific data that I assume will bring light to the underlying phenomenon. A series of general probing questions will be prepared and ready to implement the moment the need arises to further explore a subject's statement. The extra follow-up questions are important to verify the reliability of the essential questions. For this reason, there will most likely be similarities between the essential questions and extra questions. As mentioned previously, in qualitative research, the key is on validating the data rather than ensuring reliability.

By design, there is ample opportunity to sufficiently retrieve data from the subjects interviewed. Each category will have a set of questions that pinpoints the phenomenon that contributes to inaccurate risk assessment. The semi-structured interview approach, when coupled with probing questions, will allow the interviewer to go beyond the initial set of questions to pursue key data until the four categories are sufficiently covered. Though somewhat redundant, the extra questions will serve as a first step in data validation by cross-referencing previous questions to indicate consistency in answers given by respondents, or the lack thereof.

Data Analysis Process

The raw data gathered from interviews will be analyzed relative to the literature and the author's observations. A methodical approach in this regard will set the stage for grounding the author's explanations in the qualitative interview data through analytic induction. Analytic induction will reveal patterns in the data that will lend themselves to the creation of categories. These categories must be grounded in the data from which they emerged (Denzin, 1978; Glaser & Strauss, 1967). In this effort, the data will be understood and sorted by thematic group types relevant to the phenomenon under investigation. For instance, it will be useful to distinguish between risk management processes derived from Air Force guidance versus those imposed by contractors. Doing so may evidence a lack of ineffectiveness in Air Force RM guidance or inconsistencies between RM processes by different contractors.

Once the interview data was sorted, themes relevant to the scope of the investigation were developed through the process of inductive coding techniques. The inductive coding techniques used were first articulated in 1967 by Glaser and Strauss but best articulated in 1990 by Strauss and Corbin. Specifically, Anselm Strauss, his colleagues, and other methodologists outline a three-step process to accomplish qualitative in-depth interview data analysis through inductive coding. Berg describes the process of coding as a funnel where "you begin with a wide opening, a broad statement; narrow the statement throughout the body by offering substantial backing; and finally, at the small end of the funnel present a refined, tightly stated conclusion" (Berg 2001, 252). The three steps, from broadest to most refined, include open coding, axial coding, and selective coding. Throughout the process, the primary research question can be a framing mechanism from which the themes, or the answers to the research questions, can emerge.

Open coding. As the broadest and first step, open coding will serve as a 'first pass' or a 'first read' of the interview notes to get a feel for the data. In essence, open coding will initiate immersion in the data to gain a deep and thorough understanding, which is the primary objective of the coding process. As Neuman (2000) describes, open coding "brings themes to the surface from deep inside the data" (p. 422). To conduct open coding, four guidelines prescribed by Strauss (1987, p. 30) will be followed. First, the data will be used to form specific and consistent questions toward meeting the original objective of the research question (Berg, 2001). Specific to this study, questions will be aimed at identifying the phenomenon that contributes to RM inaccuracy or the lack thereof. Second, the data will be analyzed minutely to identify all relevant categories, incidents, and interactions to ensure extensive theoretical coverage and grounding until a set of codes become repetitious (Berg, 2001). Third, the coding of the data will be interrupted frequently to write notes on ideas, notions or thoughts (Berg, 2001). Doing so will ensure that ideas triggered by the data, though not instantaneously key, will be captured to complete the explanation later. Fourth, the relevance of variables will not be assumed unless the data supports it (Berg, 2001). Preventing precognitions from influencing the assessment of the data ensures that the final findings are as accurate as possible. Once key words and phrases have been extracted from the data through open coding, the assessment will proceed to the second step: axial coding, or developing coding frames.

Axial coding / Coding frames. Neuman (2000) describes axial coding as a 'second pass' that allows the researcher to make connections between themes that emerged in the open coding process. Neuman further clarifies that axial coding provides the data analyst the opportunity to focus on the initially coded themes more than on the primary data itself. More specifically, Strauss and Corbin (1990) describe axial coding as forming connections between the key words, phrases, and themes developed via open coding. Berg and Lune (2012) offer a similar viewpoint but refer to axial coding as developing *coding frames*. Although essentially the same as axial coding, the use of coding frames allows for a more broadly based connection between the themes developed between open coding. In other words, axial coding tends to have an unlimited number of potential connections between themes; in contrast, coding frames tend to limit the number of connections developed among themes discovered in open coding. Following suit with the techniques prescribed in the literature, coded observations will be cross-referenced for notable similarities or discrepancies and then compared across themes to see how each is either similar or different.

Selective coding. Selective coding is the third aspect of qualitative inductive data analysis. It will serve as a ‘third pass’ through the data to see if the previous codes developed in open and axial coding are sound from a theoretical standpoint. The patterns, themes and codes developed from the data will be examined in the context of the literature and theories described thus far to see if there are connections to the data (Berg & Lune 2012). Neuman (2000) argues that selective coding can be used to see if the major themes and/or concepts are either (a) relevant within the context of the research, or (b) can be used to build up an explanatory framework or theory.

Ethical Concerns

There was little to no risk that the interview designed for this study induced an ethical breach. Fundamentally, the data that was sought after in the schedule was purely related to organizational practices and did not obtain any personal identifiers or demographic information. Because the schedule solicited information that reflected the organization and subject's attitude towards risk management, all identifiers were kept confidential and stored securely. Specifically, the identifiers were only known and accessible to the author as the sole researcher, and the data collected was kept secure and managed according to the recommendations that the Institution Review Board (IRB) made concerning the interview protocol. If a subject's response reasonably placed them at risk of criminal or civil liability or is damaging to their financial or personal standing, employability, or reputation, the requirement is understood that an adverse event report will be immediately filed with the institution's IRB office. At the conclusion of the study, the Principal Investigator (PI) turned over all de-identified data to the advisor, and extraneous copies were destroyed. Stated concisely, the interviews conducted for this study and all corresponding efforts were done in accordance with the institution's IRB regulations.

Summary

The challenge faced in this particular study is finding the key details necessary to accept or reject the explanation deduced from the literature. The data gathered from interviews must be tediously scrutinized and sorted to reveal the phenomenon, or in the case of this study, the contributors to inconsistent Air Force project risk management. Towards this end, steps will be taken to ensure that the data pool is as robust and valid as possible. The criteria used for selecting interview subjects will target those who are in a position to bare the underlying truths behind risk management processes in the Air Force. The potential for bias will be mitigated by masking the subjects' identities and associated organizations and doubly serves to comply with ethical IRB regulations. Such considerations of extraneous variables enable the success of the interview process and data analysis.

The effectiveness of the study as a whole will hinge on the success of data gathering and analysis thereafter. The schedule of questions will be created as a way to hone in on the explanations derived from the literature earlier, but as is intended with semi-structured interviews, will allow the flexibility to discover other contributors to inaccurate risk management. While the interview technique will allow variation, the data analysis process will be methodic and structured in order to sort the complexity expected within the data collected. The overall design of the study takes into account the unique characteristics of the research problem and is grounded in proven techniques.

IV. Analysis and Results

Chapter Overview

Twenty subjects who fit the research criteria outlined in chapter three of this thesis were interviewed and sufficient amounts of raw data were collected to answer the investigative questions and draw conclusions. A description of the subjects interviewed will be provided to give context to the data collected and analysis of that data. Specifically, the description will explore the skill sets, mission involvement, experience, and employment conditions unique to the subjects interviewed. Descriptions of the subjects interviewed will also align to the scope of the research study. This chapter will provide a description of how the study was conducted, what data was gathered and how the data was interpreted. Finally, all components surrounding Air Force PRM will be available for discussions and conclusions.

In this chapter, it will become evident that the results of the research study stem from a proven research approach, i.e., grounded theory, which has been tailored and strategically scoped to investigate the particular gaps of knowledge identified regarding the consistency of PRM processes in the Air Force. The groundwork will then be set to make comparisons between the data gathered from interviews, the author's observations, and the findings in the surrounding literature. A comprehensive review of the research study will also be provided to clarify if risk management processes are truly inconsistent, and if so, whether the lack of normalization impacts decisions made at the enterprise level.

Research Study Scope

The research study conducted endeavored to answer the following five foundational questions posed in chapter one of this thesis:

- Is project risk management (PRM) inconsistently practiced in the U.S. Air Force?
- What parts of the PRM processes across the Air Force tend to be inconsistent?
- How do inconsistencies in Air Force PRM processes lead to inaccurate risk assessments? How do inconsistent PRM assessments impact executive RM?
- What contributes to Air Force PRM inconsistencies?
- What steps can be taken to address contributors to inconsistent PRM across the Air Force?

The interview questions were derived from these five foundational questions in a format more suitable for obtaining complete data through interview discussions. Therefore, the five foundational questions and the interview set both address the assumption that inconsistent risk management practices between organizations within the Air Force can be attributed to a combination of ambiguous direction, cognitive biases, flawed practices, and inadequate tools. The results of the research study will be comparable to the author's observations and the literature review for a couple of reasons. First, the author's observations made directly in the field of study are what initiated the project and led to the five foundational questions. Second, the research study shares the same objective as the literature review in its attempt to answer the five foundational questions. Answering the five foundational questions directly addresses the assumptions made about inconsistent risk management practices in the Air Force.

With the foundational questions finalized, the next challenge was to obtain credible answers. Obtaining credible answers meant interviewing subjects that had direct experience with the risk management processes in the Air Force field of acquisitions. Specifically, the criteria for choosing interview subjects only required that they have or had worked in the Air Force field of acquisitions as a program manager, systems engineer, and/or contractor PRM SME. There was no preference concerning the age or sex of respondents as these attributes were considered to be non-relevant. However, there was an assumed potential for patterns to emerge between the interview data and the subject's rank, experience level, career field, mission type/major command (MAJCOM), employer, product, and product budget. The recording of a subject's attributes germane to the study was done during the initial interview session as singular questions, while other attributes were best investigated as part of the in-depth discussion.

Method Execution

In terms of the method planned, the research study achieved all the objectives by provoking insightful discussion and obtaining data that revealed the underlying phenomenon causing inconsistent PRM processes across the Air Force. The threshold set for the number of subjects to be interviewed ranged from fifteen to twenty, and the objective to interview twenty subjects was met. While the criteria set for subjects was met in all cases, there was also an overarching effort to have a broad variance of certain subject attributes. The result of achieving this goal was twofold: 1) A more comprehensive representation of the population most involved with Air Force PRM; 2) Insightful patterns were found in the association between the subject attributes and the answers provided. The study targeted Air Force acquisition members with attributes ranging in seven areas. The following table shows the seven attributes and their respective ranges mapped to the subjects interviewed.

Table 1

Summary of Subject Attributes

ATTRIBUTE	RANGE and COUNT		
Mission Type	Air (4)	Space (12)	Cyberspace (9)
Employer	Active Duty (9)	Gov't Civilian (9)	Contractor (5)
Rank (1)	Low (6)	Medium (10)	High (4)
Career Field	Systems Engineer (8)	Program Manager (11)	PRM SME (5)
Product	New Tech (9)	Support Equipment (7)	Weapon System (12)
Product budget	< $10M (14)	$10M < $100M (9)	> $100M (7)
Experience (2)	High (14)	Low (6)	

Key:
(1) Low: 1 Lt and below or GS/GG 11 and below or contractor equivalent; Medium: Capt through Maj or GS/GG 12 through 13 or contractor equivalent; High: LtCol through Col or GS/GG 14 through 15 or contractor equivalent.
(2) Low: Experience with one additional unit PRM process or less; High: Experience with two additional different unit PRM processes or more

Fortunately, the target sample was readily available because the U.S. Air Force acquisitions community is close-knit and has a global index of all members and their contact information. An additional technique, that proved effective, involved asking the subjects to recommend other members who fit the targeted characteristics. For these reasons, it was possible to interview subjects possesses a diverse range of qualities in the seven target attribute areas.

Despite the advantages mentioned, the need to reach a sample of subjects representative of Air Acquisitions as a whole, and therefore different mission types, meant that geographical dislocation prevented in-person communication for fourteen out of twenty of the interviews. At first, having interviews in-person versus over the telephone was highly preferred for establishing report and building trust. However, the camaraderie and commonality between Air Force members countered the disadvantages inherent in over-the-phone interviewing. Such elements also contributed to an overall willingness of members to contribute their time and effort towards the study. Subjects seemed to be further motivated to partake in the interview once made aware of the discussion topic. The subject of PRM was a point of frustration for the majority of the subjects, especially those with more experience, and the interview sometimes became an opportunity to rant and vent for some of the research subjects.

Despite tendencies for the topic of PRM to provoke passionate tangents among some of the research subjects, the interview set served to solicit the intended discussions and information. The question-set was used as a trial four times with colleagues before actual use in the field, and as a result, was refined to serve as a seamless discussion prompt to ensure all questions were clearly received and remained unchanged for all interviews. The intention was to conduct all interviews over the phone or in person while capturing the raw data as recordings. However, the majority of the subjects had fully booked schedules, and six out of the twenty subjects requested to preview the question set and make notes prior to the interview. In these cases, the interview became more focused on the questions or answers that were not fully understood or that were deserving of further discussion. Transcribing the interview then became a matter of expanding upon the subject's written answers. The deviation from plans in this manner is not suspected to have reduced the validity of the data received.

From an ethical standpoint, it was important to ensure the subjects anonymity of concerning their identity and any organizations they mentioned. Four of the subjects emphasized the need for anonymity due to their organizational reliance on government evaluation. Despite one subject's enthusiasm to participate in the interview, the subject actually refused to be recorded. In this case, an agreement was made that I would not record and would only take notes. The need to do this hinged on the fact that this particular subject's input was valuable, as the subject was a systems engineer and a PRM SME with direct PRM experience in eight prior units. It was also the case for six other subjects that a recording could not be obtained because their schedule only permitted an interview within the work setting that happened to be at a sensitive compartmented information facility where recording devices were not allowed. From a security perspective, access to all information and data was kept secure through electronic password protection on the interviewer's personal laptop.

Investigative Questions Answered

Emphasis was placed on ensuring that the assumptions made about PRM were directly addressed by the five foundational questions posed in Chapter 1. The five foundational questions served as a baseline for reviewing the surrounding literature and laid the groundwork for creating the interview question-set used in the research study. Maintaining focus on determining the underlying phenomenon at hand was crucial because the problems observed by the author are inherently ambiguous. In other words, many assumptions could be made about the observed lack of PRM consistency. Take for instance viable assumptions that the observations could be false, biased, or exceptions to the norm. To maintain traceability, the results of the study will be explained in terms of the stated assumption, which is restated below, and segmented into three parts with their associated questions in the interview set.

> *Project risk management processes are inconsistently practiced by units in the Air Force because of ambiguous direction, cognitive biases, flawed practices, and inadequate tools; this is evidence of project risk mishandling and leads to misinformed decisions at the Air Force enterprise level.*

First Stated Assumption. The first foundational question explores the first assumption stated in chapter one that "Project risk management processes are inconsistently practiced by units in the Air Force…" by asking, "Is project risk management (PRM) inconsistently practiced in the U.S. Air Force?" To better facilitate conversation in an interview setting, the first foundational question was broken out into a series of primary, follow-up probe, and Likert-scale questions. The following table maps the lineage from the first stated assumption and foundational question to the interview questions.

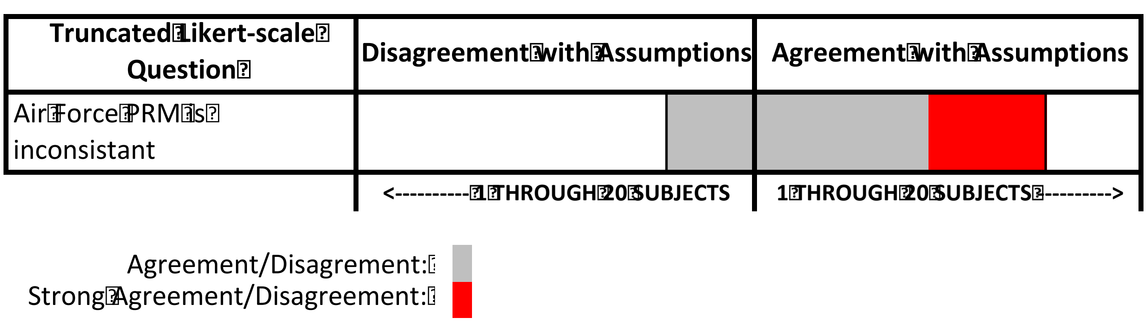
Table 2

Lineage – First Assumption and Associated Questions

STATED ASSUMPTION
Project risk management processes are inconsistently practiced by units in the Air Force…
FOUNDATIONAL QUESTION
Is project risk management (PRM) inconsistently practiced in the U.S. Air Force?
INTERVIEW QUESTIONS
How does the emphasis on PRM processes at your current unit compare to other units you've been involved with or are aware of?
a. In how many different Units have you been involved with the PRM process?
b. Did you encounter or know of any units that either lacked or had little regard for PRM? If so, why do you think that is?
c. Were the differences in emphasis you describe driven by necessity differing guidance, or other reasons?
LIKERT-SCALE QUESTION
For any given risk, units across the Air Force are likely to arrive at the same assessment in terms of the probability and impact that would be reported. **Strongly Disagree (6) – Disagree (9) – Uncertain (0) – Agree (5) – Strongly Agree (0)**

Figure 1

Likert-scale – Summary of First Assumption



Overall, fifteen out of twenty subjects agreed that PRM was not consistently practiced across the Air Force. A detailed look at the responses revealed several insightful trends associated with four of the seven attribute ranges. While there were strong trends discovered with experience, rank, mission type, and budget, there were no trends evident with employer, career field, or product.

The strongest trend was a positive relationship between experience and claims of inconsistent Air Force risk management processes. In this case, a subject was considered experienced after two or more previous assignments with direct exposure to their unit's PRM process. Twelve of the fourteen subjects considered experienced, and two of the subjects considered inexperienced, explained PRM inconsistencies throughout the interview. The fourteen subjects who explained inconsistent PRM answered concurrently on the Likert-scale question with the same query. It was interpreted that the three subjects with little to no experience who concurred with PRM consistency relied on the expectations of their recent initial training and guidance as a reflection of reality. On the other hand, the twelve subjects with greater experience explained how those expectations did not materialize. If the interpretation is correct, then there may be aspects of the Air Force's PRM training curriculum that deserve assessment for applicability and relevance.

Although rank is a different attribute than experience, the two tend to go hand-in-hand. It is possible that a member could obtain medium to higher rank without having high experience in PRM, but this possibility is not likely. The positive relationship between higher rank and higher experience showed true for all subjects in the study. In other words, all fourteen members with high experience were also medium to high rank. The interpretation of the relationship between higher rank and concurrence with PRM inconsistencies is therefore the same as they were for higher rank. That said, it was noteworthy to learn that the higher-ranking subjects did not plan to use their authority to implement corrective actions.

Contrary to the interpretations and assumptions made regarding experience and rank, two of the fourteen subjects with high experience claimed that PRM was consistent. Interestingly, these two highly experienced subjects had spent their careers in highly funded space programs, with the majority of these programs being greater than $100M. Furthermore, nine of the twelve high experienced subjects that concurred with inconsistent PRM processes did reference consistency between highly funded Space programs in their past experiences. These patterns seem to suggest that for some reason, consistent PRM processes are inherent in the field of Space acquisitions and/or highly funded programs. It would then make sense that two out of three of the less experienced subjects who concurred with PRM consistency belonged to a Space acquisitions unit. However, the pattern is also concurrent with the interpretation that low experienced subjects concur due to expectations from recent training which was exclusively applicable to only one of the five low experienced subjects. The two low experienced subjects who concurred with PRM inconsistency were not part of a Space acquisitions unit nor did they have any such experience. Overall, the data suggested that there is a relationship between space acquisitions units and claims that PRM is consistent, a positive relationship between funding and claims that PRM is consistent, and a negative relationship between experience and claims that PRM is consistent.

The two most frequent inconsistencies described by subjects were PRM process emphasis and risk handling accountability. Not only were these two emphasis areas described as inconsistent across units, but also as critical areas that determined the success of the unit's PRM process. The majority of the subjects were quick to point out that all Air Force units are mandated to produce risk reporting and that there was a drastic difference between checking a box and intrinsic action. The difference driver was often described to be leadership-buy-in. As it takes a team to carry out a PRM process on complex systems, individuals will get discouraged if not brought together as a team to carry out the endeavor simultaneously. Getting beyond the box-checking mentality also meant having purpose, as the purpose of having a PRM process is to identify and react to project risks and take the best action. If there is no action towards the risks identified, or decision of non-action for that matter, then there is no purpose.

Second Stated Assumption - Overview. The second stated assumption attempts to answer why PRM processes are inconsistent across Air Force units. Determining exactly what and why there is PRM inconsistency is the linchpin of the study and appropriately received the greatest research emphasis. According to the author's observations directly in the field of study, PRM inconsistency can be attributed to ambiguous direction, cognitive biases, flawed practices, and inadequate tools. To promote natural discussion for an interview setting, questions where designed to simultaneously probe for what in particular was inconsistent and why.

Second Stated Assumption – Ambiguous Direction. Publications are to the Air Force what a conductor is to a symphony. The Air Force is large, geographically separated, and highly diversified across air, space, and cyberspace missions. It is crucial for these diverse domains to be synchronized, and PRM is no exception. However, funneling directions and guidance from the headquarters echelon down to the units is a delicate balance between specificity and adaptability. Air Force publications must synchronize units while allowing leeway for interpretation and tailoring to fit unit specific missions. Based on the author's experience in the field of study and review of the literature, such balances have not been achieved, and as a result, risk management directives and guidance seemed ambiguous and contradictory.

Table 3

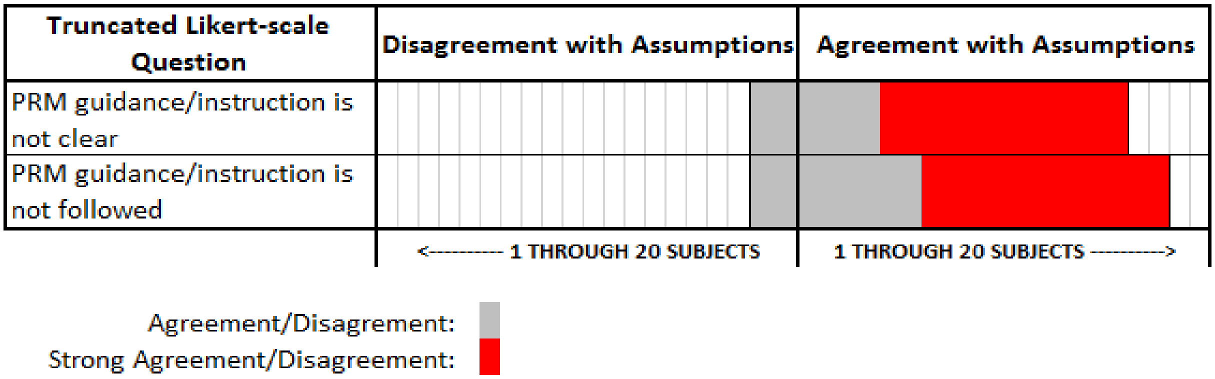
Lineage – Second Assumption and Associated Questions

STATED ASSUMPTION
...because of ambiguous direction…
FOUNDATIONAL QUESTIONS
What parts of the PRM processes across the Air Force tend to be inconsistent?
What contributes to Air Force PRM inconsistencies? (1)
INTERVIEW QUESTIONS
What publications does your unit use and why do you think that it was selected?
a. Is it clear which publications to use?
b. Are the publications used understandable and specific?
c. Are the publications used adequate?
LIKERT-SCALE QUESTION
There is clear guidance and instruction available to your unit on how to carry out risk management. **Strongly Disagree (12) – Disagree (4) – Uncertain (2) – Agree (2) - Strongly Agree (0)**
Air force guidance and instruction are strictly followed in your unit. **Strongly Disagree (12) – Disagree (6) – Uncertain (2) – Agree (2) - Strongly Agree (0)**

Key:
(1) Questions that address 'why' there are PRM inconsistencies are highlighted to discern them from questions that address 'what' PRM inconsistencies exist.

Figure 2

Likert-scale – Summary of Second Assumption



In terms of the seven attributes recorded for each subject, trends were observed for mission type, product budget, employer, and career field. No significant trends were found for rank, product, or experience. The most notable pattern was mission type and product budget, which, as mentioned before, are not mutually exclusive. There was a distinct relationship between better directives and space acquisitions units found within the data. There was also a positive relationship between highly funded programs and better publications, which happens to be indicative of space acquisitions programs. Although risk management seems to be a long-lived staple of space missions, funding seems to be the enabler for a robust risk management process. A strong document management process was common between all programs reported as having consistent PRM processes.

The author discovered that document management involved not only applying the correct documentation and references to the acquisition life cycle, but also tailoring higher-level documents to the unique unit level mission. Such efforts are resource intensive and therefore require extra funding. Programs that did not have strong document management considered the endeavor to be extraneous to their primary mission and too low of a priority to adequately fund. All twelve subjects that had experience working in a highly funded space acquisitions units, and two other subjects who were working in a highly funded aviation acquisitions unit, reported either current or past experiences with clear PRM documentation in these units. The commonality in the cases of sufficient documentation was sufficient funds to afford document management.

It could be argued on the basis of the data from this research study that a majority of Air Force units reference higher-level PRM guidance with little to no success. Fourteen subjects who either had current or past experience with lower funded acquisitions units reported that unit level PRM guidance was not available. Twelve of the fourteen subjects who did not have unit level guidance could not identify the higher-level publication(s) that were applicable to their PRM process, and as a result, felt that the guidance was non-value added. Subjects did not specifically mention contradiction or confusion about what higher-level publications to use; however, eighteen out of twenty subjects described ambiguity and vagueness among the higher-level publications. Most notable were the descriptions from the five PRM SMEs and five out the eight systems engineers who directly interpreted higher-level publications in efforts to create tailored unit level PRM guidance. The subjects directly involved with interpreting higher level PRM guidance reported that the degree of vagueness encountered left too much room for interpretation.

The data indicates that the myriad of higher-level PRM publications do not achieve a unified approach to PRM. Per the interviews, subjects indicated that the publications were either not referenced at all or they become loosely interpreted. The most consistency was achieved between units who had contractors that created unit level PRM guidance. In these cases, contractor interpretations were ultimately influenced by industry-best-standards. Two detached separate units both having unit level PRM and contractor resources had similar PRM guidance that fit high-level PRM criteria but aligned with industry-best-standard.

Second Stated Assumption – Cognitive biases. All subjects interviewed explained that there existed some degree of cognitive bias. There were no distinct patterns or trends that were found with respect to any of the seven attributes. That said, the consistent existence of cognitive bias reflected by the subjects was a consistent trend, as bias has the potential to produce inconsistent PRM assessments and decisions. The research study bolstered the earlier claim that cognitive biases are inherent in all group interactions, but that the goal is not to just identify inevitabilities. On the contrary, the effort to confirm and pinpoint the different biases begins the understanding of how to control for and mitigate biased PRM assessments and decisions.

Table 4

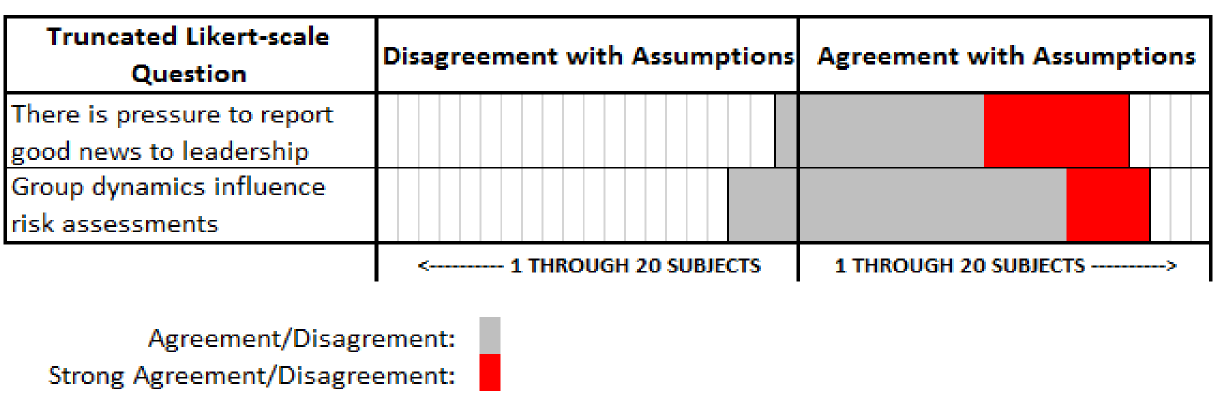
Lineage – Third Assumption and Associated Questions

STATED ASSUMPTION
...because of cognitive biases…
FOUNDATIONAL QUESTIONS
What parts of the PRM processes across the Air Force tend to be inconsistent?
What contributes to Air Force PRM inconsistencies? (1)
INTERVIEW QUESTIONS
What collaboration methods do you use (Ex: Delphi technique, story board, meeting, email) and why were they chosen?
a. Are the methods you mention different than in other units you know of? Why do you think there is a difference?
b. Are the methods you mention adequate (i.e. do you encounter any challenges such as bias, strong personalities, or group think)?
LIKERT-SCALE QUESTION
There is pressure to provide positive news about risks when reporting to supervisors and leadership. **Strongly Disagree (0) – Disagree (1) – Uncertain (2) – Agree (9) - Strongly Agree (7)**
Group dynamics such as group think and strong personalities influence your unit's risk assessments. **Strongly Disagree () – Disagree (3) – Uncertain (0) – Agree (13) - Strongly Agree (4)**

Key:
(1) Questions that address 'why' there are PRM inconsistencies are highlighted to discern them from questions that address 'what' PRM inconsistencies exist.

Figure 3

Likert-scale – Summary Third Assumption



All things considered, the bias described as skewing PRM reports positively for upper leadership and management generated the most passionate discussions among the research subjects. In the research study, two reasons were provided for why PRM reports were positively skewed. The most frequent reason given by 13 of the 20 subjects was to avoid the additional oversight brought on by reported high risks. It would make sense to provide a high-risk project with more resources to overcome associated challenges, but instead, the expected result of reporting high risk seemed to be the opposite. Resources would be required to provide additional reporting to upper leadership and management instead of focusing on handling the high risks at hand. The second most frequent reason provided by 11 subjects was to preserve reputation of both stakeholders and the project(s) at hand. For a project in a risk adverse environment, reporting a high level of risk reduces the likelihood for further personnel and funding support. For stakeholders in the same environment, especially government systems engineers and program managers, reporting a high level of risk could lead to a chain of failures and ultimately limit the likelihood for career progression.

The two main reasons provided by subjects in the research study were contingent on their environments being risk adverse. In hindsight, it would have been insightful to directly ask the subjects about their unit's tolerance to risk. However, four subjects strongly alluded to a risk adverse environment and the two main reasons provided for avoiding reporting high risk indicate a strong possibility for a trend of risk adversity in the Air Force.

The second most emphasized problem pertaining to cognitive bias was a combination of groupthink and strong-voice. Seven subjects described a common scenario where someone in a collaborative environment with a strong voice or dominating personality would trigger groupthink. Two subjects alluded to PRM topics as susceptible to strong opinions and groupthink because the endeavor was inherently assumption based. In other words, PRM was likened to the abstract realm of future predictions where no opinions could be grounded, but merely swayed by the temperament of any given person or group.

The third cognitive bias, mentioned by 4 subjects was positivity bias. Positivity bias could be possibly tied into the tendency to report good news to upper leadership and management as having the same effect. Subjects explained the tendency to underestimate the probability and/or impact of potential risks. Similarly, subjects also reported tendencies of stakeholders to underestimate schedule length and costs and overestimate technical and human capabilities.

The cognitive biases explained by all twenty subjects are not specific to only groups wrestling with PRM; rather, they are inherent in all group collaboration. The purpose for exploring the cognitive biases experienced by the subjects is to understand their particular effect on PRM assessments and decisions. Characterizing the full dynamic of cognitive biases in the PRM setting will shape the recommendations for corrective actions to be discussed in chapter five of this thesis.

Second Stated Assumption – Flawed Practices. The assumption that Air Force units use flawed techniques and practices was based on the author's observations and review of the literature. The implication with using flawed practices does not directly result in inconsistent risk level assessment margins of error. In theory, if all Air Force units were consistently using the same flawed practices, there would be consistent risk level assessment margins of error. Although in a few interviews there were indications of inconsistent flawed practices leading to consistent margins of error, consistency cannot be decoupled from accuracy. Consistency is achieved by converging on accurate risk assessments. As such, evidence of inaccurate risk level assessment error is an indication of inconsistency and can be partially attributed to flawed practices where they exist. Flawed PRM practices must be identified and understood in order to take corrective action.

Table 5

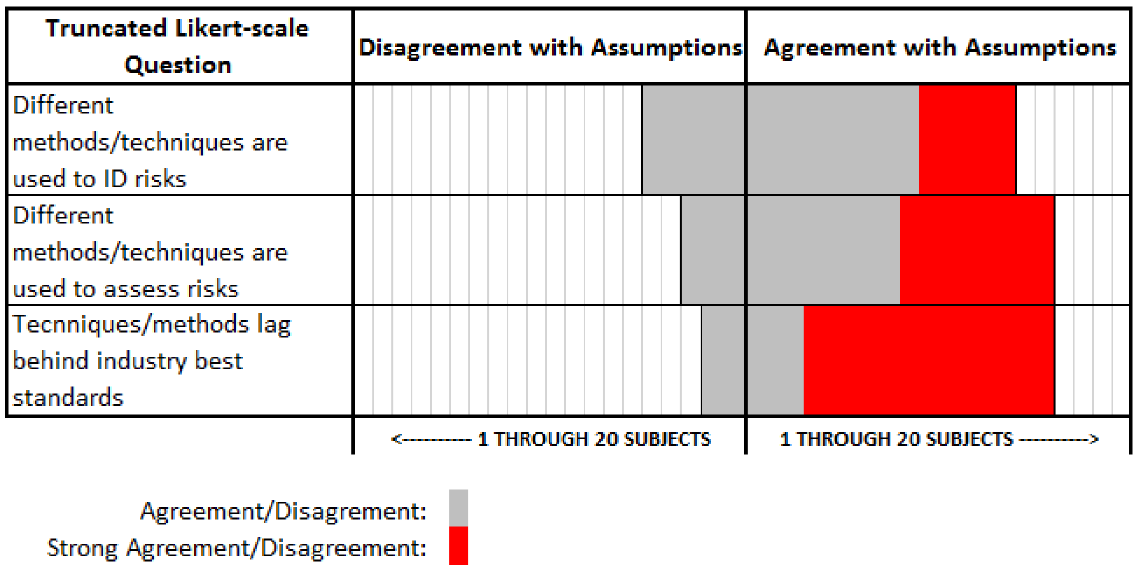
Lineage – Fourth Assumption and Associated Questions

STATED ASSUMPTION
...because of flawed practices…
FOUNDATIONAL QUESTIONS
What parts of the PRM processes across the Air Force tend to be inconsistent?
What contributes to Air Force PRM inconsistencies? (1)
INTERVIEW QUESTIONS
What techniques does your unit use (Ex: risk matrix, montecarlo)? Why do you think these specific techniques are used?
a. Do these techniques differ from other units and what do you think is the cause?
b. Do you think these techniques are adequate? Why or why not?
What risk identification methods (Ex: email, meetings, delphi) are used in your unit and why do you think these specific techniques are used?
a. Are there differences between the methods used in your unit versus other units that you know of, and if so, what do you think is the cause?
b. Do you think these methods adequately identify notable risks?
What are the analysis techniques used to assess likelihood and impact and why do you think these specific techniques are used?
a. Are there differences between the techniques used in your unit versus other units that you know of, and if so, what do you think is the cause?
b. Do you think these techniques produce accurate assessments?
LIKERT-SCALE QUESTION
Different units in the Air Force use the same methods and techniques to assess project risks. **Strongly Disagree (8) – Disagree (8) – Uncertain (1) – Agree (3) - Strongly Agree (0)**
The techniques and methods used by your unit to carry out PRM processes are adequate and are equally as effective as industry best-practices. **Strongly Disagree (14) – Disagree (3) – Uncertain (1) – Agree (2) - Strongly Agree (0)**

Key:
(1) Questions that address ‘why’ there are PRM inconsistencies are highlighted to discern them from questions that address ‘what’ PRM inconsistencies exist.

Figure 4

Likert-scale – Summary of Fourth Assumption



In terms of the seven attribute areas, there were trends that were associated with mission type, employer, career field, and product budget. However, closer analysis of the data pointed to the career field and employer attributes as the drivers for the observed pattern while the other attributes were merely shared by the same subjects. While all subjects claimed to some degree that Air Force PRM practices were not as effective as industry best standards, PRM SMEs and six out of the eight systems engineers were able to explicitly explain why the Air Force is lagging. The data suggests that the PRM SME and systems engineering career fields afforded the subjects a more focused role with PRM. Contractors had the most insight into the comparison between industry best-standard practices and Air Force practices, as their respective companies were an integral part of industry and defining what was considered best-standard practices. That said, there was a positive association between a greater understanding of PRM practices and greater claims that Air Force PRM practices were lagging.

The most notable Air Force practice articulated by the subjects during the interviews was the five-by-five risk matrix, also termed a risk cube. The risk matrix was consistently described as prolific and central to Air Force PRM. It was also notable that the risk matrix was the only Air Force practice mentioned. On the other hand, the contractor subjects were able to identify a multitude of techniques used in the private sector considered necessary to handle PRM for complex projects and programs. The majority of the subjects criticized that the risk matrix was non-deterministic and subjective. The contractor PRM SMEs and systems engineers who had in-depth PRM knowledge further explained the inability of the risk matrix to account for compounded risks, and that consistency cannot be decoupled from accuracy. Indeed, these subjects noted that consistency is achieved by converging on accurate risk assessments.

Second Stated Assumption – Inadequate Tools. The implication with inadequate tools is analogous to flawed practices; proficiency must be achieved in order to consistently converge on accurate risk assessments. According to the subjects familiar with industry best-standard PRM tools in the private sector, tools can promote rigor, accountability, new processes and techniques through behavior-shaping constraints. The patterns deduced from the interview data in terms of the seven attribute areas were also similar to that of flawed practices.

Table 6

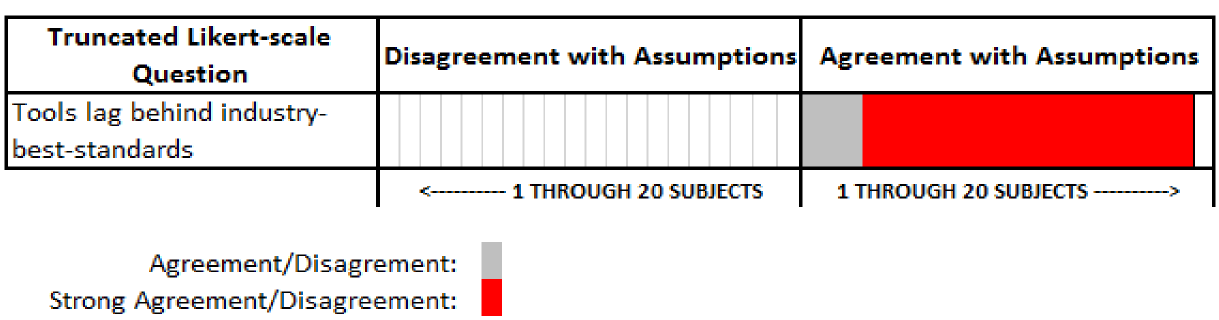
Lineage – Fifth Assumption and Associated Questions

STATED ASSUMPTION
…because of inadequate tools…
FOUNDATIONAL QUESTIONS
What parts of the PRM processes across the Air Force tend to be inconsistent?
What contributes to Air Force PRM inconsistencies? (1)
INTERVIEW QUESTIONS
What tools does your unit use to implement the PRM process? Why do you think these specific tools are used?
a. How are these tools different than other units and what do you think is the cause?
b. Are these tools available to the right personnel (Ex: Active risk manager, MSOffice)? Why do you think these specific tools are available?
c. Are the tools you mentioned adequate? Why or why not?
d. On which portion of the risk management process are the tools you mentioned actually used? Why or why not certain parts?
LIKERT-SCALE QUESTION
The tools used by your unit for PRM processes at the CGO/mid-management level are adequate and are equally as effective as industry-best-practices. **Strongly Disagree (16) – Disagree (3) – Uncertain (1) – Agree (0) - Strongly Agree (0)**

Key:
(1) Questions that address 'why' there are PRM inconsistencies are highlighted to discern them from questions that address 'what' PRM inconsistencies exist.

Figure 5

Likert-scale – Summary of Fifth Assumption



The research study revealed trends that were related to mission type, employer, career field, and product budget. However, closer analysis of the data pointed to the career field and employer attributes as the drivers for the observed pattern. While all subjects claimed to some degree that Air Force PRM tools were not as effective as industry best standards, PRM SMEs and four out of the eight systems engineers were able to explicitly explain why the Air Force is lagging. Interpreting the data revealed that the PRM SME and systems engineering career fields afforded the subjects a more focused role with PRM, and as a result, better insight into the inadequacies. Contractors had the most insight into the comparison between industry best-standard tools used in the private sector and Air Force tools, as their respective companies were an integral part of industry and defining what was considered best-standard practices. That said, there was a positive association between a greater understanding of PRM tools and greater claims that Air Force PRM practices were lagging.

The Air Force's designated tool for PRM was confirmed by eighteen out of twenty subjects to be Active Risk Manager (ARM) as predicted earlier from the author's observations and review of the literature. ARM was found to only be available to six of the twenty subjects, two of the eight systems engineers and four of five contractor SMEs. Only one systems engineer and two contractor SMEs had the aptitude to use ARM. Of the other fourteen subjects that had no direct experience with ARM, only eleven were aware of tool's existence. It was assumed that the other two subjects were not aware of the tool due to their low experience. It is important to remember the surrounding circumstances to comprehend the problem at hand. Given the criteria, all subjects interviewed should have had an integral role in the handling of their program's risks. According to the contractor SMEs and industry best standards, PRM stakeholders such as the subjects interviewed should ideally all collaborate on a tool that is dedicated to PRM.

It became evident through the research study that the root cause of why ARM was not used by stakeholders was threefold. First, it was too intricate and complicated to use as those subjects who used it were dedicated PRM SMEs whose primary responsibility was PRM while those who did not use it had multiple other responsibilities. For instance, in addition to PRM, a program manager has to contend with balancing cost, schedule, scope, and resources for their project(s). A systems engineer, by definition, is responsible for eleven disciplines other than just PRM, which can often simultaneously include the management of requirements, testing and evaluation, human factors and architecture integration. Second, the subjects who were experienced with ARM claimed that when the tool was used to its fullest extent, that it was only proficient at reporting as opposed to the actual management and handling of the identified risks. Third, licensing for ARM was said to be too expensive to provide to all stakeholders.

The research study confirmed the author's observations and review of the surrounding literature regarding PRM tools in the Air Force. The only dedicated tool was ARM and it is inadequate in terms of usability, suitability, and availability. The inadequacy of ARM left PRM stakeholders using generic tools provided by Microsoft Office to manage risk. Microsoft Office tools are capable, usable, and available for a wide range of purposes in the Air Force, but are not specifically designed for PRM. Compared to PRM tools that are considered to be the industry-best-standard, Microsoft Office tools lack automation, digital form templates that standardize techniques, and a platform for collaboration.

Summary – Mission Impacts

The research effort provided insight that grounded the author's stated assumptions and reinforced the information found in the surrounding literature. Validation in this manner was key in identifying the deficiencies surrounding Air Force PRM, as it runs counter to the incentives of those who are usually aware of them. Furthermore, the key to unraveling the complex combination of contributors to Air Force PRM inconsistency was held deep within the knowledge of the PRM subjects interviewed. Not only was valuable insight gained, but cross-referencing a diverse set of perspectives for trends and patterns provided comprehensive insight to the underlying phenomenon behind PRM inconsistencies.

In efforts to invoke change, a shift in focus from characterizing AF PRM deficiencies to mission impacts will ensure effective changes are made. The third and last stated assumption claimed that not only did PRM inconsistencies evidence risk mishandling at the program level, it also led to misinformed decisions at the Air Force enterprise level. Take for instance this scenario. Unit A carries out an accurate risk management assessment on risk X, and unit B carries out a positively skewed risk assessment on the same risk X. Not only is unit B postured to underreact to the risk, but on an enterprise level, the erroneous assumption will be made that unit B is a less risky investment for further funding and resources.

In hindsight, there was a lack of emphasis in the interview set on discussing mission impacts resulting from deficient and inconsistent Air Force PRM. There were two questions, one addressing the impacts at the unit level and the other addressing the enterprise level. The two questions occurred at the end of the lengthy interview and all twenty subjects apathetically agreed with the obvious; bad things happen if PRM is not proficiently and consistently carried out across Air Force units. Although misinformed decisions at both the unit and enterprise level can lead to an onslaught of complications, the objective is as simple as the answers provided. Measures need to be taken towards improving Air Force PRM proficiency and consistency by focusing on the four problematic areas identified: publications, biases, practices, and tools.

V. Conclusions and Recommendations

Chapter Overview

The motivation to scrutinize Air Force PRM stemmed from the author's experiences directly in the field of study. While many were observed to give up on PRM and resort to "box checking," the author believed in the potential of PRM to achieve positive mission effects. Stated more succinctly, the author believed that risks could be identified and assessed to inform decisions and generate action as opposed to just serve as another meeting topic. Follow-through beyond reporting is also applicable to the efforts of the research study conducted.

Given the author's observations directly in the field of study and the review of the surrounding literature grounded in the results of the research study, a characterization of the Air Force PRM environment will be articulated. It is necessary to understand the current state to determine how to achieve the desired state. In the case of the research study, an explanation of what and why AF PRM inconsistencies exists will be provided along with an understanding of the resulting mission impacts. An examination of the research results will reveal additional areas for further study. In the spirit of follow-through, an examination of any Air Force PRM deficiencies found will serve as a launch pad for further action.

Conclusions of Research

As predicted by the author, the research conducted revealed inconsistencies and deficiencies within AF PRM. The fourteen subjects who reported AF PRM to be inconsistent also reported that publications, biases, practices, and tools were all factors that contributed to inconsistent risk management to some degree. Other contributors were introduced in the study but did not stand out as significant if they were only mentioned two or less times and/or considered to be a sub-factor to one of the four assumed contributors. However, lack of education and training was mentioned thirteen times and stands out independently as another contributing factor to AF PRM inconsistency.

Comparing and contrasting the interview data in terms of the subject's salient attributes revealed patterns about the underlying phenomenon causing PRM inconsistencies and deficiencies. Analysis of the seven attribute areas revealed mission type as a source for the most trends discovered. Overall, space mission units demonstrated more PRM emphasis and proficiency than air and cyberspace mission units. Mainly, the criticality of space missions and the catastrophic consequences of failure necessitates higher PRM effectiveness. The requirement for PRM effectiveness drove trends in other attribute areas such as the availability of funding which enabled the onset of contractors who tend to have focused expertise in PRM. In this case, the mission type attribute drove the product budget, employer, and career field attribute areas. The research study has demonstrated that space units can be used by the Air Force as a model to improve PRM proficiency.

A macro perspective of the research study showed inconsistencies across the Air Force contingent on five of the seven attribute areas explored. In regards to the mission type attribute, PRM proficiency inconsistencies were found between aviation, cyberspace, and space units. The conclusion was made that a high need for PRM in space units drove higher funding. As such, funding did not drive the inconsistency;

rather, funding enabled the higher PRM proficiency through the hiring of contractor SMEs familiar with industry best practices. Inconsistency between different levels of rank were concluded to be driven by experience and was therefore thrown out as a factor. The trends associated with the experience attribute helped explain the outlying data provided by two inexperienced subjects not in a space unit who claimed that there were no PRM deficiencies or inconsistencies. Analysis of the data led to the understanding that a more accurate interpretation of PRM, one with deficiencies and inconsistencies, was gained through experience. The table below provides an outline of the interpreted interview data in terms of the seven attribute areas.

Table 7

Summary of Attribute Trends and Observations

<table>
<tr><th>ATTRIBUTE</th><th colspan="6">RANGE & CONCLUSIONS</th></tr>
<tr><td rowspan="2">Mission Type</td><td colspan="2">Air</td><td colspan="2">Cyberspace</td><td colspan="2">Space</td></tr>
<tr><td colspan="6">Aviation and cyber units had a low emphasis on PRM compared to Space units resulting from the need for high reliability. Aviation units relied on operational risk management for mission reliability.</td></tr>
<tr><td rowspan="2">Employer</td><td colspan="2">Active Duty</td><td colspan="2">Gov’t Civilian</td><td colspan="2">Contractor</td></tr>
<tr><td colspan="6">Active duty and gov’t civilian personnel were similar in terms of their knowledge and implementation of PRM. Gov’t civilians assigned to PRM & contractors were highly adept to PRM.</td></tr>
<tr><td rowspan="2">Rank (1)</td><td colspan="2">Low</td><td colspan="2">Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="6">The trends and patterns found ran concurrent with experience, which was determined as the true diver of higher PRM situational awareness and competence.</td></tr>
<tr><td rowspan="2">Career Field</td><td colspan="2">Systems Engineer</td><td colspan="2">Program Manager</td><td colspan="2">PRM SME</td></tr>
<tr><td colspan="6">Systems Engineers & program managers were similar in terms of their knowledge & implementation of PRM while PRM SMEs (contractors) were highly adept to PRM (similar to the ‘employer’ attribute).</td></tr>
<tr><td rowspan="2">Product</td><td colspan="2">New Tech</td><td colspan="2">Support Equipment</td><td colspan="2">Weapon System</td></tr>
<tr><td colspan="6">There were no specific patterns or trends found.</td></tr>
<tr><td rowspan="2">Product budget</td><td colspan="2">< $10M</td><td colspan="2">$10M < $100M</td><td colspan="2">> $100M</td></tr>
<tr><td colspan="6">Aviation and cyber units were funded less than $100M and had a low emphasis on PRM compared to Space units funded over $100M. This attribute is concurrent with the ‘mission type’ attribute.</td></tr>
<tr><td rowspan="2">Experience (2)</td><td colspan="3">High</td><td colspan="3">Low</td></tr>
<tr><td colspan="6">Subjects with higher experience reported more inconsistencies and deficiencies than subjects with lower experience. It was deduced that a more accurate interpretation of PRM was gained through experience.</td></tr>
</table>

Significance of Research

The objective of the research study was to reveal the phenomenon responsible for inconsistent Air Force PRM so that corrective actions can be focused appropriately. Though the author's explanation of the phenomenon came directly from observations in the field of study and from over nine years of experience, further substantiation was needed. Assumptions limited to just the author's perspective could be rebutted in multiple ways. It could be argued that the author's scope of experience is not representative of the whole U.S. Air Force. On the other hand, the research study was comprehensive in that it tapped into the knowledge of twenty subjects who represented multiple Air Force perspectives. That said, the research study bolstered the author's assumptions and introduced new information regarding the deficiencies surrounding Air Force PRM. The results from the research study can be used as a launch point for further research and corrective actions.

Recommendations for Action

The results from the research study point to space acquisitions units as the most proficient in PRM. The trends show that higher funding for contractor PRM SMEs and their knowledge of industry best practices have the tendency to promote effective PRM practices. Interjecting more contractors with industry knowledge is an example that can be followed directly, but the focus should be on aligning Air Force practices with industry best standards. Despite units that had an abundance of industry savvy contractors, PRM was short of full potential due to lack of sufficient tools and community buy-in.

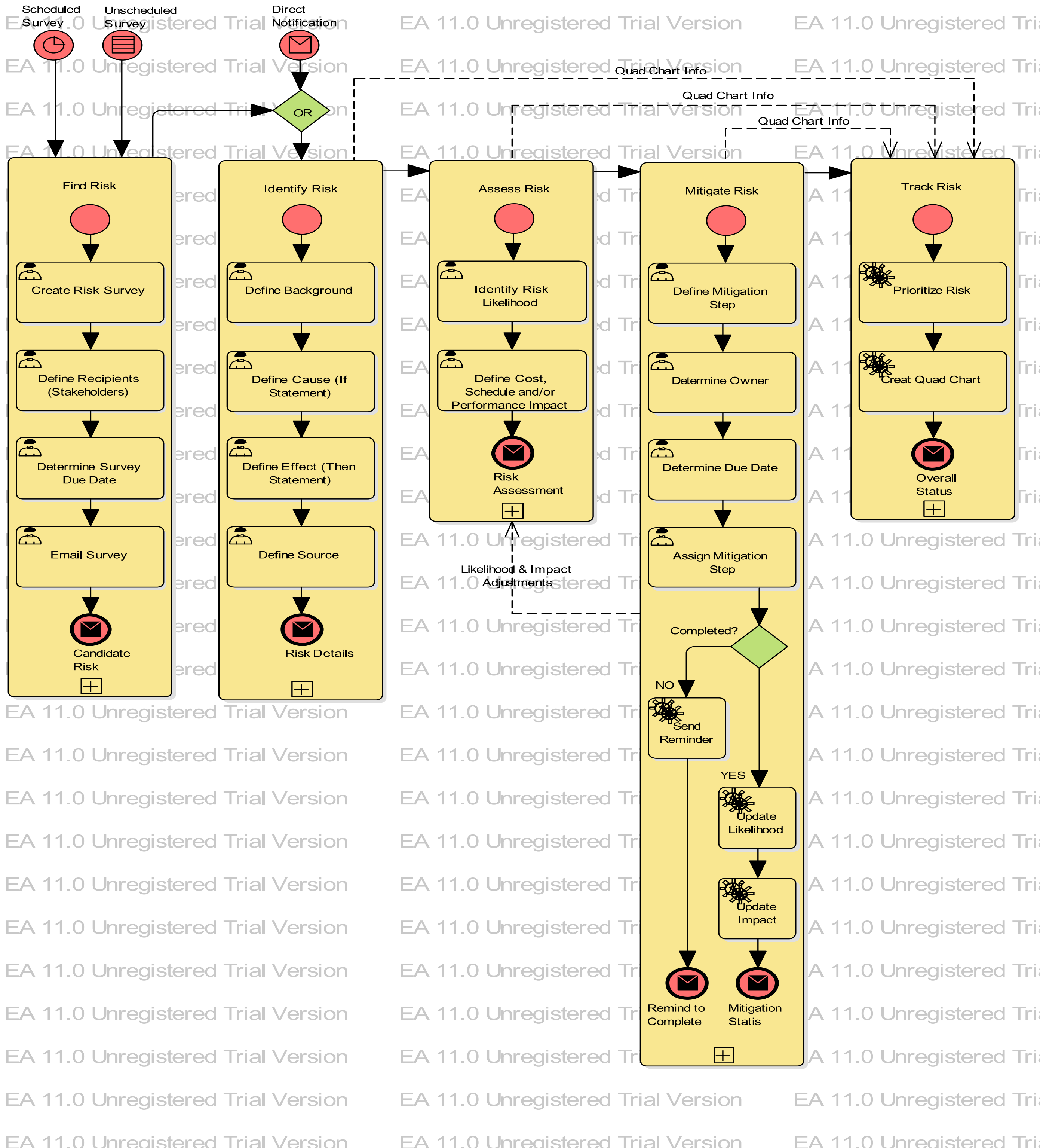
A simple and affordable computer-based tool designed to manage all aspects of PRM should be made available to all PRM stakeholders. Such a tool would most effectively address the deficiencies outlined in the research study if it satisfied the following requirements:

- Shall interface with Microsoft Outlook calendars to send auto reminders about action item due dates and descriptions (Similar to SharePoint)
- Shall interface with Microsoft Outlook email to provide updates and solicit for risk identification and input (Delphi method)
- Shall be virtually accessible simultaneously as to promote real time collaboration
- Shall force a standard reporting format consistent to industry-best-standard accessible at any time to account holders with access rights
- Shall be able to produce reports in Microsoft PowerPoint
- Shall be able to produce reports in portable document format (PDF)
- Shall be able to produce reports in Microsoft Excel
- Shall force all steps of the PRM process
- Shall virtually store identified risks and all salient risk information
- Shall interface with Microsoft Outlook to solicit for risk assessment input (Delphi method)

- Shall track risk assessments to include, but not limited to, trigger criteria, probability, impact, and the compounded effects of multiple risk occurrence (potential effects of mutually inclusive risks)
- Shall automatically track and update reports when risk is reduced through the completion of risk handling action items

The endeavor of implementing a PRM tool, or any tool for that matter, is a daunting and cumbersome task. There would be many aspects to consider such as enterprise-wide installment, compatibility, license accountability, software integration, process integration, funding, and security measures, to name a few. There is also a high potential for conflicts with the current contracts between the Air Force and ARM, not only from a proprietary perspective but also in terms of redundancy. There would most likely be confusion as to which tool to use and how to transition. Planning would have to account for when ARM would terminate and the length of time the new tool would overlap. Coordination efforts would need to consider the transfer of information from ARM to the new tool. Or, if both tools were kept, funding would have to be justified in an already financially strained environment. Much of the pain involved with introducing a new tool could be avoided by enhancing the already approved and existing ARM tool with add-in lite version. Specifically, each full version license should come with ten lite versions that can be distributed to non-SME stakeholders. A lite version would be suitable, available, and useable. Below is a business-process-model-and-notation (BPMN) diagram that graphically represents the process flow for how such a tool fulfill the previously listed requirements.

Figure 6



Proposed PRM Tool – Business Process Model Notation

Recommendations for Future Research

When implementing corrective action and process change, it is important to consider the human element. Further research should investigate the next PRM tool or ARM add-in from a human factors perspective to ensure the "ilities" are in line with what is needed and what will be used. Doing so will ensure the best possible chance for leadership and unit buy-in. In the interviews and the author's experience, buy-in is critical to the success of a new process and/or tool as change tends to be inevitably challenging and inherently resisted.

Training could act as catalyst to the paradigm shift that is needed in Air Force PRM. Not only should training correspond to the latest techniques in the field, it is also an opportunity to introduce and stay current on industry best standards. In addition to opportunities to affect change, training was recognized as a weak area in the research study. It would be advantageous to know what is currently being taught and to what extent.

In addition improving training, the possibility of centralizing PRM change implementation to a "schoolhouse" should be explored. Such a school house could be virtual or physically located where PRM training takes place and would act as the authority for pushing software updates to the new PRM tool as industry best standards change and improve.

Aside from industry best standards as a source for PRM practices and training, other service branches should be researched for examples that work, or do not work, in the unique military setting. Aggregating risk data across the entire DoD would form a higher macro level than previously discussed and work well to inform crucial decisions made at the presidential level.

Summary

PRM is a mainstay in Air Force acquisitions, as missions become ever more challenging, so does the complexity of systems and the associated risk. Air Force acquisitions teams and personnel who rely on intuition and reactionary measures will falter; an effective and comprehensive PRM plan is key to project success. The literature review outlined a series of historical events that prove the worth of PRM. Catastrophe has ensued when PRM was neglected and avoided when PRM was effectively practiced.

Inspired by the potential of PRM in Air Force acquisitions, the author has scrutinized PRM effectiveness directly in the field of study for over nine years. From the author's vantage point, there was evidence of an underlying phenomenon impeding the full potential of PRM in Air Force acquisitions. The scope of this thesis was therefore born out of the author's observations. Specifically, the thesis effort sought to determine if there is indeed inconsistency between Air Force PRM processes, and if confirmed, what the cause is, and the ensuing impact. The literature reviewed supported the author's assumptions that Air Force PRM inconsistencies could be attributed to ambiguous publications, cognitive biases, flawed practices, and inadequate tools. Supporting evidence would serve as an indication of risk mishandling at the Air Force unit level and misinformed decisions at the Air Force enterprise levels.

To build the rapport necessary to initiate corrective action, further validation was pursued. The author's assumptions and findings in the surrounding literature were validated through a qualitative grounded theory research study. The study was designed to interview a pool of twenty subjects who represented a wide slice of Air Force acquisitions personnel. Ultimately, the study provided insight to the underlying phenomenon causing inconsistent and deficient Air Force PRM.

In addition to addressing the initial assumptions, the study revealed trends and patterns in the data to provide new insight into what causes and enables both good and bad Air Force PRM. The information from the research study can be used to focus corrective efforts and changes on the sources of the problems identified. Air Force leaders and units responsible for program execution, and more importantly, the success of warfighters and our Nation's military objectives, must continue to measure and improve project risk management rigor.

Appendix A

Thesis Interview

Thesis: Air Force Project Risk Management (PRM) Inconsistency and Potential Solutions

Study: Investigation of Air Force Project Risk Management process consistency and consequent effects on enterprise acquisition decisions.

Time of interview: _______________

Type (circle one): Phone or In-person

Date: ___________________________

Subject's MAJCOM: _____________

Subject's Position: _______________

Subject Rank: __________________

Subject's Product: _______________

Subject Budget: <$1M - $10M - $100M - $1B<

Verbal Statement for Participants

Hello, I am Captain Eric Perez, a student at the Air Force Institute of Technology pursuing a Masters in Systems Engineering. Towards this effort, I am conducting research under the guidance and supervision of my advisor, Lieutenant Colonel Kyle Oyama. Specifically, you are being asked to participate in a short interview and respond to several open-ended questions. Participation in the interview is voluntary and there is no penalty for non-participation. If you choose to participate in the interview, no personally identifiable information will be collected nor will your unit/organization be identified. Our correspondence for this procedure will be recorded and I will indicate when the recording has been started and ended. You may choose not to answer any or all of the questions. The recording and my subsequent analysis will be kept confidential by storing the data in a password-protected file. Participation in this interview and data collection process is endorsement of your consent. Do you have any questions regarding the explained terms of consent and/or what you are be asked to participate in? I will be investigating the consistency of project risk management (PRM) processes across the U.S. Air Force and its effects on decisions made at the Air Force enterprise level. Thank you in advance for your time.

Background

The research study and the respective interview questions will be investigating the consistency of project risk management processes across the U.S. Air Force and consequent effects on decisions made at the Air Force enterprise level.

Definitions

- Project Risk: future uncertainties relating to achieving program technical performance goals within defined cost and schedule constraints. Defined by (1) the probability of an undesired event or condition and (2) the consequences, impact, or severity of the undesired event, were it to occur (Deputy Assistant Secretary of Defense for Systems Engineering 2014).
- PRM: The iterative process involved with: planning, assessment (identification and analysis), handling, and monitoring of risks throughout the lifecycle of a project or program (Under Secretary of Defense, 2001).
- PRM Consistency: The similarity between the processes used by different organizations to manage the effects of uncertainty encountered in pursuit of baselined objectives.
- PRM Processes: The means by which uncertainty is handled to include: procedures, methods, and techniques.

- Unit: For the purposes of this interview, a unit refers to a group of individuals to which the subject interviewee is affiliated with that share common objectives in Air Force acquisitions.
- PRM Steps: The different phases of the process used to manage risk to include: planning, assessment (identification and analysis), handling, and monitoring.
- Implementation methods: techniques used to carry out the PRM steps unique to the interviewee's unit to include tools, types of communication, assessment approach, data storage, and collaboration methods.

Questions

1. **Primary question:** What is your involvement with the PRM processes within your unit?

Follow-up probe question:

a. How did you become involved in this way?

2. **Primary question:** How does the emphasis on PRM processes at your current unit compare to other units you've been involved with or are aware of?

Follow-up probe questions:

a. In how many different Units have you been involved with the PRM process?
b. Did you encounter or know of any units that either lacked or had little regard for PRM? If so, why do you think that is?
c. Were the differences in emphasis you describe driven by necessity (i.e. differing missions or schedule pressures), differing guidance, or other reasons?

3. **Primary question:** Between the different unit PRM processes you are aware of, what tends to be inconsistent?

Follow-up probe questions:

a. What steps make up your unit's PRM process (Planning, assessment (identification and analysis), handling, and/or monitoring)? Why do you think these specific steps are used?

    i. How are these steps different than other units and what do you think is the cause?

    ii. Do you have examples?

    iii. Do some steps get more emphasis than others? What do you think causes the difference?

b. What tools does your unit use to implement the PRM process? Why do you think these specific tools are used?

    i. How are these tools different than other units and what do you think is the cause?

    ii. Are these tools available to the right personnel (Ex: Active risk manager, MSOffice)? Why do you think these specific tools are available?

    iii. Are the tools you mentioned adequate? Why or why not?

    iv. On which portion of the risk management process are the tools you mentioned actually used? Why or why not certain parts?

c. What techniques does your unit use (Ex: risk matrix, montecarlo)? Why do you think these specific techniques are used?
    i. Do these techniques differ from other units and what do you think is the cause?
    ii. Do you think these techniques are adequate? Why or why not?
d. What publications does your unit use and why do you think that it was selected?
    i. Is it clear which publications to use?
    ii. Are the publications used understandable and specific?
    iii. Are the publications used adequate?
e. What collaboration methods do you use (Ex: Delphi technique, story board, meeting, email) and why were they chosen?
    i. Are the methods you mention different than in other units you know of? Why do you think there is a difference?
    ii. Are the methods you mention adequate (i.e. do you encounter any challenges such as bias, strong personalities, or group think)?
f. What methods does your unit use to report risks (Ex: email, meeting w/powerpoint) and why do you think it is done that way?
    i. Who are the stakeholders that receive the reports (Ex: customer, leadership, peers) and why do you think they are slated to receive this information?
    ii. Does the status of who is receiving the reports effect the risk assessments that are reported?

g. What risk identification methods (Ex: email, meetings, delphi) are used in your unit and why do you think these specific techniques are used?
    i. Are there differences between the methods used in your unit versus other units that you know of, and if so, what do you think is the cause?
    ii. Do you think these methods adequately identify notable risks?
h. What are the analysis techniques used to assess likelihood and impact (Ex: best estimate, metrics used, strategic to fulfill other agendas) and why do you think these specific techniques are used?
    i. Are there differences between the techniques used in your unit versus other units that you know of, and if so, what do you think is the cause?
    ii. Do you think these techniques produce accurate assessments?

4. **Primary question:** Based on the inconsistencies we discussed, how do you think they impact risk assessments, if at all?

Follow-up probe question:

a. Which contributors do you think have the greatest impact? Are the impacts positive or negative?

5. **Primary question:** How do you think inconsistent PRM risk assessments impact enterprise risk management (ERM) decisions at the macro level (Ex: PEM decisions on which projects and programs to fund)?

Follow-up probe question:

a. How do you think inaccurate PRM processes, and ultimately risk assessments, relate to inconsistent risk assessments?

6. **Primary question:** What actions do you think could be taken mitigate the effects of inconsistent PRM risk assessments in the Air Force?
    a. Which contributor(s) to inconsistent Air Force PRM should receive the most focus?

Appendix B

Thesis Interview Follow-up Likert Questions

Thesis: Air Force Project Risk Management Inconsistency and Potential Solutions

Study: Investigation of Air Force Project Risk Management process consistency and consequent effects on enterprise acquisition decisions.

1. For any given risk, units across the Air Force are likely to arrive at the same assessment in terms of the probability and impact that would be reported.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

2. Different units in the Air Force use the same methods and techniques to identify project risks.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

3. Different units in the Air Force use the same methods and techniques to assess project risks.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

4. There is pressure to provide positive news about risks when reporting to supervisors and leadership.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

5. Group dynamics such as group think and strong personalities influence your unit's risk assessments.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

6. There is clear guidance and instruction available to your unit on how to carry out risk management.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

7. Air force guidance and instruction are strictly followed in your unit.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

8. The techniques and methods used by your unit to carry out PRM processes are adequate and are equally as effective as industry best-practices.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

9. The tools used by your unit to carry out PRM processes at the CGO/mid-management level are adequate and are equally as effective as industry best-practices.

Strongly Disagree - Disagree - Uncertain - Agree - Strongly Agree

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14. ABSTRACT

On the surface, the majority of Air Force units appear to be executing some form of project risk management (PRM). Deeper investigation exposes many of the PRM practices currently in place to often be ad hoc, and as such, have the potential to poorly inform decisions when risk data is escalated to the enterprise levels of the Air Force. Resultantly, there is inconsistency between the PRM processes practiced by Air Force units. This inconsistency is an indication of risk mishandling at the project level and erroneous risk data provided at the enterprise levels of the Air Force. It may be the case that PRM process inconsistency could be attributed to ambiguous direction, cognitive biases, flawed practices, and inadequate tools. To investigate whether this is the case, a pool of twenty subjects who represented a wide slice of Air Force acquisitions personnel were interviewed to provide insight to the underlying phenomenon causing inconsistent and deficient Air Force PRM. Specifically, the data collected was sorted and analyzed for trends and patterns concerning current PRM practices. The information from the research study can be used as a launch point to focus corrective efforts and changes on the sources of the problems identified.

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