3-14-2014

Tailoring Systems Engineering for Rapid Acquisition

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TAILORING SYSTEMS ENGINEERING FOR RAPID ACQUISITION

THESIS

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AFIT-ENV-14-M-69

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THESIS

Presented to the Faculty

Department of Systems Engineering and Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Engineering Management

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March 2014

AFIT-ENV-14-M-69

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Abstract

The use of Systems Engineering (SE) is mandated by the Department of Defense (DoD) and United States Air Force (USAF) policy and is to be considered under the purview of the Program Manager (PM). A normal SE program can consist of multiple processes from user requirement generation to the verification and validation of the system under design. The SE process encompasses the entire acquisition program and can take multiple years to conduct with completion only being achieved when the program is disposed of at the end of its life.

Rapid acquisition programs such as those fulfilling a Joint Urgent Operational Need (JUON) can have timelines that are compressed to less than 24 months from the moment the capability gap is recognized to the time that the system is put into operational use. This compressed timeline often necessitates the truncation of some tasks and the removal of others.

This research examines the literature on how the USAF completes rapid acquisitions and compares it to the responses of twelve members of the acquisition community with experience in rapid acquisition. The data is categorized to allow for the main points to be collected explaining how the USAF tailors the acquisition and SE processes. The results showed that while some programs do follow prescribed instructions, most use an ad-hoc execution process, and the Systems Engineering Technical Management Processes were underutilized.

AFIT-ENV-14-M-69

Thank you to my wife for understanding the long hours needed to complete this study and supporting me throughout my time at AFIT.
Also, thank you to my parents for your support and patience with your youngest child. I could not have asked for a better childhood or parents.

Acknowledgments

I would like to thank my research advisor, Dr. David Jacques, for always having time to help me wrap my head around the so called squishy problem of how the Air Force does rapid acquisition. It took a couple of tries to finally settle on a research path and his patience with me as I found a path was much appreciated. I would also like to thank my committee members, Dr. John Colombi and Lt Col Kyle Oyama for continuing to help keep me on that path and moving towards completion of the thesis.

I would also like to thank all of the personnel who took time out of their schedules to discuss this with me and give me the valuable data. Without you I would have been unable to complete this research.

Capt David J. Wilson

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TAILORING SYSTEMS ENGINEERING FOR RAPID ACQUISITION

I. Introduction

General Issue

The use of Systems Engineering (SE) in acquisition programs is mandated by Department of Defense (DoD) and United States Air Force (USAF) policy and is to be considered under the purview of the Program Manager (PM). A typical SE acquisition program can consist of multiple processes from user requirements generation to the verification and validation of the system under design. The SE process parallels the entire acquisition program and typically takes multiple years, or even decades, to complete.

Rapid acquisition programs, such as those fulfilling an Urgent Operational Need (UON) or JUON, can have timelines that are compressed to less than 24 months from the moment the capability gap is recognized to the time the system is put into operational use. This compressed timeline necessitates the truncation of some tasks and the elimination of others. This research examines the SE and acquisition processes that are implemented by different members of the acquisition community to understand how they tailor the processes to meet expedited timelines associated with rapid acquisition programs.

Currently, the Chief Systems Engineer and PM decide what system engineering activities will be completed in accordance with DoD and USAF policy. This means the experience level of both the Chief Systems Engineer and the PM will heavily influence

what they perceive as value added products and required documentation. As SE is very broad and rapid acquisition programs are constrained by the expedited approach, the program will not have enough time to allow for all systems engineering activities to be completed.

Problem Statement

With standard acquisition practices taking too long to be responsive to the urgent needs of a warfighter currently engaged in operations around the world, how does the acquisition community in the Air Force tailor their process to meet that user's needs? This research investigates the different acquisition and SE processes used in rapid acquisition programs and compares them to the military instructions. The objective of the research is to better understand the different ways programs are managed and how the SE processes are used during the lifecycle of these programs.

Rapid Acquisition

The DoD categorizes its acquisition programs based upon the amount of money allocated to different parts of the program. Acquisition Program Category (ACAT) I include programs over $1Billion in research and development funds (Office of the Undersecretary of Defense for Acquisition Technology & Logistics, 2008). These are the major programs of the DoD that take years to develop; however, not all programs reach this level of cost or schedules. Rapid Acquisition programs are considered streamlined programs that "rapidly produce and deliver capabilities" (Joint Chiefs of Staff, 2012). Many programs are considered rapid acquisitions, in which the entire program only has

eighteen to twenty-four months between when the requirements are initiated and when the program is fielded.

New policy being published by the DoD will classify its acquisition programs by schedule, along with the cost associated to the program. This means there are now three new stratifications for projects: 1) rapid, which consist of programs that are scheduled for less than two years of acquisition time before fielding; 2) emergent, which consists of programs that are scheduled for two to six years of acquisition time before fielding; and 3) legacy, which is all programs that will take more than six years of acquisition time to go from need validation to initial fielding (Office Of The Undersecretary Of Defense For Acquisition Technology & Logistics, 2013).

The DoD considers JUONS as rapid acquisition and removes them from the standard acquisition strategy (Gansler & Hughes, 2009). All DoD acquisition programs are required by federal regulations to include systems engineering in their processes. However, inside of a compressed time schedule there is limited time available for most SE processes. As will be seen in the literature review, there is no guidance as to which activities will provide the most benefit for the time invested.

Methodology

This research was designed to answer how the USAF tailors systems engineering and acquisition programs to complete rapid acquisitions. The researcher conducted interviews with twelve members of the Air Force's rapid acquisition community spanning three laboratories, two traditional system program offices (SPO), and two rapid development system program offices inside the Air Force Life Cycle Management Center

(AFLCMC). By using a broad population sample from across the Air Force the data was able to be triangulated to improve the internal validity of the research.

The subject matter experts (SMEs) interviewed were selected for their experience in rapid acquisition and by their availability to the researcher. Twelve SMEs were interviewed from a variety of organizations; however, due to limitations of time, money and access, not all DoD organizations that conduct rapid acquisition were included in this study.

The data collected from the interviews was coded and categorized based upon the content and used to answer the basic questions posed in this thesis; i.e. how does the USAF conduct rapid acquisition?

Investigative Questions

With the inconsistent implementation of tailored acquisition and SE in mind, this thesis focuses on understanding which acquisition and SE activities should be conducted to help the acquisition programs in meeting the user's needs. The following five questions were investigated during this thesis.

1. What processes does the United States Air Force use to complete rapid acquisition projects and programs?
2. Are the observed processes consistent with prescribed instructions?
3. What SE activities are used in rapid acquisition programs in the United States Air Force?
4. How are rapid acquisition programs tailored in the United States Air Force?
5. Which program attributes are used to determine program tailoring?

Summary

This chapter introduced the issues that are facing rapid acquisition in the DoD and Air Force. There have been multiple attempts to accelerate the traditional rapid acquisition process to allow for faster responses to the warfighter. This thesis examines how the acquisition professionals in the Air Force conduct rapid acquisition and the Systems Engineering activities required to meet the expedited timelines. Chapter 2 will discuss the prescribed processes defined by the organizations that conduct rapid acquisition along with the literature review of previous inquiries analogous to this study. Chapter 3 will provide the methodology of the study. Chapter 4 will present the results of the interviews conducted, and Chapter 5 will examine the results and give recommendations for future research and improvements for the study.

II. Literature Review

Chapter Overview

The purpose of this chapter is to review the published literature in the domain of systems engineering along with documentation describing what is required to be completed in the subset of rapid acquisition. This overview lays the groundwork for the research questions outlined in the previous chapter.

Description

The DoD is mandated to use three processes to develop new systems and capabilities; the Joint Capabilities Integration and Development System (JCIDS), the Planning, Programming, Budgeting and Execution System (PPBE) and the Defense Acquisition System (DAS) (Sullivan, 2009). Typical acquisition programs take anywhere from 5 – 15 years, with some major programs such as aircraft or naval vessels taking even longer (Sullivan, 2009). Examples include the F-22 Air Superiority Fighter which entered Demonstration and Validation Phase in 1986 and didn't reach its initial operation capability until 2005, and the Navy's newest nuclear aircraft carrier, the USS Gerald R. Ford which the Navy began funding and development in FY2001 and won't be delivered to the Navy until 2016 (Department of the Air Force, 2008) (Department of the Navy, 2005; Department of the Navy, 2013).

Legacy Acquisition

DoD 5000.1 and 5000.2 are the formal instructions defining the way the military acquires new weapon systems and capabilities. First published in 1971 and evolving out of the Cold-War policies and dictated by federal statutes, the avenues for acquiring

weapons systems and capabilities are organized into a series of decision gates allowing a program to progress from one phase to the next contingent on demonstrating progress towards program objectives and user requirements (Ferrara, 1996). As stated in the current version of the instruction, "evolutionary acquisition is the preferred DoD strategy for rapid acquisition of mature technology for the user" (Office of the Undersecretary of Defense for Acquisition Technology & Logistics, 2008). However, as discussed above and seen below in Figure 1, this is not always the case.

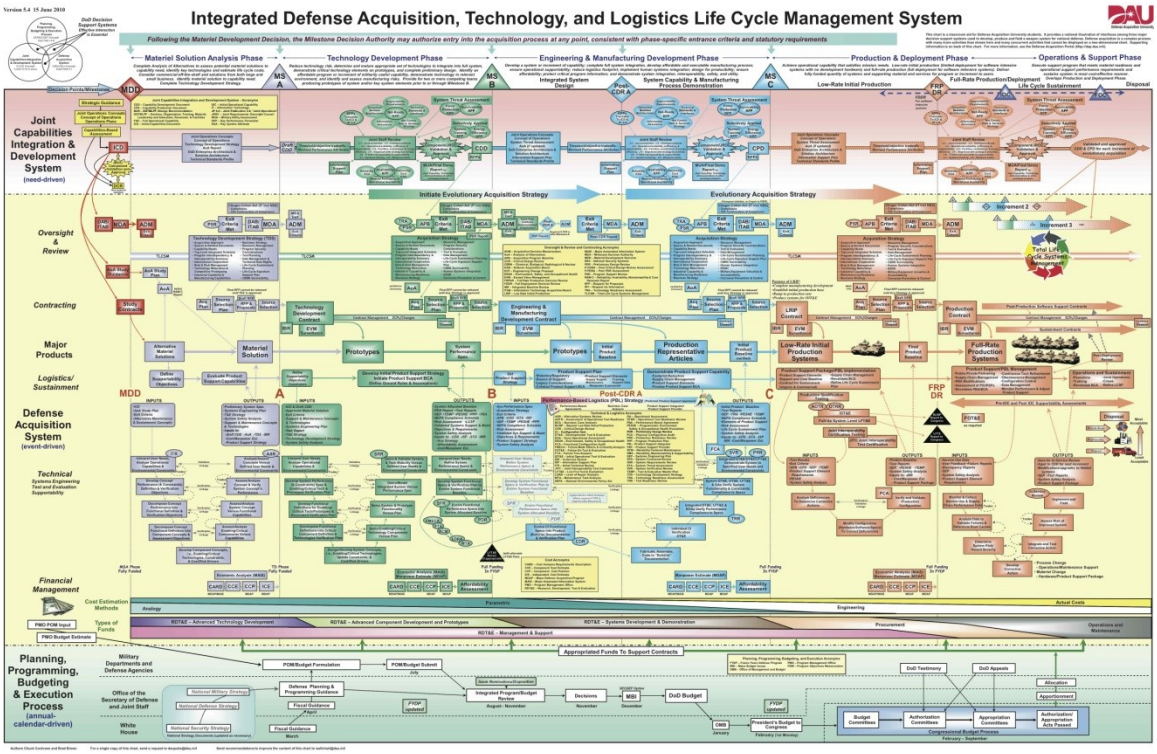

Figure 1 Program Lifecycle (Defense Acquisition University, 2014)

Starting from the left of Figure 1, a requirement is validated and then the program moves from the left to right, going from the Material Solution Analysis Phase to the Technology Development Phase, later to the Engineering & Manufacturing Development Phase, then to the Production & Development Phase and finally onto Operations and Sustainment. Based upon the expected cost of the programs, they will be categorized as

an ACAT Level I, II, or III and, as such, the ACAT level I and II programs will be required to complete more of the activities shown in the chart than those programs designated as ACAT level III (Office of the Undersecretary of Defense for Acquisition Technology & Logistics, 2008).

Need for Rapid Acquisition

The longer timelines of legacy acquisitions are one of the reasons why the military uses JUONs to establish rapid acquisition programs that will meet an operational need within 18 to 24 months. Examples of these accelerated programs include the Mine Resistant Ambush Protection (MRAP) Vehicle which was initiated in 2007 and delivered vehicles by 2008, and the Project Liberty aircraft in which, inside a year of receiving the warfighters need statement, the United States Air Force received their first airframe for deployment (Force, 2010) (Sullivan, 2009).

To meet the timelines associated with rapid acquisition, certain processes normally required under the JCIDS, PPBE and DAS are shortened while others are eliminated or completed after the initial fielding of the system. Per military instruction rapid acquisition is:

> A streamlined and tightly integrated iterative approach, acting upon validated urgent or emergent capability requirements, to: conduct analysis and evaluate alternatives and identify preferred solutions; develop and approve acquisition documents; contract using all available statutory and regulatory authorities and waivers and deviations of such, appropriate to the situation; identify and minimize technical development, integration, and manufacturing risks; and rapidly produce and deliver required capabilities (Joint Chiefs of Staff, 2012).

UONs are "capability requirements identified by a DoD component as impacting an ongoing or anticipated contingency operation. If left unfulfilled, UONS result in capability gaps potentially resulting in loss of life or critical mission failure" (Joint Chiefs

of Staff, 2012). UONs and JUONs are required to be revalidated every 2 years after the original validation date to ensure that the requirement is still valid and to facilitate the transition to an enduring requirement or the assessment of limited duration sustainment (Joint Chiefs of Staff, 2012).

UONs and JUONs are required to have an "assessment of operational utility for the capability solution within 90 days of the initial fielding" (Joint Chiefs of Staff, 2012). This will help facilitate the movement of the program through the transition and to determine its sustainability. There are three assessment categories: Failure/Limited Success, Success/Limited Duration Requirement, and Success/Enduring Requirement (Joint Chiefs of Staff, 2012).

Prescribed Rapid Acquisition Processes

AFI 63-114 is the set of instructions given by the USAF on how it answers UONs, JUONs or Chief of Staff of the Air Force (AF/CC) directions. It is meant to provide a framework for PMs to satisfy the urgent needs of the warfighter's to reduce the capability gap -defined in the requirements documentation. A program is designated as a Quick Reaction Capability (QRC) by the milestone decision authority (MDA) based upon the following three triggers, with an expected timeline for a QRC of 180 days to 2 years (Department of the Air Force, 2011).

1. Trigger 1 is a UON given by a Commander Air Force Forces (COMAFFOR) such as the Commander of Air Combat Command (COMACC).

2. Trigger 2 is a JUON from a Unified Combatant Commander such as the Commander of Central Command (CENTCOM) or Pacific Command (PACCOM). The JUON will be validated by the Joint Requirements Acquisition Cell (JRAC) and passed on to the lead service.

3. Trigger 3 is if directed by the AF/CC to "rapidly fulfill a validated urgent operational need" (Department of the Air Force, 2011).

The designation as a QRC allows the programs to minimize the number of reviews that are required and provides access to exemptions and waivers not normally given to traditional acquisition programs. There are four phases for a QRC after its requirements have been validated: Course of Action (COA) Development, Materiel Development Decision (MDD), Execution, and Transition. This process is shown below in Figure 2.

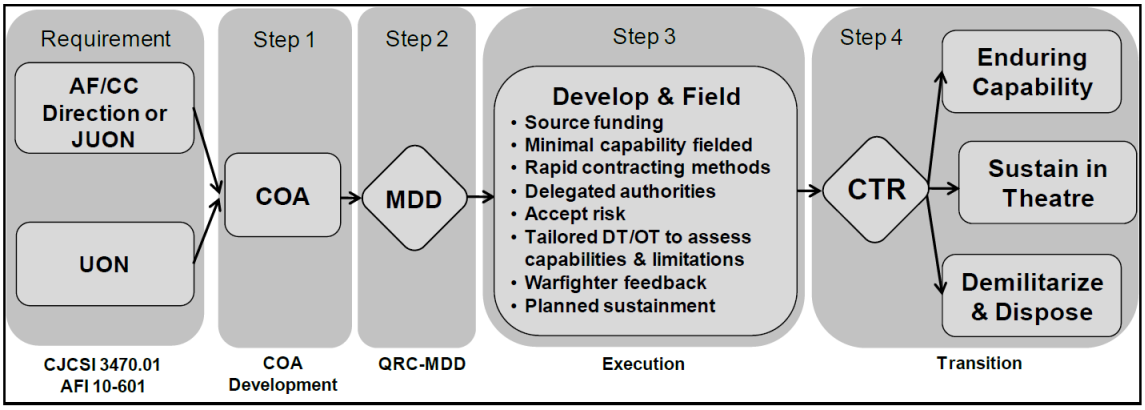

Figure 2 QRC Process (Department of the Air Force, 2011)

In COA development the PM decides on which of the different possible COAs that the program will follow. During the MDD the proposed solution from the previous phase is validated and officially chosen. The Execution phase is where the bulk of the work for the program is completed, with the engineering design, testing and initial fielding completed during this phase. The Transition phase is the process in which the program is either transitioned to an enduring program of record, sustained in-theater only, or demilitarized and disposed of. (Department of the Air Force, 2011)

An important aspect for the QRC programs is tailoring. It is directed that the QRC programs will use an expedited review process along with streamlined

documentation and certifications to the "maximum extent possible and accept appropriate risk to provide rapid capability to war fighting commanders" (Department of the Air Force, 2011). As such, if it is not a statutory requirement, QRCs will most likely tailor regulatory requirements while keeping documentation and certifications to a minimum. The AFI also states that the QRC will only "provide or modify the minimum number of systems needed for testing and in-theater operations" (Department of the Air Force, 2011).

Systems Engineering

The International Council on Systems Engineering (INCOSE) defines SE as "a discipline that concentrates on the design and application of the whole (system) as distinct from the parts" (Haskins, Forsberg, & Krueger, 2006). Alternatively the DoD defines SE as "integrating technical processes to define and balance system performance, cost, schedule, and risk within a family-of-systems and systems-of-systems context" (Department of Defense, 2008). The Defense Acquisition Guidebook (DAG) defines SE as "is a methodical and disciplined approach for the specification, design, development, realization, technical management, operations, and retirement of a system" (Defense Acquisition University, 2004). INCOSE views SE as a collection of different processes that allow the optimization of a complex problem set. In the DoD acquisition world SE has evolved into multiple Technical Processes and Technical Management Processes.

For any acquisition program in the DoD, either traditional or rapid, the PM has the responsibility to ensure the program is executed properly, instructions and laws are followed, establish who the stakeholders are and their requirements, coordinate all

acquisition and SE plans, ensure decision are documented, and manage risk (Defense Acquisition University, 2004).

The Systems Engineer is responsible for the execution of the SE plan created with the PM, understanding the context of the proposed system within the system-of-systems, assessing process improvements, managing the technical risks of the program, overseeing the program's technical reviews, ensuring the test and evaluation master plan is being followed, and reviewing the deliverables from contractors (Defense Acquisition University, 2004).

According to Defense Acquisition University (DAU), SE can be thought of as 16 interrelated processes, categorized as either technical processes or technical management processes as seen in Table 1. The eight technical processes are the "top-down design processes and bottom-up realization processes" needed to take a user's needs and produce a working system. This is contrasted with the eight technical management processes which "provide insight and control to assist the Program Manager and Systems Engineer to meet performance, schedule, and cost goals" (Defense Acquisition University, 2004).

Table 1 Systems Engineering Processes

Technical Processes	Technical Management Processes
Stakeholder Requirements Definition	Technical Planning
Requirements Analysis	Decision Analysis
Architecture Design	Technical Assessment
Implementation	Requirements Management
Integration	Risk Management
Verification	Configuration Management
Validation	Technical Data Management
Transition	Interface Management

Technical Processes

The first Technical Process to discuss is the Stakeholder Requirements Definition Process in which the PM will "elicit, negotiate, document and maintain stakeholders' requirements for the system-of-interest within a defined environment" (Haskins et al., 2006). The Stakeholder's Requirements Definition Process allows the designated lead office to work with the program stakeholders to define the requirements for the system and translate those system level requirements into technical requirements (Defense Acquisition University, 2004). The user requirement typically requires refinement by the acquisition program office so that the overall program can be scoped and be managed to balance user needs and system performance with schedule and cost. This process ensures that the different stakeholders all have a say in the system definition and agree on the future vision of what the system will be capable of doing. This process helps to complement the Architecture Design Process and the Requirements Analysis Process by reducing the chance of requirements creep and a change in focus of the system (Defense Acquisition University, 2004).

The next process is the Requirements Analysis Process where the PMs "review, assess, prioritize, and balance all stakeholder and derived requirements (including constraints), and to transform those requirements into a functional and technical view of a system description capable of meeting the stakeholders' needs." This decomposition of the stakeholders' requirements into system specifications allows for the system to be designed without introducing "implementation biases" (Haskins et al., 2006). During the beginning of the program the process is used in concert with the Stakeholder's

Requirements Definition Process to define what the system will be required to do, but as the program matures and the design becomes more defined the process should "support allocation and derivation of requirements down to the system elements representing the lowest level of the design" (Defense Acquisition University, 2004).

INCOSE views the Architecture Design Process as the creation of a "system architecture baseline that satisfies the requirements" (Haskins et al., 2006). Another view is that the Architecture Design Process allows the PM and SE to "translate the outputs of the Stakeholder Requirements Definition and Requirements Analysis Processes into alternative design solutions" (Defense Acquisition University, 2004). This architecture is used to examine any configuration changes that are brought up in the design process and to ensure that system interfaces have been discussed. The Architecture Design Process, along with the Stakeholder Requirements Definition and Requirements Analysis, combine to provide insights into technical risks along with mitigation strategies for the program. Defining and analyzing the architecture during this process allows the PM and SE to look at concepts such as maintainability, sustainability, performance and cost before finalizing the expected design (Defense Acquisition University, 2004).

The Implementation Process's purpose is "to design, create or fabricate a system element conforming to that element's detailed description" (Haskins et al., 2006). That is to say that the Implementation Process is when the different parts of the user's product are physically created. There are two phases for the Implementation Process: design and realization. The design phase includes the engineering and contracting activities to develop the "detailed design down to the lowest level system elements in the system architecture" (Defense Acquisition University, 2004). The realization phase of the

Implementation Process is "the process of building the system elements using specified materials and fabrication and production tools/procedures identified during the design" (Defense Acquisition University, 2004). This could include manufacturing or coding the part to meet all the specifications spelled out in the previous processes.

The Integration Process is how the subsystems created during the Implementation Process connect together to form the full system. It combines all of the individual parts to "realize the system-of-interest […] in accordance with the architectural design requirements and the integration strategy" (Haskins et al., 2006). This is an iterative process where all of the design considerations will be implemented to ensure that the different parts of the system all correctly fit together to meet the purpose of the user. This works in concert with the Verification process to ensure that each part and subsystem meets the requirements for it. The Interface Management Process helps ensure that each subsystem is able to connect to the correct mate and that the system as a whole is able to connect to other systems as required for the capability being provided (Defense Acquisition University, 2004).

The Verification and Validation Processes include SE activities in which the PM verifies that the requirements are being addressed in the design and then validates that the product produced meets the requirements of the user (Haskins et al., 2006). The Verification Process ensures that each "system element performs its intended functions and meets all performance requirements listed in the system performance specification" (Defense Acquisition University, 2004). In other words, verification ensures that what was built was done correctly. This can be done by a combination of demonstration, examination, analysis, and testing. The Validation Process is the way that the PM and SE

can prove that the system built is correct for the needs stated by the stakeholders. If the Verification process asks "did we build what we wanted to," then the Validation process asks "did we build what we needed" (Defense Acquisition University, 2004)? This process consists of evaluations that examine the system for operational suitability, effectiveness sustainability and survivability under realistic environmental constrains.

The Transition Process's purpose is "to transfer custody of the system and responsibility for system support from one organizational entity to another" (Haskins et al., 2006). The Transition Process is how the system will be delivered to the end-user. This includes training personnel to use the system, the installation of the system and the delivery of any manuals or technical data to the correct stakeholder. The Transition Process begins early in the development of the system to allow for proper transitioning of the system and includes maintenance and support functions for the entire system under design (Defense Acquisition University, 2004). This is a crucial step in the acquisition process as this is when the program is turned over to the user to be implemented in the field, and in the case of the DoD this is when warfighters' lives could be at stake depending on how well the system is designed.

Technical Management Processes

The first of the technical management processes (TMPs) is Technical Planning which includes "defining the scope of the technical effort required to develop, field, and sustain the system, as well as providing critical quantitative inputs to program planning and life-cycle cost estimates" (Defense Acquisition University, 2004). Technical planning allows the Systems Engineer and the PM to plan for and program money for different planned activities along with helping to create a foundation for the risk

management process and the creation of the measures that will be used during the Technical Assessment Process (Defense Acquisition University, 2004). This process is continually re-evaluated at each phase of the acquisition program.

The Decision Analysis Process is the way that the DAG defines the decision making process to allow for traceability of decisions along with the creation of an actionable plan (Defense Acquisition University, 2004). It has multiple levels, with multiple lower level discrete analyses' being "aggregated into a higher-level view relevant to the decision maker and other stakeholders" (Defense Acquisition University, 2004). This process should influence and interact with other SE processes including: Technical Planning, Technical Assessment, Stakeholder Requirements Definitions, Requirements Analysis, and Architecture Design (Defense Acquisition University, 2004).

By conducting the Technical Assessment Process the Systems Engineer is able to "compare achieved results against defined criteria to provide a fact-based understanding of the current level of product knowledge, technical maturity, program status, and technical risk" (Defense Acquisition University, 2004). This process allows the PM to have access to data to conduct decisions about the program. It is conducted throughout the life-cycle of the program and provides the data necessary to make any corrections needed for the program.

The Requirements Management process ensures that the program turns out a capability or item that meets the needs of the end user (Defense Acquisition University, 2004). Those needs are normally defined during the Stakeholder Requirements Definition process along with the Decision Analysis Process and are updated as required for changes provided by the stakeholder (Defense Acquisition University, 2004). This

process also allows for the traceability of high level requirements to detailed design specifications and vice-versa. By allowing a two-way traceability it ensures that no detail specifications are orphaned from system needs nor are any system needs not meet during the design (Defense Acquisition University, 2004).

The Risk Management Process is "the overarching process that encompasses identification, analysis, mitigation planning, mitigation plan implementation, and tracking of program risk" (Defense Acquisition University, 2004). Risk is defined as "an unwanted event that may or may not occur in the future" and needs to be managed at all phases of the program (Defense Acquisition University, 2004). This process allows the PM and SE to manage the program and minimize the programmatic and technical risk of the program.

Configuration management is more than ensuring the output of the program is in controlled versions for upgrades, it "allows technical insight into all levels of the system design and is the principal methodology for establishing and maintain consistency of a system's functional, performance, and physical attributes with its requirements, design, operational information throughout the system's life cycle" (Defense Acquisition University, 2004). While the processes is ongoing during all phases of the program it is important that the different baselines, such as the functional and allocated baselines, are used in ensuring the correct configuration is being worked on by the program team.

AFRL Systems Engineering

AFRLI 61-104 defines how the Air Force Research Laboratory (AFRL) PM and scientists look at SE with respect to reviewing and executing programs under their purview. It is derived from the 16 processes defined in the DAG and should be tailored

for the particular projects and programs that are being conducted in the lab. The process described in AFRLI 61-104 is how AFRL "[decomposes] scientific research objectives to knowledge, or capability needs to technology alternatives" (AFRL, 2013b). The below figure shows how AFRL views their process and incorporates the 8 Technical Management Processes and 8 Technical Processes defined in the DAG.

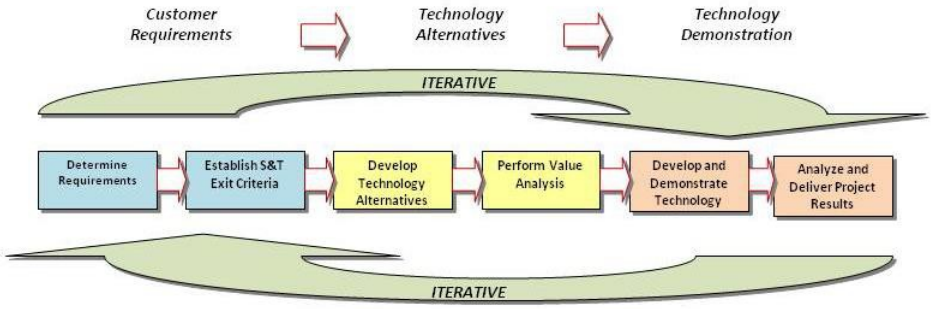

Figure 3 S&T Systems Engineering Process (AFRL, 2013b)

The AFRLI recommends that the 8 TMPs be conducted "continuously and concurrently while the eight technical processes are performed sequentially, although with considerable iteration and feedback checking" (AFRL, 2013b).

The AFRLI also lists eight questions that it expects its PMs and SEs to use during the assessment of their programs. These questions were derived from the 16 DAG processes.

1. Who is your customer?
2. What are the customer's requirements?
3. How will you demonstrate you have met the requirements?
4. What are the technology options?
5. Which is the best approach?
6. What are the risks to developing the selected technology?

7. How will you structure your program to meet requirements and mitigate risk?
8. What is your business-based transition plan that meets customer approval?

As can be expected, the eight questions tie in with the 16 processes described in the DAG and are used to "assess the sufficiency of the SE process on a particular S&T program" (AFRL, 2013b).

Tailoring

The need for tailoring is paramount in rapid acquisition, not only tailoring the acquisition processes used but also the SE activities completed, and the tailoring should "reflect the system's maturity and complexity, size and scope, [and] life-cycle phase" (Defense Acquisition University, 2004). Rapid acquisition is often tailored due to the smaller scope and less complex solutions that are required to meet the expedited timelines. SE processes are normally designed "with the mindset of developing a completely new complex system" (Pickard & Nolan, 2010). Pickard and Nolan recommend using Risk Management and Probability Calculus to determine which processes need to be completed and to what level of rigor. Risk Management is the SE process used to identify and reduce uncertainty (Pickard & Nolan, 2010). Probability Calculus is the comparison of the cost of preventive measures versus the probability of harm multiplied by the loss. If the cost is less than the product of the harm and loss then the preventative measure should be included, and if the cost is greater then it should be excluded. In the context of rapid acquisition tailoring, engineering design and all of the SE and acquisition processes used can be considered a risk mitigation process whereby "every requirements specification, every architecture, every drawing, every analysis and

every test is aimed at reducing the risk that the solution will not be fit for purpose" (Pickard & Nolan, 2010).

Pickard and Nolan focus on two types of tailoring: "a decision about whether to apply a process, and the second is to choose between two alternative processes" (Pickard & Nolan, 2010). The first is examining which process to include or exclude while the second is determining which of two processes to include when they both will meet a certain need or requirement. They found the introduction of risk into the system in a controlled manner is acceptable, with an understood trade-off in the value of the system. They do give one caveat on where not to tailor a program, safety critical systems. As the probability of occurrence is defined, such as 1 failure in 10,000 hours of usage, "all mitigations required to achieve this level of probability of occurrence have to be applied and cannot be tailored out" (Pickard & Nolan, 2010).

Beasley and Partridge discuss the fact that optimizing each subsystem does not mean you are optimizing the overall system; the focus needs to be on "trying to make the best system it can [be]" (Beasley & Partridge, 2010). This focus can help alleviate the sub-optimization of the overall project by optimizing a sub-activity or process. Each process must work in harmony with the others so that the goal of an optimized system can be achieved.

Previous Research

The study completed by Capt Kipp Johnson looked at the rapid acquisition case study of the Self-Awareness Space Situational Awareness (SASSA) Program and how that program used a tailored versus DoD prescribed Systems Engineering process. The

author found that while the program deviated from standard SE processes, not all of the changes were beneficial to the programs performance, schedule and cost (Johnson, 2010). He found that by exempting SASSA from the JCIDS process the program was able to "move more quickly than a JCIDs program" while also running the risk that the final output of the program might not meet the user's needs (Johnson, 2010).

Another study looked at different principles of rapid acquisition to determine how the systems engineering process could be tailored. This was done by interviewing the senior leaders for a number of AFRL programs and creating a framework to define the level of rigor that the different systems engineering processes should be completed to. Their findings and associated framework, while helpful to a program manager in a holistic sense at AFRL, is not generalizable to non AFRL projects and programs (Behm, Pitzer, & White, 2009).

One of the key research questions postulated by Smith (2011) was "what accepted activities in rapid development literature and practice correlate to Defense Acquisition SE activities" (Smith, 2011). His analysis of the literature showed that stakeholders' requirements definition, architecture design and technical planning were all emphasized. This was completed using a qualitative analysis of the literature and focused interviews with leaders in AFRLs core process programs administering rapid development programs trying to deliver new technologies inside of two years. While this framework states a qualitative view that these processes are the most important it does not go into detail on the level of tailoring that best suits different projects or how they interact with other processes to create a successful program.

In 2012 AFIT's Systems Engineering Research Center (SERC) published its report on Expedited Systems Engineering for Rapid Capability and Urgent Needs which discussed its findings on the different ways that rapid acquisition can be completed. It makes recommendations based upon three areas: 1) organizational best practices; 2) "go fast" cultural best practices; and 3) "rapid world" best practices.

They found that "rapid requires an integrated approach: People making judgments, Processes for task reductions, and Product aspects focused on rapid objectives" (Lepore & Colombi, 2012). When looking at the organizational best practices with respect to this thesis, the report recommend the use of mature technology and "focus on the state of the possible" (Lepore & Colombi, 2012). The authors recommended using a stable requirement list gathered from the customer while using an incremental development process for the system under design. Other recommendations included the acceptance of some risk and trying to exploit any flexibility allowed (Lepore & Colombi, 2012).

The findings for cultural best practices include the use of "intense and efficient knowledge sharing […] to enable stabilization and synchronization of information" (Lepore & Colombi, 2012). One other important recommendation at the "rapid world" level is that the DoD should focus not on having a single rapid organization, but many flexible rapid development teams with a shared knowledge base (Lepore & Colombi, 2012).

Summary

This section discussed how the DoD views SE and what has been previously researched. It has showcased the different technical and technical management processes

incorporated into the larger SE process, while also laying the framework for the research questions that this thesis addresses.

III. Methodology

Chapter Overview

The purpose of this chapter is to explain the methodology used to understand the acquisition and SE processes used by the United States Air Force to complete rapid acquisition and how those programs were tailored to meet the expedited schedule requirements. There are five research questions investigated during this research:

1. What processes does the United States Air Force use to complete rapid acquisition projects and programs?
2. Are the observed processes consistent with prescribed instructions?
3. What SE activities are used in rapid acquisition programs in the United States Air Force?
4. How are rapid acquisition programs tailored in the United States Air Force?
5. Which program attributes are used to determine program tailoring?

This research was completed in a four step process based upon the qualitative research design described by Merriam, in which the first phase is the literature review, followed by purposeful sampling and data collection. The third phase is the analysis of the collected data, and the fourth and final phase is drawing conclusions with respect to the research questions (Merriam, 2009). Figure 4 shows the methodology process used during the study.

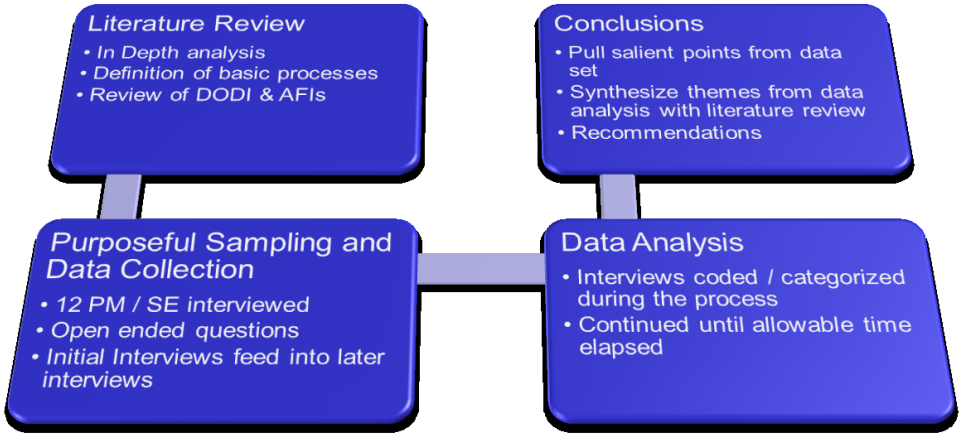

Figure 4 Qualitative Methodology Process

Setting

This is a qualitative study examining how the Air Force completes rapid acquisition. The interviews were completed in two locations: face to face at AFIT and over the phone while the interviewees were at their work locations. The location at AFIT allowed for a quiet situation with little to no distractions for the interviewee. The phone interviews were conducted to minimize the disruption to the interviewee's work and to facilitate the interviewing of personnel who were not located at Wright-Patterson AFB.

Participants

The SMEs themselves were selected because they are acquisition personnel who have experience in the rapid acquisition processes. Due to the small population of program managers with rapid acquisition experience and the time frame associated with this research, the number of interviews was kept to twelve. The sampling technique used in this thesis was a non-probabilistic purposive-based sampling where initial SMEs were selected based upon personal recommendations from the research committee. Then, the

SMEs were asked to recommend others that they have worked with that had the necessary background to be included in the study. This type of snowball sampling helps to reach underserved or hard to reach populations such as rapid acquisition SMEs required for this thesis (Lund Research Ltd, 2012). As mentioned, due to time constraints associated with the research program, the total number interviews conducted was capped at twelve to allow proper time to conduct data analysis and to draw conclusions.

As mentioned previously, the participants were selected as SMEs with experience in rapid acquisitions within the Air Force. These participants were required to have been associated with rapid acquisition programs and to have knowledge and understanding of how they were conducted and what processes were used. Of the twelve participants, all were members of the Air Force; nine were civilian employees, two were Officers and one was a contractor. Two had reported spending a portion of their career at a systems program office (SPO), with five having spent time working in AFRL. Due to the need for the respondents to be experts in their fields, many of the participants held a senior level position inside their respective organizations with nine being considered senior (equivalent of government service (GS) level 14-15), two mid-level (GS level 12-13), and one contractor (AFRL, 2011). The seniority level of the SMEs is shown below in Figure 5.

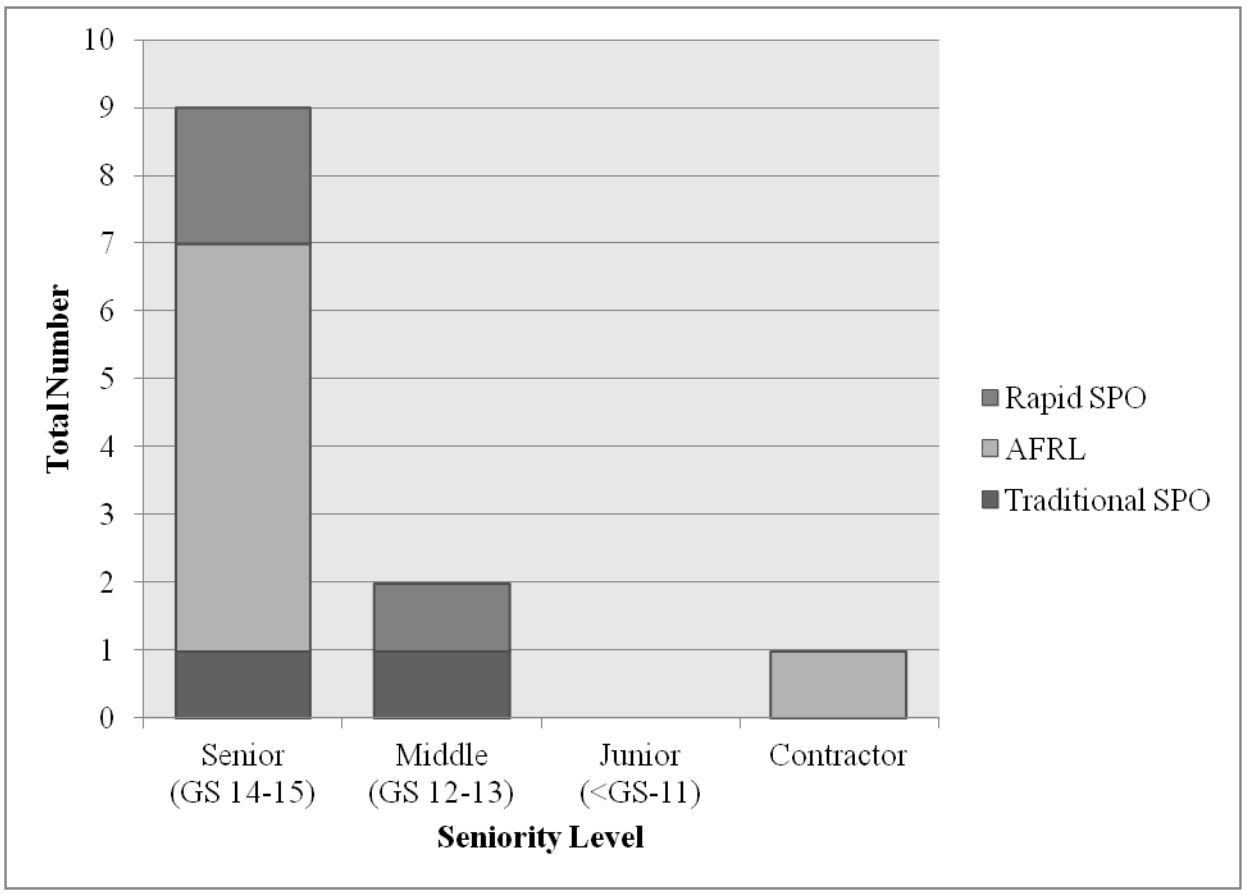

Figure 5 Seniority Level of SMEs

The SMEs interviewed for this study had different backgrounds and experiences with rapid acquisition and the acquisition process as a whole. Five personnel work in AFRL on rapid development projects in various locations, while another two work as senior leadership at one of the laboratory directorates and will be referenced as lab personnel for the duration of this thesis. Two personnel work in traditional program management positions in program offices at AFLCMC and will be referenced as Traditional SPO personnel. Another two SMEs work at an organization focused on rapid design and prototyping which is managed by AFLCMC. The final interviewee was a PM at an office that works on sensitive rapid acquisition for the intelligence community. These final three SMEs are designated as Rapid SPO personnel due to the uniqueness of

their programs with respect to the acquisition corps as a whole. The distribution of personnel interviewed can be seen below in Figure 6.

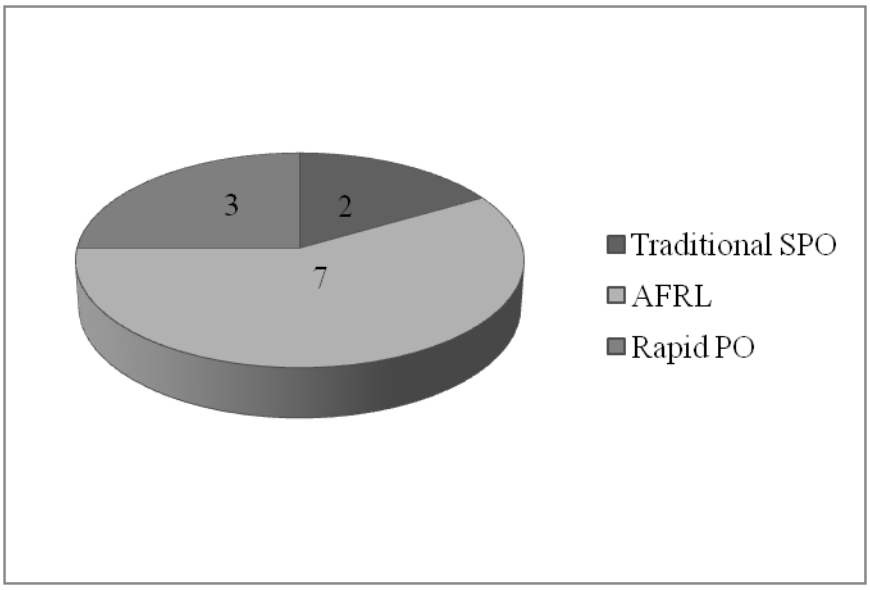

Figure 6 Personnel Distribution

Measurement Instruments

To collect the data from the participants, a semi-structured interview was conducted to elicit responses. The interviewees were instructed that they would be asked sixteen questions and they did not have to answer any or all of the questions. A copy of the interview protocol used during the interviews is included in Appendix A.

The purpose of the interviews was to gather knowledge from the different SMEs to understand the different processes used across the Air Force. Interviewing the SMEs allowed the researcher to gather data from across many programs but to keep the sensitive nature of the programs at bay as they were not discussed in any detail that might compromise the programs or this research. The information was recorded in all of the interviews except one, so that the data could be transcribed and then coded during the data analysis phase. For the one interview that wasn't recorded, notes were taken and

then reviewed by the interviewee to ensure that the answers were 100% factual to what was discussed during the interview. Another outlier was interview #10 in which the interviewee brought a second SME to the interview. Their responses are combined in Appendix D, Summary of Interview 9.

The interview questions were created specifically to answer the research questions of this thesis. The purpose of the interview questions was to elicit responses from the interviewees with regard to their experience with rapid acquisition in the Air Force. The interviews ranged from 30 minutes to an hour and a half depending on the respondent's comments and the need for follow up questions from the interviewer for clarification of any answers. The questions were sent to all of the interviewee's before the interview to allow them to familiarize themselves with the content of the interview and gather any information they would need to answer the questions. An attachment was also sent to each interviewee that explained the eight SE management processes and eight technical management processes as defined by the Defense Acquisition Guidebook (DAG) as seen in Appendix B. This attachment also included nominal sub processes that one would expect to complete with respect to the sixteen SE processes as culled from the thesis of Maj Behm, Maj Pitzer and Ms. White (Behm, Pitzer, & White, 2009).

Validity and Reliability

Validity is "the extent to which the instrument measures what it was intended to measure" (Bui, 2014). The interview script was designed specifically for this research and it was reviewed by SE and PM experts to ensure that the questions being asked would result in the answers that were applicable to the research. Another aspect of validity comes from data triangulation, which refers to taking a broad sampling of data

from multiple collection points as was done here, i.e. interviewing personnel from multiple Air Force agencies. Data collection from multiple people and agencies helps to raise the internal validity of the research because it reduces bias from any one viewpoint (Merriam, 2009).

Procedure

The data was collected through semi-structured interviews. As discussed in the Setting section, the interviews were conducted both face-to-face and over the phone due to travel and time limitations. When the interviews were conducted in person, they were completed at the AFIT campus in a room free of interruptions and distractions. When conducting the phone interviews the interviewee was at their work desk. This allowed the interviewee to feel comfortable and secure in their surroundings. Before each interview, the interviewer would complete some short personal discussion with each interviewee to put the participant at ease and to build rapport. At the start of each interview, the interviewer would ask if the interviewee would allow the interview to be taped and transcribed for data analysis purposes. Each interview then began with a reading of a preamble to remind the interviewee of the subject that was to be discussed. The interviewer would then pose each question to the interviewee in turn, asking follow-up questions as needed, as shown in the interview protocol in Appendix A. After the interview was completed each taped interview was transcribed using a denaturalism methodology that removes "idiosyncratic elements of speech (e.g. stutters, pauses, nonverbals, involuntary vocalizations)" (Oliver, Serovich, & Mason, 2005). The use of a verbatim transcript was used to minimize investigator bias before handling and

interpreting the data (Halcomb & Davidson, 2006). Each question posed during the interview was mapped to one of the research questions, as shown below in Table 2.

Table 2 Interview Questions

Interview Question	Research Question
1. What experience do you have with rapid acquisition?	N/A
2. What process have you seen being used to complete rapid acquisition programs?	1
3. Does your office follow the QRC process defined in AFI 63-114?	2
4. How do these programs begin (i.e. initiation by UON/JUON, technology push.)?	2
5. How iterative is the rapid acquisition process that your office uses?	2
6. Do you view rapid acquisition as an incremental process or a single time solution?	2
7. What SE activities did your programs include?	3
8. How did you decide which processes to include?	3
9. How iterative are the SE activities used in your programs?	3
10. What interactions did you see between the SE process included or excluded?	3
11. How have projects you have been involved in tailored the acquisition process?	4
12. How do you determine to what level a program needs to be tailored?	4
13. What effects did tailoring have on the overall project?	4
14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?	4
15. What attributes does your organization use to determine how a program is tailored?	5
16. What interactions are observed between the attributes and the outcome of the program?	5

Data Analysis

The data analysis consisted of four phases: open coding, analytical coding, category construction, and drawing conclusions. Open coding is described as the taking of notes based upon data collected from the SME interviews. These are the researcher's thoughts of what the data is describing and are not limited to preconceived concepts (Merriam, 2009). Each transcript is analyzed through the open coding process and has notes describing what the key thoughts and ideas are. These notes were placed on

printouts of each transcript and then recorded in a Microsoft Excel file that annotated the interview number, page and line number of the data along with the code.

The second phase is analytical coding which is described as the grouping of the open codes (Merriam, 2009). In this phase the codes themselves are interpreted and grouped based upon the meanings of the data. This was completed in the Excel file by grouping each data point with others that shared common points or themes. These groups lead to the next phase of the data analysis.

The third phase is the construction of the different categories based upon the analytical coding of phase two. The categories are populated by the data points that are culled from the analytical coding based upon patterns and any commonality found. Each category was analyzed and modified as more of the interview data was incorporated into the pool of analyzed data. The categories had five criteria that they had to meet before they could be considered as a final category for the research: "be responsive to […] the research questions, be as sensitive to the data as possible, be [collectively] exhaustive, be mutually exclusive, [and] be conceptually congruent" (Merriam, 2009).

Examining the five criteria further we see that responsiveness means that each category should somehow be related to and answer one of the research questions purposed by this thesis (Merriam, 2009). Sensitive categories should be named in such a way that "an outsider should be able to read the categories and gain some sense of their nature" (Merriam, 2009). Exhaustive means that all of the relevant data is placed into one of the categories while mutually exclusive means that each relevant data point is place only able to be placed in a single category (Merriam, 2009). The final criterion, conceptually congruent, means "that the same level of abstraction should characterize all

categories at the same level" (Merriam, 2009). The final categories and codes used during the study will be discussed further in Chapter 4.

The final phase of the data analysis is the drawing of conclusions that answer the research questions. This is done by examining each of the categories that were created to describe the data collected and then pulling the salient points and themes out. Assumptions and Limitations

The assumptions made in this thesis are as follows. It was assumed the SMEs were actually subject matter experts and they would have said they did not qualify for the study if that was the case. This assumption was validated by the first question of the interview in which the SMEs were asked to describe their experience with rapid acquisition.

Another assumption was that, collectively, the SMEs interviewed represent a cross-section of the rapid acquisition efforts of the Air Force. Due to time and availability constraints some offices were not interviewed or were unable to participate in this study. As such the generality of this thesis could be limited by the lack of fully including all areas of Air Force rapid acquisition.

Summary

This section discussed the methodology of the interviews and data analysis conducted for this thesis. By interviewing SMEs and analyzing their comments, a broad understanding was reached regarding what the Air Force does in support of rapid acquisition, and the SE processes that go along with the tailoring that is done to ensure meeting the timeline. These results are discussed in Chapter 4.

IV. Results

Chapter Overview

The purpose of this chapter is to examine the results of the interviews and draw conclusions from the data to answer the five research questions posed earlier.

1. What processes does the United States Air Force use to complete rapid acquisition projects and programs?
2. Are the observed processes consistent with prescribed instructions?
3. What SE activities are used in rapid acquisition programs in the United States Air Force?
4. How are rapid acquisition programs tailored in the United States Air Force?
5. Which program attributes are used to determine program tailoring?

Each interview was transcribed verbatim and then coded and categorized based upon the content provided by the interviewees. An example of a coded portion of an interview transcript is shown below in Figure 7. As stated earlier, each main category meets the five requirements: be responsive to the research questions, be as sensitive to the data as possible, be exhaustive, be mutually exclusive, and be conceptually congruent (Merriam, 2009).

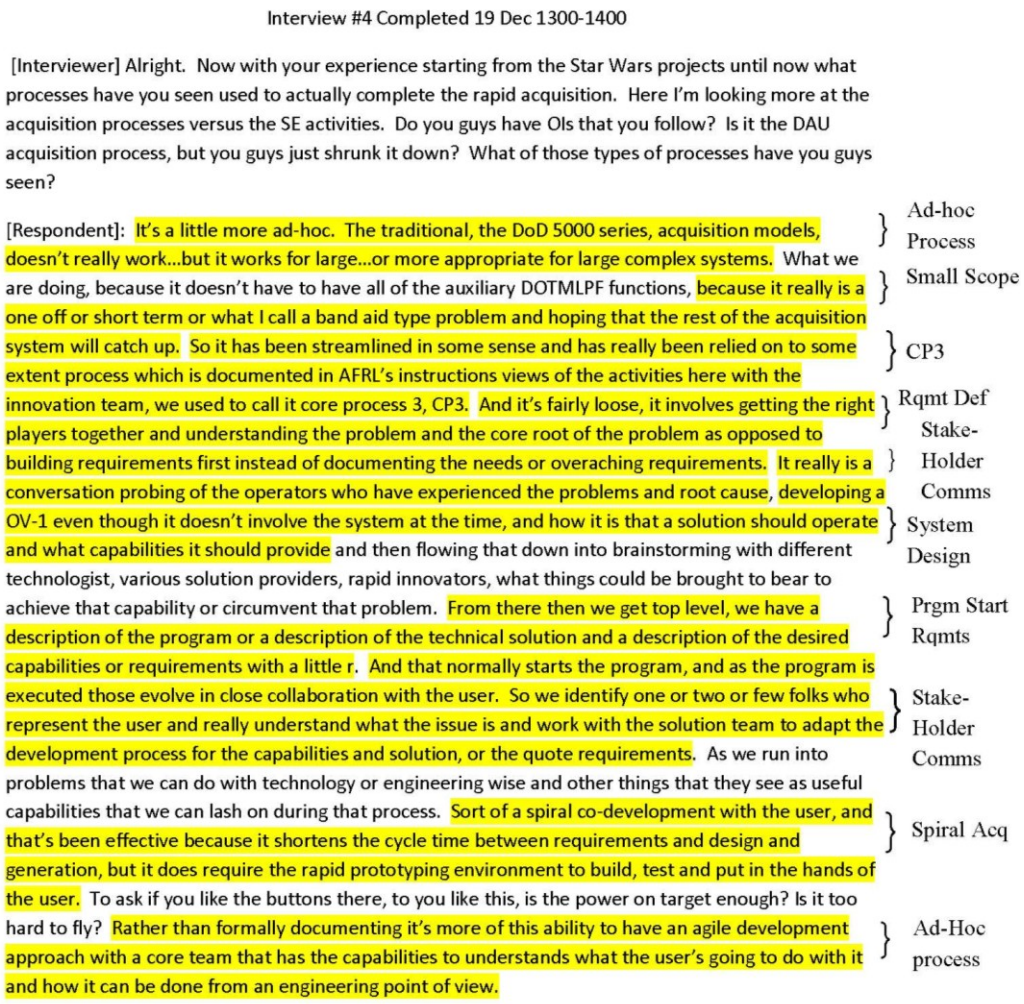

Figure 7 Example Coding of Interview

Figure 7 shows an example of the first stage of the data processing, open coding. This is followed by analytical coding where the open codes are grouped together. In the passage shown in Figure 7 the following codes were grouped together based upon the content that they represented: Ad-hoc Process, CP3, Spiral Acquisition, and Ad-hoc Process. When this group was combined with the others formed during the open and analytical coding of the ten other interviews the category that was created was called Process. A full listing of the seven categories used during the study and the number of codes included is shown in Table 3. 8 shows the frequency of the top twenty-five codes

used during this study and helps show the importance the SMEs placed on different themes. A full listing of the codes used during the study is included in Appendix C.

Table 3 Listing of Categories and Codes

Category	Data Points	Research Questions
Attributes	52	5
Personnel Experience	12	N/A
Process	116	1, 2
Requirements	52	2, 3, 4, 5
Solutions	8	3, 4
Systems Engineering	138	3
Tailoring	67	4
Total	445	N/A

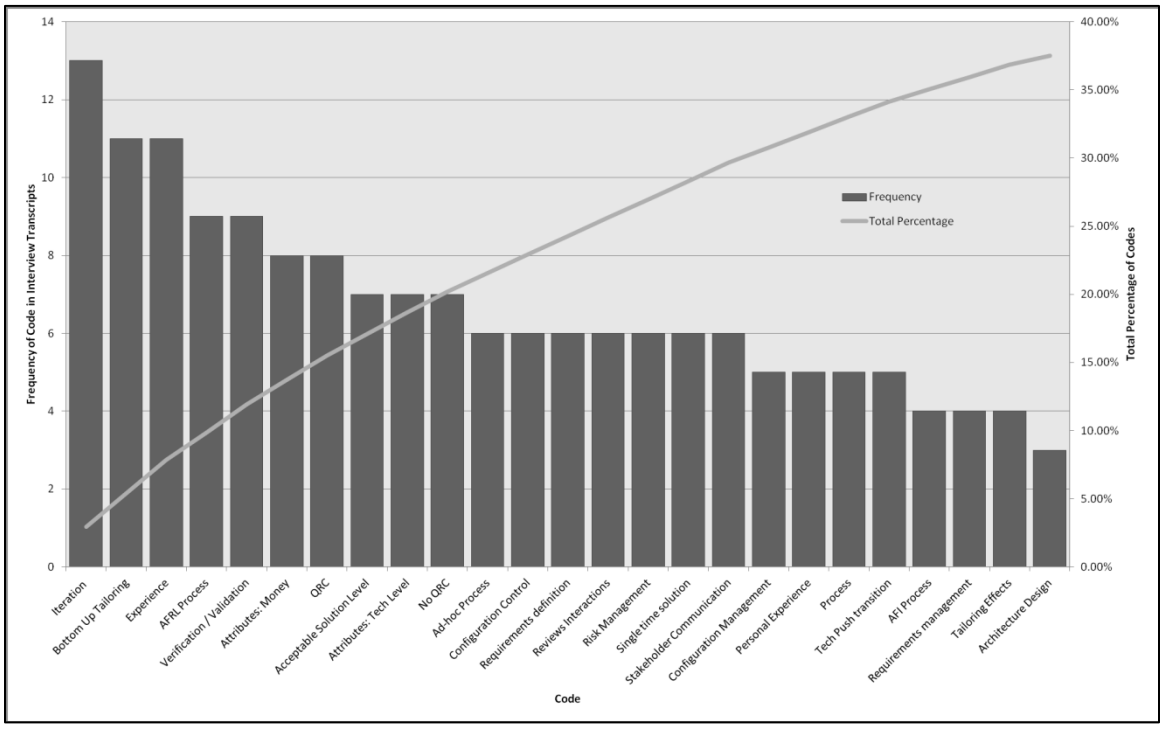

Figure 8 Histogram of Code Usage

Each category was associated with a different research question to allow for the drawing of conclusions as shown above in Table 3. Each category is not tied to only one

research question; for example, the process category was used to answer research questions 1 and 2. The only category that is not used to directly answer a research question is Personnel Experience; this was used to categorize the experiences of each of the respondents to give an overall narrative of the personnel interviewed. This category is exempted from the requirement of categories being responsive to the study as it ensures that the SMEs meet the requirement of being knowledge experts for this study.

Question 1: What processes does the United States Air Force use to complete rapid acquisition projects and programs?

The two traditional SPO personnel reported using the QRC process to answer at least one rapid acquisition program each, while the lab personnel, as a majority, did not use or even know of the process. One lab personnel reported having previous experience with the QRC process.

Another process that was reported was defined in AFRLI 63-104. All seven lab respondents were familiar and had participated in that process to conduct rapid acquisition. A caveat to this is the fact that an ad-hoc process was reported to be used by all seven of the respondents.

Both of the traditional SPO respondents, all of the rapid SPO respondents and five of the lab respondents reported that the acquisition process that they currently use to answer rapid acquisition requests were currently ad-hoc processes that are ill-defined in instructions or literature. That was not to say that they were undisciplined, as two of the respondents showed that they had a process that their organization used for successfully completing over 170 rapid projects. One of the traditional SPO respondents described how their process was based on AFI 63-114; however they were not conducting a

designated QRC and hence were not considered for that process. One of the rapid SPO respondents discussed how their process was managed predominately by personality and varied greatly between each PM and program. The reported results can be seen in Figure 9.

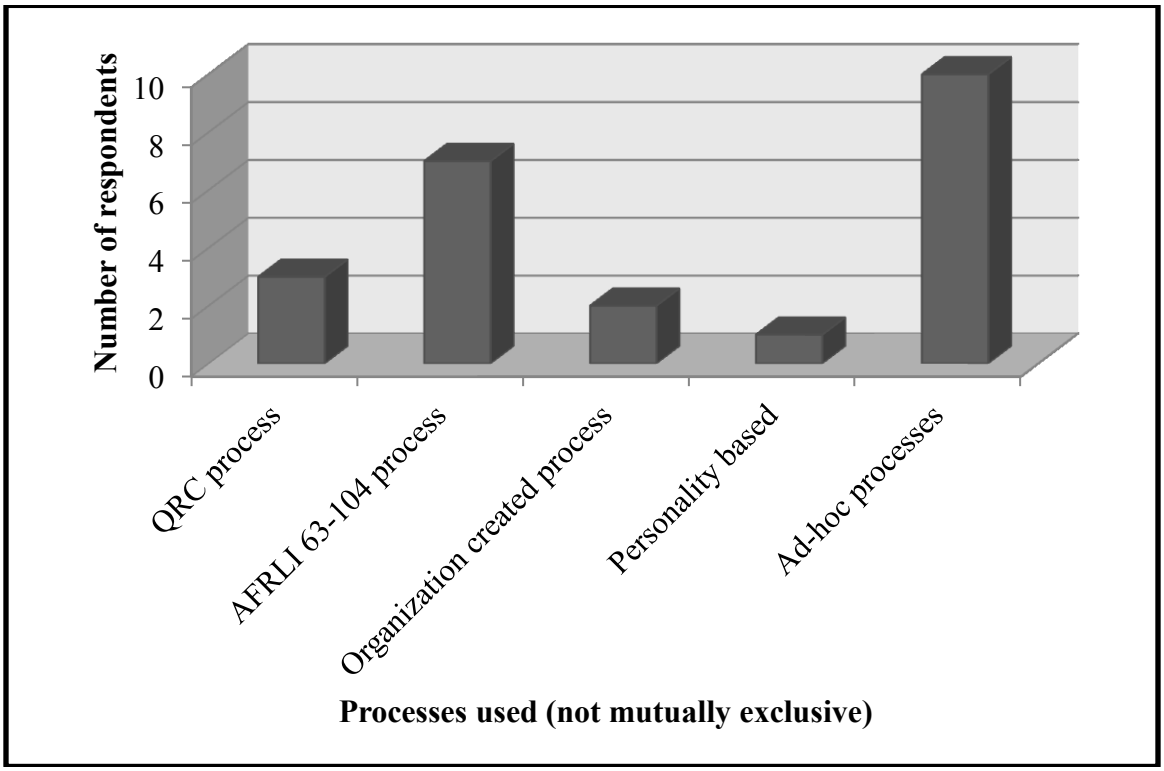

Figure 9 Reported Process Utilization

This result differs from the perception of a standard process used throughout the USAF to complete rapid acquisition. The interviewees likened this to the difference in their perspective of the work to be completed. The lab personnel looked at the rapid acquisition process as trying to accomplish smaller scope programs with limited quantities of an item being produced. The laboratory programs were normally started by indirect discussions with the COCOMs and not a capability gap declared in a UON or JUON. The traditional SPOs looked at larger solutions that were down scoped to allow

for a faster program but produce a larger amount of items due to the need to implement across a fleet of aircraft.

Question 2: Are the observed processes consistent with prescribed instructions?

The data show there are multiple processes that the USAF uses to complete rapid acquisition. When examining if the QRC process defined in AFI 63-114 was used to answer JUONs and UONs from the warfighter it was reported by the respondents that the majority of them did not use the QRC process. This can be seen in Figure 10.

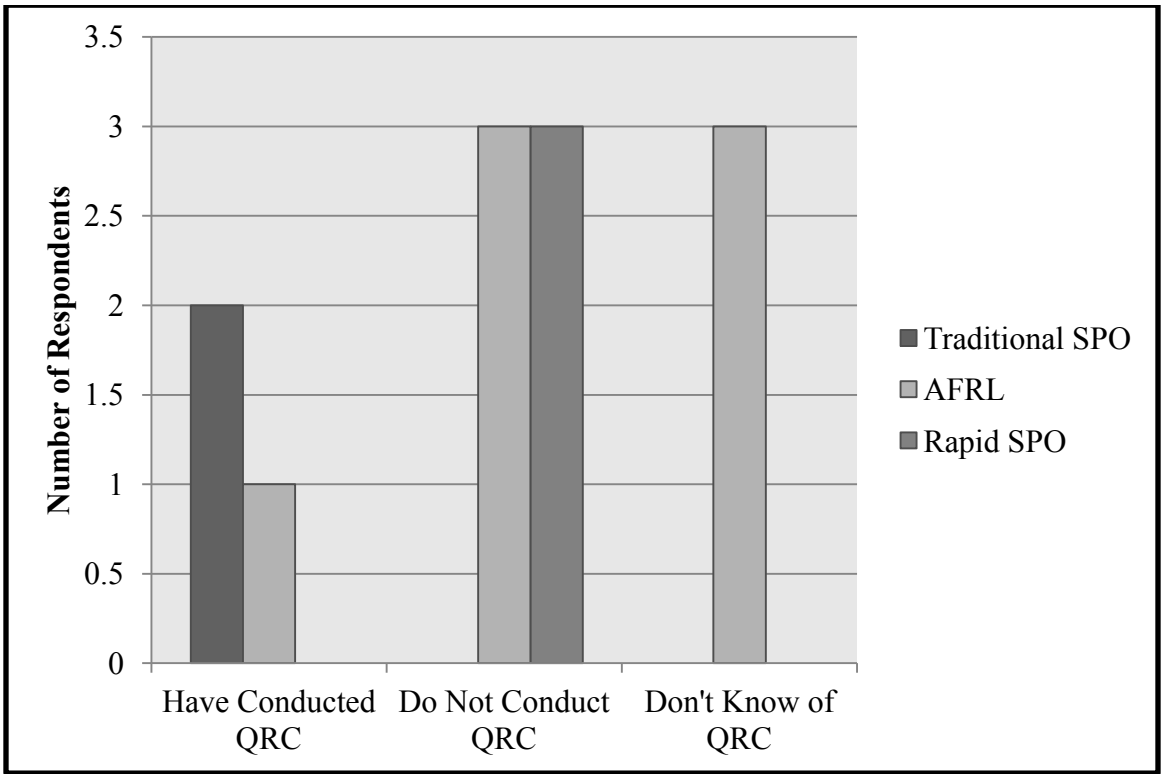

Figure 10 Reported Usage of the QRC Process

This question examined whether the processes that were observed in the first research question followed prescribed instructions. These instructions could be AFI 63-114, AFRLI 61-104 or any other defined instruction that was approved by the USAF. When examining the different responses the answer becomes, as one respondent

mentioned, the classical PM answer … 'it depends.' One rapid SPO respondent stated that they do not normally work QRC programs due to political issues and infighting from the stakeholders of the UON/JUON. They still answer UONs and JUONs, but they are not designated as QRCs and therefore do not fall under AFI 63-114.

As shown previously in Figure 10**Error! Reference source not found.**, the traditional SPOs do follow the process as defined in AFI 63-114 for QRC designated programs. However, when working on a rapid acquisition program that was not designated as a QRC, the traditional SPOs used an ad-hoc process that was based on the QRC process but more tailored to the requirements for that program. As stated by the PM "we didn't have a […] QRC that was initiated with a 63-114 but we said this is something we can do in a rapid process or a rapid manner and meet a fairly aggressive schedule."

While the lab personnel reported that they work in an ad-hoc manner, they do base their decisions on the processes as prescribed in AFRLI 61-104. They still do not follow the process strictly; however they use that as a starting point and then tailor from there.

As mentioned previously in Figure 9, one of the two rapid SPOs does not follow any prescribed process, while the other organization does not follow AFI 63-114 as the programs they work on are not UONs or JUONs. This organization has its own process due to the fact they are not tasked with completing the full program; their programs are based upon taking the need of the user and designing a working solution in less than six months. This solution is then passed to a program office to be included in a more formal acquisition program, either as a legacy update or rapid acquisition program.

Question 3: What SE activities are used in rapid acquisition programs in the United States Air Force?

When examining what SE activities were used, the sixteen SE activities called out in the DAG were the starting point. Each respondent was given the list shown in Appendix B and was asked if their organization used those activities. As a general answer, most of the respondents stated they do incorporate Systems Engineering into their programs. However, the delineation here comes in the form that not all programs use the same level of SE rigor and not all SE activities are conducted. The aggregated results are shown later in Figure 11 and Figure 12, and are tabulated as a percentage for the respondents who answered that they do incorporate the SE activity in their programs.

General Findings

For the traditional SPO personnel, it was reported that SE was important to their processes. They attempted to use discipline and rigor when working through their rapid acquisition process. The scope of the problem being addressed played a large part in deciding how much of the SE activities to include in the programs. There were reported instances of the SE activities being iterative, however it was noted that those iterations were minimized to expedite the process.

The lab viewed SE through the lens of AFRLI 61-104, with the eight questions taking the place of the classical SE nomenclature. The effort focused primarily on the Technical Processes, with an iterative approach being used.

The rapid SPO personnel discussed how they complete the SE activities, but do not use the classical nomenclature due to emotional responses to it. As one respondent stated "you mention a word and it invokes in the person what they think […] needs to be

done." The respondents stated that they focused on the intent and completed most of the SE activities as a whole instead of stating the completion of each individual activity.

Findings on the Technical Processes

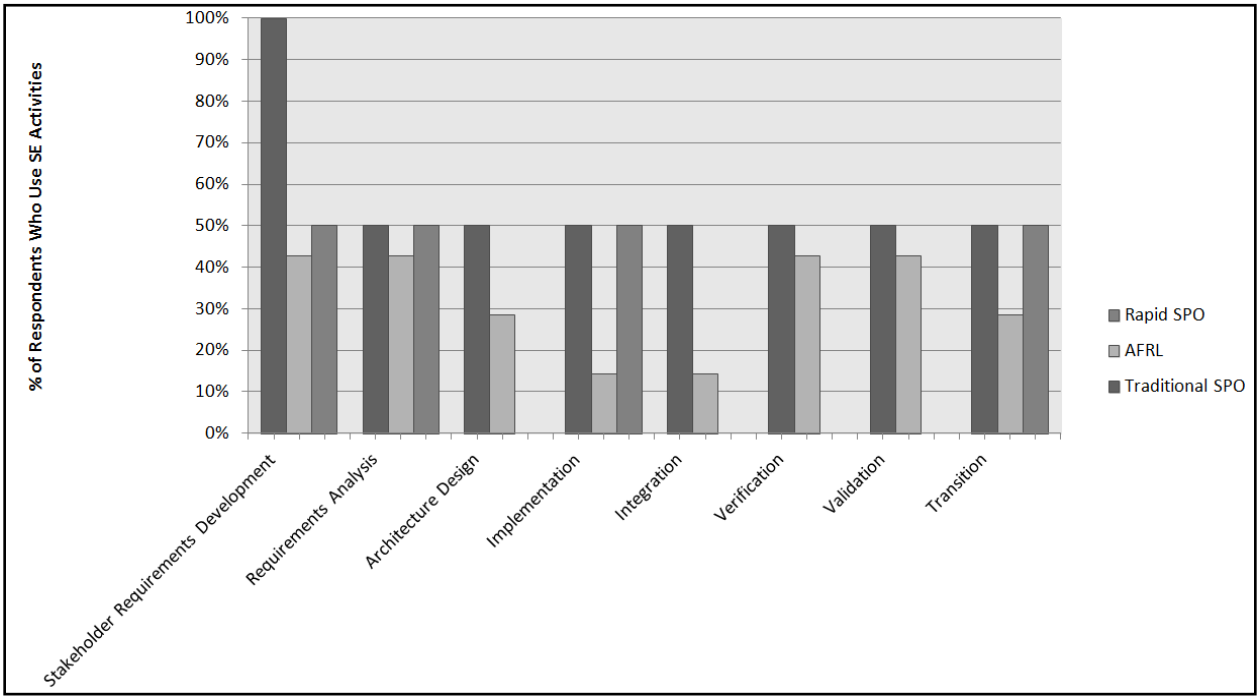

Figure 11 Reported Technical Processes Used

When examining the responses with respect to the first Technical Process, Stakeholder Requirements Development, the establishment of communications with the stakeholder seemed to be the biggest concern with almost half of the participants (5 of 12) stating such. There were minimum conversations about other activities called for during this process. It should be noted that in Figure 11 and the following figures, due to the scarcity of the SMEs in the organizational categories, some categories have an artificial step function. This can be seen in the traditional SPO response above; if both respondents answer yes, then it's 100%, while one respondent gives an answer of 50%.

Requirements Analysis was utilized less by the traditional SPO personnel with a reported positive correlation to scope in that as the programs scope became larger, the amount of time spent performing requirements analyses' grew. The lab personnel reported they included the requirements analysis activity at a higher, more conceptual level "but enough to kind of provide the top level vision of where we want to go as an organization. As we get down to the specific programs, requirements management, there is a process for that. I'd say that process is reasonable, but again, in an attempt to get to other parts of the program, sometimes it gets watered down a bit."

Architecture Design was reported as low across all of the respondents, with one of the traditional SPO respondents discussing how they will allow the contractor for the aircraft to address it due to the small scope of their programs. Inside the lab, only two of the personnel discussed working architecture activities, with one stating it is something that their organization is attempting to improve.

With Implementation, only one traditional SPO and lab personnel each discussed it, with both stating that they complete this phase during their programs. An assumption may be made stating that to complete a program you must compete the activities that are discussed in this process, therefore the respondents assumed that it was completed and did not mention it during the interviews.

With Integration, one of the traditional SPO personnel stated that "that's about all we do. We take things that are already developed and put them on the airplane." The lab personnel stated that this step worked in concert with the Verification process during their projects, where the Verification process would show them areas that they did not integrate correctly and would require more design work.

The next two processes, Verification and Validation, work hand in hand. The traditional SPO discussed conducting both the developmental test (DT) and the operational test (OT) at the same time to accelerate the process by reducing the number of tests needed. The lab respondents stated that less than half complete the verification and validation activities. This is not to say that they don't test their products or designs, but that they do not consider what they do to be part of these two SE activities.

The last TP to discuss is the Transition process. One of the traditional SPO personnel discusses the questions that they face after fielding their programs. "Now that the thing is out there what are we going to do with it? Is it programmed for? Is it spared for? We don't normally get into big logistical source and repair analysis, normally it's ten percent spares for QRCs. It's kind of the rule of thumb." This contrasts with the lab, where they recognize a "valley of death" between the lab programs and transitioning the programs to the SPOs.

One of the respondents from the Rapid SPOs discussed their SE processes used, which focused mainly on the different Technical Processes described in the DAG (DAG). "So you've got your customer, you identify stakeholders; you go through determining your requirement analysis. Can we do it? Let's hold a meeting with the customer. Now mind you, this might be [all during] day one. [Starting of the design process] might be day five, and we deliver at day 30. That's how fast it is."

Findings on the Technical Management Processes

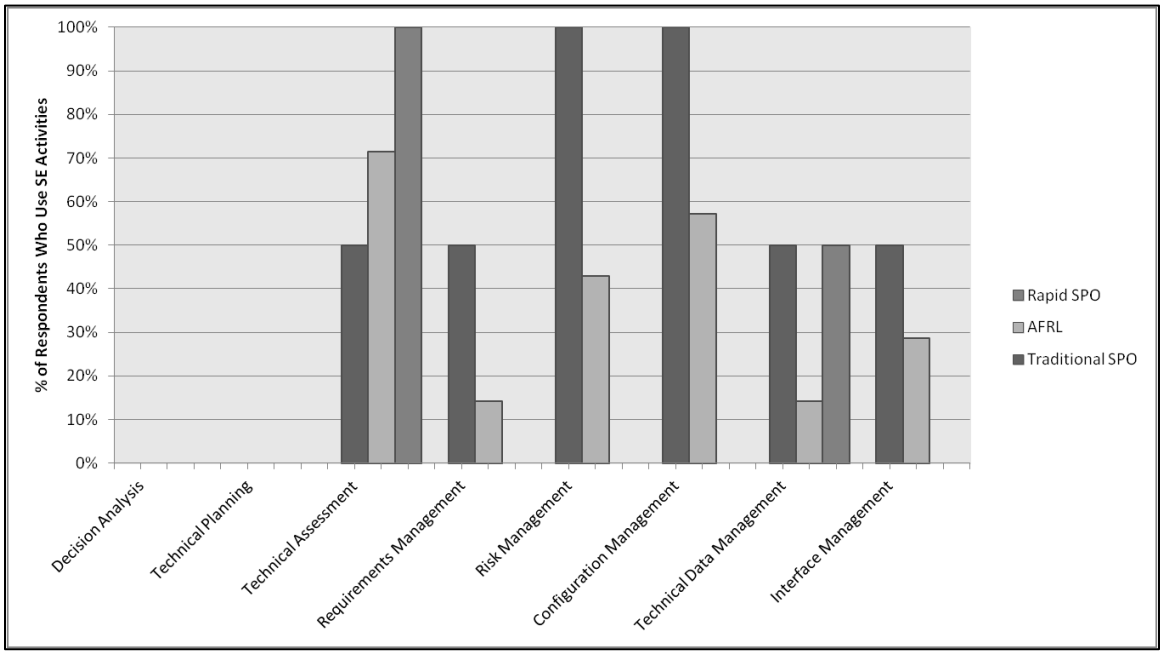

Figure 12 Reported Technical Management Process Used

As seen in Figure 12, the first two TMPs, Decision Analysis and Technical Planning were not described as being used during the rapid acquisition programs discussed during the interviews. The third TMP, Technical Assessment was how the respondents examined the technical aspects of their programs. One of the traditional SPO personnel discussed how their reviews were at two levels, first was the weekly assessments of the program run by the PM and the second was the more formal Preliminary Design Review (PDR) and Critical Design Review (CDR) conducted by the PEO. The lab personnel reported completing technical reviews, such as PDRs and CDRs or semi-annual program reviews. The respondents from the Rapid SPOs discussed competing "design develop, design approved, design released" reviews and PDRs and CDRs that are much closer to each other, in the range of 2-3 months apart.

The fourth TMP is Requirements Management, and only had one response from a Lab personnel stating that "they did determine roles and responsibilities" but that the other activities listed for this TMP were not conducted. This might be from the respondents lumping activities that could be considered Requirements Management into one of the other TPs such as Stakeholder's Requirements Development or Requirements Analysis.

Risk Management was discussed by both of the traditional SPO personnel and included the risk planning, identification and analysis sub-activities. Both respondents discussed how Risk Management is used in planning and executing their programs. The lab personnel stated that Risk Management varies between programs with two of the six stating that they do not use it while three other's state that they do include this activity in their programs. One stated its importance as "when you're on a fast moving train and things starts falling off or things start rattling around and shaking you need to have already thought three steps ahead and be thinking about all the possible contingencies so you've got plan b and plan c so you can quickly implement so you don't have a train wreck, or stop the train."

Configuration Management, from the traditional SPO personnel's perspective, grows with an increase in the size of the programs being managed. Ensuring software and hardware configurations are the same throughout the program and the fleet of equipment being serviced is important. From the lab's perspective, this TMP is used, however with varying degrees of rigor. Two respondents stated that what Configuration Management is completed is very minimal, while three stated that it's completed, but it tends to be corrected closer to the transition of the program and it's fielding.

Technical Data Management was discussed by one of the traditional SPO respondents in response to issues that they had perceived with the contractor that they use and the use of Independent Research and Development (IRAD) money previous to the program. The lab respondents stated that this TMP was poorly applied across the different programs and leadership had begun to try and drive more discipline into the programs. One unique item that was discussed came from the rapid SPOs, due to the fact that as the rapid design and manufacturing capability inherent in the organization they are the provider of technical data to many programs that they work with. After they have completed the design they help those programs leverage that data into rapidly procuring larger numbers of items from contractors.

The final TMP is Interface Management. The traditional SPO personnel conducted Interface Management due to the systems that they are in charge of. Their viewpoint of it is "here is the interface for the airplane, build your widget to that." The lab personnel discussed the TMP, however less than half indicated that it was an activity that they include with their programs.

Findings on the Initiation of Programs

There were four main initiation points discussed during the interviews as seen below in Figure 13. Three were listed in the literature review: a JUON or UON from the warfighter, AF/CC request and designation, and technology push. AFI 63-114 discussed the first two, and AFRLI 63-104 was the instruction that discussed how technology from the lab can initiate a rapid acquisition program. The other option that was discussed by the SMEs was that of informal requirements initiation.

The informal method was almost exclusively used in the laboratory, with it being described as "direct conversations with leaders of COCOMs or MAJCOMs and asking the two star or three star 'what is it that is really bothering you right now? If you had a solution within in a year, what can the Lab do for you? What is the most pressing need to be solved?'" This was only slightly different for the one respondent from the rapid SPOs who stated that they received some of their program initiations from organizations based upon phone calls and emails from PMs whom they've briefed on their abilities.

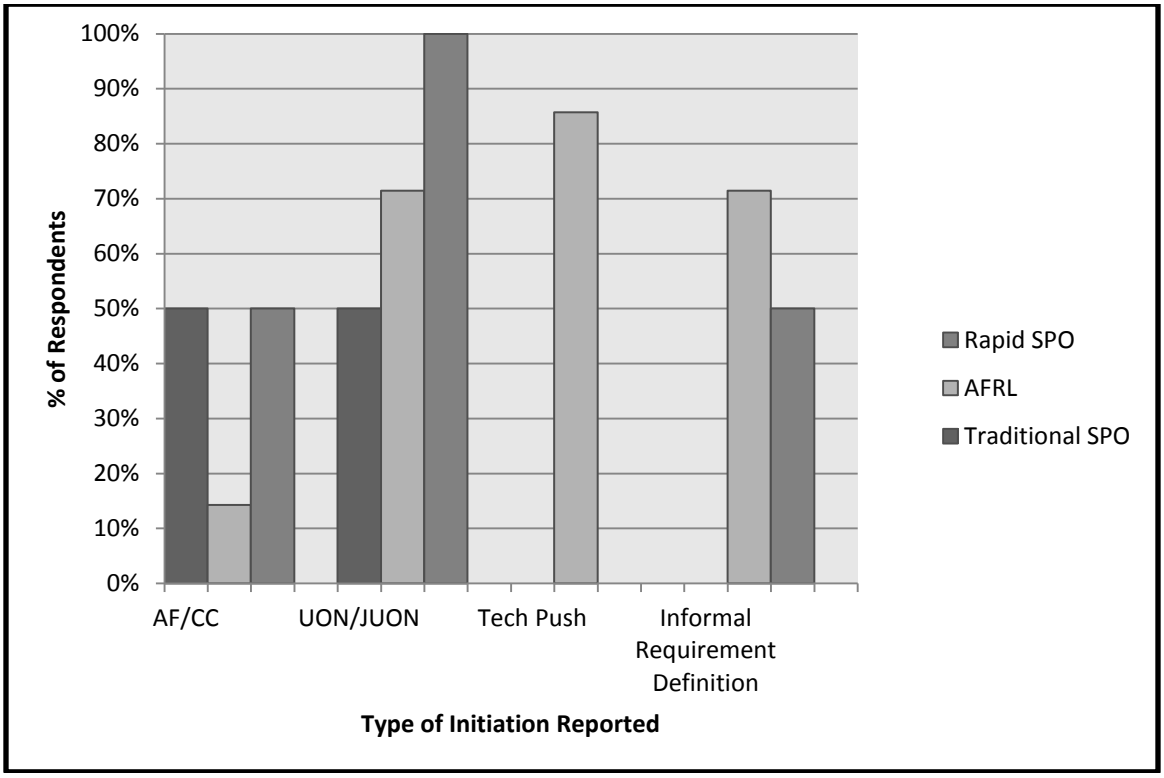

Figure 13 Reported Program Initiation

There was another unique item brought up by the respondents associated with UONs and JUONs, in that many times the respondents discussed that they would have JUONs written for specific material needs or solutions that are already available. This is different then what the literature states should happen where the UON or JUON states the

capability gap. As one respondent stated "Usually the user or sponsoring organization (SAF/AQI, JIEDDO, etc) sees the tech (aka shiny widget) in a briefing or demonstration and decides they need it right away. The requirement is then crafted as an 'I need that shiny widget' UON/JUON."

One respondent from both the traditional SPO and rapid SPO stated that they began programs based upon an AF/CC initiation. These were stated to be high priority programs that had oversight and priority based upon the Chief of Staff of the Air Force interest in the programs.

Findings on Systems Engineering Iterations

There was a stark difference in the viewpoints of how iterative the SE processes were between the personnel groups. The traditional SPO personnel discussed how they believe that the processes are iterative; however they have to try to minimize the amount of iterations to accelerate the program and due to management believing that iterations mean that you were unable to correctly complete the process the first time and requires rework.

The Lab personnel believe that the processes are very iterative. The belief held by lab personnel was that you would stop the SE activities when the team, to include the PM and Systems Engineer, was satisfied.

Question 4: How are rapid acquisition programs tailored in the United States Air Force?

Tailoring was conducted mostly in a bottom-up methodology where the PM or Systems Engineer started with some type of minimum baseline that included processes that they believe all programs must complete to be successful. SE and acquisition

activities and processes were added from that point to build up to the final program. One respondent discussed how "we had a deadline to meet and we wanted to follow a disciplined approach to the process so we took out things that didn't add value but didn't create undue risk for the project.

Another viewpoint that was brought up during the interviews was the concept of continually tailoring the process from beginning to end depending on how the program was going and the required work necessary to complete the program. As stated by another respondent, "Then as we start executing we peel back the onion a little bit. We get a better understanding of the underlying interfaces and the problems with those interfaces and other critical parameters that need to be monitored and tracked, particularly now that we understand the relationship between the underlying parts. So generally the controls get added as we move along." This is contrasted against the need to understand how much tailoring to do. One reported way to decide how much tailoring to do was using the expected level of effort for the program, with an inverse correlation. So as less effort is being put forth for the program, you would expect more tailoring of activities, and vice-versa. Another respondent stated "when [tailoring activities] starts hindering the execution you've gone too far."

The most important aspect for tailoring seemed to be the use of the experience of the personnel on the team along with the PM and Systems Engineer. All of the respondents mentioned that they choose which activities to include based upon the recommendations of their personnel or their own experiences. No one mentioned any guidance given in the AFIs or elsewhere in determining what processes must be completed or to what level. As one respondent mentioned "the trick comes down to

having the right person with the right knowledge making the decision based upon their experience, their background and their understanding of the problem."

Question 5: Which program attributes are used to determine program tailoring?

There were multiple attributes that were provided for determining how to tailor the programs: money, technology maturity, manufacturing readiness, risk, scope, requirements definition, schedule, systems integration, and acceptable levels of success and can be seen below in Figure 14.

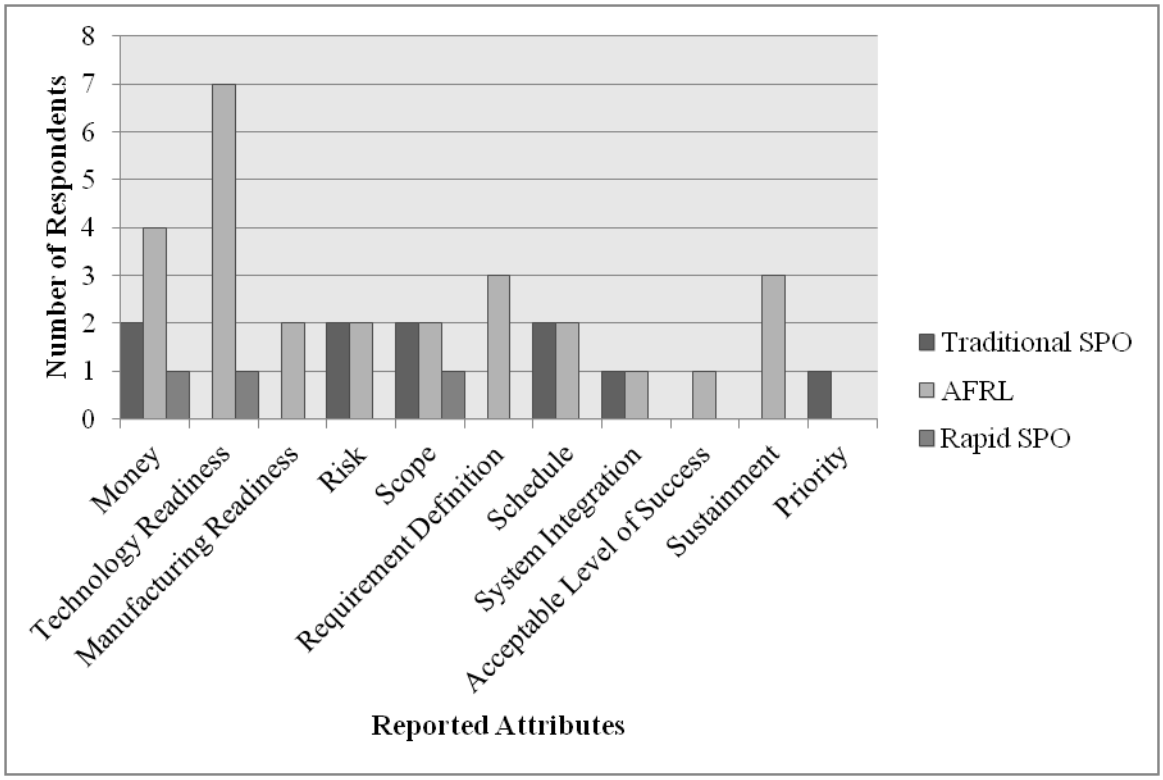

Figure 14 Reported Attributes Used for Tailoring

Many of the attributes are easily explained; a high level of risk would require more effort to mitigate the chances of failure, while low money levels might mean a smaller level of effort or available resources. Technology maturity determines how much effort must be spent in preparing different ideas before they are usable in the system. For

example, a high technology maturity can be seen as a commercial off the shelf (COTS) solution ready for integration into a different environment.

Requirements definitions was an outreach from the SE process of the same name. Multiple respondents stated that "requirements creep", as defined as a change or increase in the system requirements, has a negative impact on the success of a program. One respondent stated that by "bin and freezing" their requirements, the program was able to minimize requirements creep and turn out the first iteration of the program on schedule with a second program to meet future needs.

The acceptable level of success for a program ties into requirements definition, but can stand alone as an attribute. Multiple respondents stated that their customers would be thrilled with an 80% solution now, with one stating that "sometimes we provide a 50% solution and that's acceptable."

V. Conclusions

The standard acquisition process is unable to meet the urgent needs of warfighters in today's combat operations. Knowing this, the DoD as a whole, and the Air Force as a Service, have been executing rapid acquisition programs. This study set out to identify from PMs and Systems Engineers which processes they used to conduct these programs and how they tailored them to meet the expedited timelines. It was conducted as a qualitative study, using semi-structured interviews to gather data from the SMEs, followed by coding and cataloging the responses.

There are many processes used throughout the Air Force to conduct rapid acquisitions. The QRC process defined in AFI 63-114 along with the AFRL process defined in AFRLI 63-104 were discussed by respondents. One organization that conducted rapid design and production discussed their process as being decidedly different than either of the previously mentioned processes and redesigned based upon sound engineering principles. Another respondent described their process as being a personality driven ad-hoc process that followed the experience of the PM and Systems Engineer. Including this respondent, 9 of the 12 respondents described experience working projects using an ad-hoc methodology for the acquisition and design process. These ad-hoc processes were used in the majority of the programs that were discussed and by definition did not follow any prescribed process methodology. This is not to say that they were following a less rigorous process or failing to meet the warfighter's requirements and needs in a timely fashion. It does support the assertion found in the GAO reports stating that there is a lack of standardization in how rapid acquisition is

conducted. However, many of the respondents believe that the bureaucracy that comes with standardization is one of reasons that programs take longer than the time required for rapid acquisition.

When examining the different SE processes the majority of the programs reported using the different TPs across all three organizational groups. Looking at the TMPs it can be seen that Decision Analysis, Technical Planning and Requirements Management were not discussed by the respondents in any appreciable way. This does not mean that these processes were not used by any of the SMEs, but it does show that they are less valued when compared to the other TMPs. Here the lack of a common language and standardized processes make comparing the processes difficult, more so when compounded by the fact that multiple organizations were included in the study.

It was noted that all participants did state that SE activities are iterative but there is a difference between the traditional SPO and lab personnel when discussing for how long. The traditional SPO personnel stated that they try to minimize the number of iterations to accelerate the process, while the Lab personnel stated they iterate until they feel that they've met the need. This could be explained by the differences in the projects. The traditional SPO programs are normally using mature technology and only need to integrate them into the overall system. As one respondent stated, "one of the things that lent [the program] to being a rapid acquisition is the fact that it is what I would consider to be a federated system." This can be different from the AFRL programs, which can be defined as Joint Rapid Acquisition Cell programs where the time line is "fewer than two years with little or no development" (AFRL, 2013a).

When looking at how the programs were tailored, 10 of the 12 respondents considered the tailoring to be bottom-up. This methodology can be defined as some standard baseline that all of the organizations programs had to meet with activities added based on the program characteristics and inputs of the Systems Engineer and PM. All of the respondents discussed that decisions on how to tailor were based on the experience of the PM and Systems Engineer. Another point for tailoring that was made was the need to ensure that the customer will accept a less than optimal solution. As stated by one respondent "perfect is the enemy of good enough." This could be an instance of the so called Pareto principle, where an 80% solution would suffice, but the program would break the time suspense if it attempted to design a full 100% solution.

Examining requirements generation the instructions state that requirements should be generated by a UON or JUON, direction from the AF/CC, or the push of new technology from the laboratory, this research found that a fourth means of generation was used. The informal generation, while not harmful to the programs can allow programs to begin and use material and funding that might not meet requirements that are defined by the JCIDS process or top leadership.

Of all the program attributes discussed by the respondents, risk, technology maturity and a lack of requirements creep were the three most discussed attributes when examining programs to decide how to tailor. A high level of either technical or managerial risk would be difficult to plan for, while a high technology maturity would ensure that the program could focus on integration of the technology into the system versus maturing the technology for use. Requirements creep can derail programs by continually changing the target for the program. One traditional SPO respondent

discussed how they were able to "bin and freeze" the requirements, which allowed a focused effort with an understanding that other issues that were brought up by stakeholders would be dealt with in a future iteration of the program.

Limitations

As noted in chapter one, the access to personnel limited the inclusion of all personnel in this study. Some of the acquisition personnel work on classified programs that preclude them from participating in the study while others were unable or unwilling to participate.

Another access issue was the use of the snowball sampling, which was able to increase the total number of participants. However, it does not guarantee that you are sampling from all of the available personnel. This lack of a fully developed sample of SMEs diminishes the ability of the results to be fully transferrable to all Air Force rapid acquisition programs. A full set of SMEs should include all offices that conduct rapid acquisition and include the space domain, aircraft, cyberspace, laboratory, and special operations.

The lack of the researcher's familiarity with interviewing allowed the respondents to wander off track from the questions and also to control the information flow. This limitation could be the reason why some of the participant's information was clearly defined and others were vague and could negatively impact the internal validity of the results.

Recommendations for Future Research

Future research could be completed by reducing the scope of the study and focusing solely on the interactions between the different SE processes. By reducing the scope, the researcher can focus the study and provide a deeper analysis of the interactions between the processes to allow for PM and System Engineers to fully understand the results of how minimizing one activity impacts the other activities and the impact on successfully answering a rapid acquisition program.

Another future area of research would include the building of multiple case studies of different rapid acquisition programs to allow for an in-depth look into how they are executed. These case studies can be compared against each other to create best practices that are rooted in multiple programs.

Conclusions

This study resulted in four major conclusions. The first is that there are many processes used in the Air Force for executing rapid acquisition programs and most of them do not use prescribed processes. This can imply that the acquisition corps as a whole does not follow a standardized set of best practices nor is there a corporate memory for those best practices. While the Air Force attempted to use the QRC process as a way of meeting urgent needs of the warfighters, it seems that the expected bureaucracy of the QRC process has made senior leadership allow programs to be run without following prescribed processes. This does not mean that due diligence or proper Program Management concepts were not applied, but it does indicate that personnel would prefer a less cumbersome process.

Another finding was that while most of the respondents indicated they used the TPs, not all of the TMPs were used. Many of the programs used only some of the Technical Management Processes even though they understood that it could cause problems. This indicates that either the processes don't provide the expected benefits to rapid acquisition programs or that the time and effort requirement for those processes could be too high for the programs to use.

The third major finding was that no respondent stated that they used any outside guidance when deciding how to tailor their programs other than the experience of themselves or their team. This could indicate a lack of dissemination of information from previous research, a lack of use of best practices as seen in the first finding, or a missed opportunity for education through the DAU. This lack of information passage could be the underpinnings of other issues in the acquisition corps. A recommendation to address this problem is to create a center of excellence for rapid acquisition as a sub-center underneath either the Acquisition Center of Excellence (ACE) or DAU. This center's focus would be the collection of lessons learned and the dissemination of the basic knowledge to the members who are conducting rapid acquisition. This can be in concert with DAU classes that are required coursework for members of the acquisition profession.

The final major finding is that a lack of requirements creep, risk and technology maturity are attributes programs look at when deciding to tailor. These three are attributes that were included in other research studies; however, these were the only ones that resonated with the interviewees in the study.

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Appendix A Interview Protocol

Project: Tailoring Systems Engineering for Rapid Acquisition

Time of Interview: _____ Place: _____

Data: Interviewer: _____ Interviewee: _____

Interview Procedure

You are being asked to participate in a research study investigating how the Air Force completes rapid acquisition and the System Engineering processes used. The purpose of this study is to understand the current rapid acquisition processes used by the USAF and how programs are being tailored to meet expedited timelines. This can illuminate any areas of deficiency in the processes and identify linkages to better manage rapid acquisition. During this interview, you will be asked to respond to several open-ended questions. You may choose not to answer any or all of the questions. The procedure will involve taping the interview, and the tape will be transcribed verbatim. Your results will be confidential, and you will not be indentified individually.

Questions
1. What experience do you have with rapid acquisition?
2. What process have you seen being used to complete rapid acquisition programs?
3. Does your office follow the QRC process defined in AFI 63-114?
4. How do these programs begin (i.e. initiation by UON/JUON, technology push.)?
5. How iterative is the rapid acquisition process that your office uses?
6. Do you view rapid acquisition as an incremental process or a single time solution?
7. What SE activities did your programs include?
8. How did you decide which processes to include?
9. How iterative are the SE activities used in your programs?
10. What interactions did you see between the SE process included or excluded?
11. How have projects you have been involved in tailored the acquisition process?
12. How do you determine to what level a program needs to be tailored?
13. What effects did tailoring have on the overall project?
14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
15. What attributes does your organization use to determine how a program is tailored?
16. What interactions are observed between the attributes and the outcome of the program?

Closing
Thank you for participating in this interview. I appreciate you taking the time to do this. We may contact you in the future for the purpose of follow up interviews. Again, let me assure you of the confidentiality of your responses. If you have any questions, please feel free to contact me by telephone at XXX-XXX-XXXX.

Appendix B Systems Engineering Processes Handout

Process	Level	SE Activity
TP-1	1	TP-1 (Stakeholder Requirements Development)
TP-1	2	Establish Communications with Stakeholders
TP-1	2	Identify Project Constraints
TP-1	2	Determine Required Capabilities
TP-1	2	Determine Desired Performance
TP-2	1	TP-2 (Requirements Analysis)
TP-2	2	Analysis Preparation
TP-2	2	Perform Functional Analysis
TP-2	2	Perform Behavioral Analysis
TP-2	2	Perform Environmental Analysis
TP-2	2	Design Factors Analysis
TP-2	2	Develop Functional Architecture
TP-3	1	TP-3 (Architecture Design)
TP-3	2	Define Design Problem
TP-3	2	Generate Alternative Design Solutions
TP-3	2	Evaluate Design Alternatives
TP-4	1	TP-4 (Implementation)
TP-4	2	Generate Implementation Strategy
TP-4	2	Fabricate Hardware
TP-4	2	Code Software
TP-4	2	Conduct Unit Testing
TP-4	2	Conduct Training
TP-4	2	Prepare for Integration
TP-5	1	TP-5 (Integration)
TP-5	2	Determine Integration Process
TP-5	2	Conduct Assembly / Integration of System
TP-5	2	Relevant Environment
TP-6	1	TP-6 (Verification)
TP-6	2	Plan Verification
TP-6	2	Execute Verification
TP-7	1	TP-7 (Validation)
TP-7	2	Plan Validation
TP-7	2	Execute Validation
TP-8	1	TP-8 (Transition)
TP-8	2	Identify Transition Opportunities
TP-8	2	Qualify Production Item
TP-8	2	Execute Transition
TMP-1	1	TMP-1 (Decision Analysis)
TMP-1	2	Identify Strategy for Making Decision
TMP-1	2	Execute Decision Making Strategy
TMP-2	1	TMP-2 (Technical Planning)
TMP-2	2	Plan Systems Engineering
TMP-2	2	Implement Technical Plan
TMP-2	2	Evaluate Plan to Address Needs
TMP-3	1	TMP-3 (Technical Assessment)

TMP-3	2	Prepare for Technical Assessment
TMP-3	2	Perform Technical Assessment
TMP-4	1	TMP-4 (Requirements Management)
TMP-4	2	Determine Roles/Responsibilities During Reqs Generation Process
TMP-4	2	Define System Capabilities and Performance Objectives
TMP-4	2	Validate Requirements Development Process
TMP-4	2	Ensure Requirements Feasibility and Validity
TMP-4	2	Document Requirements
TMP-4	2	Ensure Traceability of Requirements
TMP-4	2	Establish Process for Requirements Changes
TMP-5	1	TMP-5 (Risk Management)
TMP-5	2	Risk Planning
TMP-5	2	Risk Identification
TMP-5	2	Risk Analysis (Qualitative & Quantitative)
TMP-5	2	Risk Handling
TMP-5	2	Risk Monitoring
TMP-5	2	Risk Documentation
TMP-6	1	TMP-6 (Configuration Management)
TMP-6	2	Develop Configuration Baselines
TMP-6	2	Establish Configuration Change Control Plan (Establish configuration control cycle that incorporates evaluation, approval, validation, and verification of change requests)
TMP-6	2	Develop and Maintain Configuration Control Documentation
TMP-6	2	Maintain Configuration Baselines
TMP-7	1	TMP-7 (Technical Data Management)
TMP-7	2	Develop Data Management Plan
TMP-7	2	Determine / Define System Relevant Information
TMP-7	2	Identify System Data to Purchase
TMP-7	2	Determine Data Protection Requirements
TMP-7	2	Address Long-term Data Storage Requirements
TMP-7	2	Record Program Data
TMP-7	2	Make Project Data Available
TMP-8	1	TMP-8 (Interface Management)
TMP-8	2	Define Interface Requirements and Control Methods
TMP-8	2	Develop System Interface Control Methods
TMP-8	2	Generate Interface Control Documentation
TMP-8	2	Utilize Interface Controls

Appendix C List of Codes Used In Open Coding

Code	Code
Acceptable Solution Level	Causality
Acquisition Process	Challenges
Acquisition Process Iterations	COA Development
Acquisition Tailoring	Communication
Add as they go	Configuration Control
Add to baseline	Configuration Management
Ad-hoc Process	Constraints
AFI Process	Contracting
AFRL Eight Questions	Contractor Management
AFRL Process	Decision Analysis
Architecture Design	Difference between user and acquisition
Architecture Design wasn't done	Doesn't follow CP3
Attribute Interactions	Doesn't look at lifecycle
Attributes: Communications	Don't have to procure certifications
Attributes: Configuration	Don't respond to UONs or JUONs
Attributes: Cool factor	Emotional Response to SE keywords
Attributes: Design	Engineering Reviews
Attributes: expected level of effort	Example of Communication Start
Attributes: Manufacturing readiness	Example of paperwork issues
Attributes: MDA	Example of process
Attributes: Money	Experience
Attributes: personnel	Expert driven
Attributes: Requirements	Federated System
Attributes: Risk Management	Final Decision
Attributes: Schedule	Focus on design
Attributes: Scope	Formal management
Attributes: Small Scope	Freeze Requirements
Attributes: Speed and Risk	How to decide tailoring
Attributes: Sustainment	IDIQ Contract
Attributes: synchronization	Implementation
Attributes: System Integration	Increase of SE with tech level
Attributes: Tech Level	Incremental acquisition
Attributes: User	Incremental acquisition
Bottom Up Tailoring	Informal Process

Code	Code
Can do both top down and bottom up	Informal Process
Informal Requirements Definition	No Formal Risk Management
Initiation	No JUON or UONs
Integration	No QRC
Interactions: Verification and Validation to Requirements	No Requirement Communication
Interface management	Non 63-114
Interface Management with Integration Interaction	Non iterative projects
Issues with acquisition	Not as much rigor
Issues with Big Acquisition Risk Management	Not Good at Requirements Definition
Iteration	Not iterative
Iterative SE	NVA in QRC
JIEDDO Requirements	One type of process
JTCD experience	Operational Needs
JUON Start	Organizations with contacts in place
JUON/UON	Paperwork Issues
Lab doesn't go looking for projects	part of the process versus whole process
Lab experience	PDR / CDR
Lab start with tech push	People vs. Process
Lack of lifecycle viewpoint	Performance Management
Lack of risk management	Personal Communications with leadership
Lack of SE bad	Personal Experience
less documentation	Personality driven
Less SE more problems	Policy
Level for transition	Positive Output
Level of effort	Priority
Low tech readiness to bad outcome	Priority For Program
Management	Process
Match program to existing requirements	Process BAAs
Maturity and risk define tailoring	Process Concerns
minimal iterations completed	Process improvement
Minimal named SE	Process Iteration
Multiphase	Production time frame
Multiple Attempts	Program Attributes: Tech and Manufacturing readiness
Need for Tailoring SE	Program Manager Experience
Negative effect of tailoring	Program Start
No corporate memory	Project planning

Code	Code
Project time frame	SE interactions
Project vs. program	SE interactions with timelines
Purchase	SE Iteration
QRC	SE not stressed on at 6-1, 2
Rapid Acquisition Definition	SE problems
Rapid Culture	SE Process
RDIF	SE Tailoring
Reputation helps start programs	SE TP activities
Requirement	Set apart from standard acquisition
Requirement Creep	Short Usage Period
Requirement Definition Interaction	Single iteration
Requirement Growth	Single SE iteration
Requirements Analysis wasn't done	Single time solution
Requirements definition	Smaller scale SE
Requirements Development	Spiral Process
Requirements Generation	Stakeholder Communication
Requirements Interactions	Starts COCOM Communication
Requirements management	Starts: Tech Push
Requirements Start	Starts: UON/JUON
Requirements	Streamline Contracts
Reviews Interactions	Streamline vs. Eliminate
Rigor	Streamlined paperwork: ADM solution
Risk for tailoring	Success criteria
Risk interaction	Support
Risk Management	Synergy in workforce
Risk Management Interaction	System Design
Risk Management to Overall Project Success Interaction	Systems Engineering Process Selection
SAF initiates based on JUON	Tailor based on money
Savings	Tailor based on priority
SBIR Process	Tailor buying strategy
Schedule and risk decision	Tailor contract due to money
Schedule risk	Tailor though out process
SE	tailored based on level of effort
SE concepts	Tailored based on Maturity
SE guidance	Tailoring
Tailoring Contractor	Time based iteration
Tailoring Effects	Timeline

Code	Code
Tailoring risk	Timelines and effort level determine tailoring
Tech Assessment	TMP based on size
Tech Data	TMP Processes
Tech data and contracting	Tools for acquisition
Tech Data Management	Top cover
Tech data usage	Top Down
Tech Integration	Top Down Focus
Tech planning interaction	Top down tailoring
Tech planning process for acquisition projects	Transition
Tech Pull	Transition
Tech Push transition	Transition of Program to Program of Record
Technical Assessment	Tried to extrapolate too far
Technical Data Management	TRL interacts with program success
Technical Maturity	UON process for RDIF
Technical Planning	UON/JUON
Technical Readiness	Use design discipline in decision making
Technology maturity	Use Existing JUONS
Testing	Verification / Validation
The process they use is tailored	View on SE
Thoughts on AFIs	View on Traditional Acquisition
Time / Schedule decision	When to Stop Tailoring

Appendix D Interview Transcripts

Summary of Interview #1

1. What experience do you have with rapid acquisition?
   Extensive experience in acquiring technology solutions rapidly in the laboratory environment. Minimal experience with traditional acquisition programs.

2. What process have you seen being used to complete rapid acquisition programs?
   Core process 3 in the laboratory.

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Informal requirement generation from leadership meeting with the warfighter. UON and JUON used. Both technology pull and technology push.

5. How iterative is the rapid acquisition process that your office uses?
   Somewhat iterative, depending on the program requirements.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   It can be either incremental or a single time solution. Some are small programs with limited usage; others are multiple iterations with each giving some new capability.

7. What SE activities did your programs include?
   Preliminary design reviews, critical design reviews, configuration control. They complete risk management through safety review boards.

8. How did you decide which processes to include?
   They have guidance in the AFRLIs.

9. How iterative are the SE activities used in your programs?
   When everyone is satisfied they stop the SE activities. They have independent reviews for programs at different points to determine if they are ready to progress to other phases. They also weigh the return on investment, small programs with little ROI are much less rigorous.

10. What interactions did you see between the SE process included or excluded?
    A lack of requirements analysis impacts the overall program and meeting the user's needs. Has seen "synergistic flow of processes from the engineering

review level up through technical and safety risk assessments and program reviews."

11. How have projects you have been involved in tailored the acquisition process?
    His projects have used support contractors that have the ability to do things quickly without the bureaucracy associated with government of military employees.

12. How do you determine to what level a program needs to be tailored?
    Based upon the scope of the program. The larger the program the more different activities and processes must be completed ad to higher levels of rigor. Also based upon the experience of the PM and project team.

13. What effects did tailoring have on the overall project?
    99% of the time it's a positive effect on the program with respect to time and schedule constraints.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    Depends on the PM and their experience level.

15. What attributes does your organization use to determine how a program is tailored?
    Money, time frame, who the stakeholders are, whose money it is and what the contract says, technology readiness, manufacturing readiness.

16. What interactions are observed between the attributes and the outcome of the program?
    Technology readiness to the acceptable solution level. They are happy if they can get to a 90% solution level, sometimes the customer accepts as low as 50% success as they are currently not able to get any success or relief from their capability gap. Requirements definition to the overall success of the program.

Summary of Interview #2

1. What experience do you have with rapid acquisition?
   Multiple rapid technology development programs in support of the operational warfighter.

2. What process have you seen being used to complete rapid acquisition programs?
   Used an ad-hoc process. Considers the process to be people oriented versus process oriented. "If everyone could be special operations, then we wouldn't need the infantry."

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Sometimes it's started by an UON/JUON other times it's started by informal requirements generation and phone calls between people that know each other.

5. How iterative is the rapid acquisition process that your office uses?
   Very iterative. Many field testing's with the end users before final products are produced.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   Both incremental and single time solutions used based upon the program requirements.

7. What SE activities did your programs include?
   Doesn't complete SE activities by name. Views design process as a loop; design, build, test.

8. How did you decide which processes to include?
   Inclusion of activities is based upon experience of PM and SMEs of the technology being used in the programs.

9. How iterative are the SE activities used in your programs?
   N/A due to previous answers.

10. What interactions did you see between the SE process included or excluded?
    N/A due to previous answers.

11. How have projects you have been involved in tailored the acquisition process?

Removed programs from standard laboratory processes. As long as they were designated a Core Process 3 program, they were able to waive many of the process requirements levied by their organizations on standard programs.

12. How do you determine to what level a program needs to be tailored?
    Based upon PM experience and judgment.

13. What effects did tailoring have on the overall project?
    Positive effect on schedule.

14. When determining how to tailor a program, do you start at a minimum baseline and add
    They start with a minimal program and add activities until the PM, SMEs, and customer is comfortable with the program.

15. What attributes does your organization use to determine how a program is tailored?
    "A need that both the engineers and warfighters agree is achievable." Strong communications.

16. What interactions are observed between the attributes and the outcome of the program?
    "So if you are going to do a rapid reaction project, the technology itself has been mature."

Summary of Interview #3

1. What experience do you have with rapid acquisition?
   PM for rapid program on major USAF air frame in a traditional program office. Also completed an USAF exercise for a QRC which included all the coordination issues of a rapid acquisition program but did not execute the design portion.

2. What process have you seen being used to complete rapid acquisition programs?
   The QRC process in the exercise and a QRC-like process for the rapid acquisition program.

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Exercise was a UON and the actual rapid acquisition program was started by the CSAF designating the need for the program.

5. How iterative is the rapid acquisition process that your office uses?
   The process is iterative in that they deliver a certain set of capability with the first version and then modify that to increase the capability in future iterations.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   It's an iterative process.

7. What SE activities did your programs include?
   "Well the one way to do it in a disciplined manner is to follow a systems engineering process that is tried and true and the [office] has one I just wasn't aware of it." They worked the design technical process, stakeholder requirements definition, and technical reviews.

8. How did you decide which processes to include?
   Through communication with the contractor and based upon the experience of the PM.

9. How iterative are the SE activities used in your programs?
   "I say as we moved closer to each one of those phases we took a deeper look at them to make sure are we doing, or are we meeting the minimum standards of what we need to do in each one of these phases. So we did kind of go back and double check to make sure that we were doing the right amount of due diligence in each one of those phases of the project."

10. What interactions did you see between the SE process included or excluded?
    The lack of rigor in certain activities caused the program to have to repeat them. Later in the program, the rigor was stressed and the reviews and testing went much better.

11. How have projects you have been involved in tailored the acquisition process?
    By reviewing how they were going to be reviewing the program they were able to tailor how certain products were being reported and ensured that the program met the key requirements.

12. How do you determine to what level a program needs to be tailored?
    It's based upon the experience of the PM and program staff.

13. What effects did tailoring have on the overall project?
    It expedited the schedule and allowed the program to meet the needs stated by the CSAF.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    The respondent reported that it was both. They knew the main processes that their organization would use on a traditional program and went down from there, while they also went from a detailed schedule and built up from that.

15. What attributes does your organization use to determine how a program is tailored?
    Cost, test schedule, program priority, and system integration.

16. What interactions are observed between the attributes and the outcome of the program?
    Design requirements were defined in such a way to minimize the integration necessary with the aircraft systems as a whole.

Summary of Interview #4

1. What experience do you have with rapid acquisition?
   Contractor supporting AFRL. Has conducted multiple programs in support of the rapid acquisition cell at AFRL in support of urgent needs.

2. What process have you seen being used to complete rapid acquisition programs?
   The process is more of an ad-hoc process. Considers the process to be a streamlined version of AFRL Core Process 3.

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Most start by receiving a UON/JUON. However some programs are technology push coming out of the lab.

5. How iterative is the rapid acquisition process that your office uses?
   Not all that iterative.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   The respondent considers most programs to single time solutions. Each program might build on previous ones, but not in a planned incremental solution set.

7. What SE activities did your programs include?
   Requirements Definition, interface management, assessments on capabilities required, and risk management.

8. How did you decide which processes to include?
   Trades are made between activities based upon the experience of the PM and team along with the schedule of the associated program.

9. How iterative are the SE activities used in your programs?
   Somewhat iterative.

10. What interactions did you see between the SE process included or excluded?
    The lack of configuration control cause issues when the user came back on a program and asked for more of the items. Lack of configuration control meant that the items they received were not fully compatible with the original set of equipment.

11. How have projects you have been involved in tailored the acquisition process?

Tailoring was completed based upon the experience of the PM. Tailoring was conducted based upon what the programs require, then understanding what tools had to be brought to bear on the problem. This would dictate what had to be completed based upon the time allowed.

12. How do you determine to what level a program needs to be tailored?
    "When it starts hindering the execution you've gone too far."

13. What effects did tailoring have on the overall project?
    Normally a positive effect on reaching the schedule constraint.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    It can be both a top down methodology or a bottom up depending on the program. Due to the ambiguous nature of some of the problems, they will add process as they go.

15. What attributes does your organization use to determine how a program is tailored?
    Technology readiness, integration, money, and time/schedule.

16. What interactions are observed between the attributes and the outcome of the program?
    The respondent saw non-linear relationships between requirements to cost and other implications.

Summary of Interview #5

1. What experience do you have with rapid acquisition?
   Came from the test community to the laboratory. In the respondents leadership position, they review the programs that are being conducted under his purview.

2. What process have you seen being used to complete rapid acquisition programs?
   The lab SE process based upon AFRLIs and the eight SE questions discussed there.

3. Does your office follow the QRC process defined in AFI 63-114?
   The respondent does not work QRC processes. Some programs might be part of a larger subset of activities that fall under a QRC process, but there internal process is not regulated by the QRC process.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Technology push and the needs of the warfighter. Their discussions with the warfighter might cause a JUON or UON to be created to acquire the technology that they have been working on.

5. How iterative is the rapid acquisition process that your office uses?
   The processes iteration depends on the programs being conducted. Some are single iterations while others are multiple iterations.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   Both. Some programs are technology demonstrations that once they work the laboratory is finished with the program, while others are incremental upgrades to programs already fielded.

7. What SE activities did your programs include?
   The lab is more focused on technical processes than technical management processes. Verification and validation are a "big part of what we do here." Configuration management is also conducted.

8. How did you decide which processes to include?
   The front office has begun to require more systems engineering to increase the rigor in many projects.

9. How iterative are the SE activities used in your programs?
   Iterations depends on the approval authority. If the approval authority is ok with the work completed then they will allow the program to move onto the next phase, where as if they are unhappy with the level the program is at they will require them to go back and conduct more work to correct any issues discovered during the reviews.

10. What interactions did you see between the SE process included or excluded?
    There is an interaction between Requirements Definition and Verification and Validation. Also Risk Management interacts with the program, along with interface management.

11. How have projects you have been involved in tailored the acquisition process?
    More of streamlining steps then eliminating them.

12. How do you determine to what level a program needs to be tailored?
    Level of effort drives some tailoring aspects. If the program is small you will not need or be able to conduct as many activities as on larger programs. Also, what does the risk management strategy state is the high risk areas?

13. What effects did tailoring have on the overall project?
    Generally positive effects for tailoring programs, when conducted correctly.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    Somewhere between the top-down and bottom up methodologies. They have an idea of what needs to be done and then build their processes from their based upon the program.

15. What attributes does your organization use to determine how a program is tailored?
    Technology maturity, budget, and system interactions.

16. What interactions are observed between the attributes and the outcome of the program?
    Risk impacts many of the program decisions.

Summary of Interview #6

1. What experience do you have with rapid acquisition?
   Multiple rapid projects under AFRL and JIEDDO.

2. What process have you seen being used to complete rapid acquisition programs?
   The acquisition process used was an ad-hoc process. Didn't really follow AFRLIs or AFI63-114.

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Informal requirements definition by having the respondent try new technologies that might work for a general problem set. Afterwards, the respondent discussed what he found with the warfighter to see if it would work and should be fielded.

5. How iterative is the rapid acquisition process that your office uses?
   It is an iterative solution process.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   The respondent stated that they never walk away, and some programs are iterative upgrades to older programs.

7. What SE activities did your programs include?
   Skipped due to interviewee not receiving the SE process list before interview.

8. How did you decide which processes to include?
   No answer provided.

9. How iterative are the SE activities used in your programs?
   No answer provided.

10. What interactions did you see between the SE process included or excluded?
    No answer provided.

11. How have projects you have been involved in tailored the acquisition process?
    Programs are managed informally and the respondent has had to inject more rigor into the processes used.

12. How do you determine to what level a program needs to be tailored?
    Based upon the experience of the PM and program team.

13. What effects did tailoring have on the overall project?

Couldn't answer directly. Stated that his organization relies on the "contractor to really carry the ball on the program management and systems engineering oversight."

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?

    Reported using a bottom-up methodology.

15. What attributes does your organization use to determine how a program is tailored?

    The respondent didn't really evaluate programs based upon discriminates, the only one that they discussed was money.

16. What interactions are observed between the attributes and the outcome of the program?

    Having the contract already in place so that you can add the activities for the program under an existing contract expedites the process.

Summary of Interview #7

1. What experience do you have with rapid acquisition?
   Early career was spent in the lab working rapid acquisition programs. Current job is at a traditional program office working both traditional and rapid acquisition programs for an airframe.

2. What process have you seen being used to complete rapid acquisition programs?
   Reported using an ad-hoc process.

3. Does your office follow the QRC process defined in AFI 63-114?
   Worked a two or three QRC programs when the AFI was first published but now most programs are worked as ad-hoc processes.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   At AFRL it was predominantly technology push. At the SPO it is driven by UON/JUON and CSAF directed programs

5. How iterative is the rapid acquisition process that your office uses?
   Not an iterative process. If you have to iterate you've done something wrong that is causing rework.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   Rapid acquisition can be both. Respondent stated that they would prefer to push out multiple small iterations, but some programs require larger, more complex answers that reduce the amount of iterations possible.

7. What SE activities did your programs include?
   Reported using almost all the technical processes, some of the technical management processes.

8. How did you decide which processes to include?
   Inclusion is based upon the schedule and properties of the program.

9. How iterative are the SE activities used in your programs?
   A perfect run through the processes is expected.

10. What interactions did you see between the SE process included or excluded?
    If the requirements are not flushed out in the beginning then you lose the opportunity to create some capabilities on the back end of the program due to the inability to go back on some programs.

11. How have projects you have been involved in tailored the acquisition process?
    If the process is not required by federal statue, then the organization does not complete it. The use of undefinitized contracts was approved.

12. How do you determine to what level a program needs to be tailored?
    It is usually "what can I get done in the time I have."

13. What effects did tailoring have on the overall project?
    Any standard process that isn't completed increases the risk of the program. But the experience level of the PM and team help to attenuate most issues.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    They start with a bare-bones baseline and then add processes as they progress through the planning and execution of the program.

15. What attributes does your organization use to determine how a program is tailored?
    Speed and risk.

16. What interactions are observed between the attributes and the outcome of the program?
    The speed of the programs dictates that they rarely do lessons learned. Adding in the turnover of personnel and they reported that they make the same mistakes over and over.

Summary of Interview #8

1. What experience do you have with rapid acquisition?
   Conducted multiple rapid acquisition programs at AFRL.

2. What process have you seen being used to complete rapid acquisition programs?
   In the respondents previous experience, they reported conducting QRC processes along with rapid programs that fell under the purview of the AFRL process.

3. Does your office follow the QRC process defined in AFI 63-114?
   None of the laboratory rapid acquisition programs are designated as a QRC programs.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   UON/JUON initiations along with technology push coming from the laboratory.

5. How iterative is the rapid acquisition process that your office uses?
   It is iterative.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   It's normally considered an incremental process.

7. What SE activities did your programs include?
   Requirements definition, implementation, integration, verification and validation, technical assessment, and interface management.

8. How did you decide which processes to include?
   Inclusion was based upon the experience of the PM and program team.

9. How iterative are the SE activities used in your programs?
   The processes are iterative, especially if you fail part of the verification or validation portion of the program.

10. What interactions did you see between the SE process included or excluded?
    Over extrapolation of verification in one environment to another environment. Another reported interaction was risk management to overall success of the program.

11. How have projects you have been involved in tailored the acquisition process?
    Tailoring was based upon schedule, the analysis of the problem and the maturity of the technology being used in the program.

12. How do you determine to what level a program needs to be tailored?
    [Inadvertently skipped by interviewer.]

13. What effects did tailoring have on the overall project?
    It's normally positive, but can have a negative effect if you end up tailoring out an activity you realize you needed later in the program.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    It's a bottoms up methodology.

15. What attributes does your organization use to determine how a program is tailored?
    Technology readiness, manufacturing readiness.

16. What interactions are observed between the attributes and the outcome of the program?
    "If you haven't done the requirements analysis part it's not going to turn out so hot. Your stuff isn't going to turn out to have the performance you need. And risk management is pretty much the same."

Summary of Interview #9

1. What experience do you have with rapid acquisition?
   Both respondents had experience in rapid acquisition. Respondent 1 worked in the civilian world conducting rapid development and prototype before coming to government service and working in what should be considered a rapid development program office. Respondent 2 was in private industry working and upon starting to work as a government civilian had conducted multiple rapid acquisition projects.

2. What process have you seen being used to complete rapid acquisition programs?
   Could be considered an ad-hoc process or an organizational defined best practices based upon experience of project teams and the PM.

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Informal requirements generation with normally a phone call or email from another program who requires their help in the design process and problem solving.

5. How iterative is the rapid acquisition process that your office uses?
   The process is iterative in that if the original design does not work they are ok with going back and redesigning it.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   Both respondents stated that they do not do repetitive production, but they will do incremental increases in capabilities if required.

7. What SE activities did your programs include?
   The respondents stated that while the do SE like activities, they do not do the standard SE activities. Upon further discussion they stated that they do requirements analysis, implementation, integration, verification and validation, technical reviews, but all activities have different names than the standard SE names.

8. How did you decide which processes to include?
   Based upon the PM and program member's experiences.

9. How iterative are the SE activities used in your programs?
   The processes are iterative if required, but they try for minimal rework to allow expedited timelines.

10. What interactions did you see between the SE process included or excluded?
    Their process is flexible, they only remove processes when they are not adding value to the programs.

11. How have projects you have been involved in tailored the acquisition process?
    They tailor their projects "with respect to magnitude or if [they] are going to outsource the work." .

12. How do you determine to what level a program needs to be tailored?
    [Not clearly answered during interview.]

13. What effects did tailoring have on the overall project?
    Tailoring the process accelerates the schedule.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    When designing their process, they 'threw out' the traditional acquisition process and recreated what they felt was necessary based upon their experience.

15. What attributes does your organization use to determine how a program is tailored?
    They choose some programs based upon the interest of the organization with the problem or request. Other attributes include money, functional knowledge area required, if they have the ability or can contract someone who has the ability to do the work.

16. What interactions are observed between the attributes and the outcome of the program?
    They try to level the work flow of multiple programs being run concurrently.

Summary of Interview #10

1. What experience do you have with rapid acquisition?
   Conducts rapid acquisition programs in the laboratory.

2. What process have you seen being used to complete rapid acquisition programs?
   Broad agency announcement, AFRLI 63-104 process, Small Business innovative research.

3. Does your office follow the QRC process defined in AFI 63-114?
   No.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Mostly technology push.

5. How iterative is the rapid acquisition process that your office uses?
   The process is iterative, with each program building on the last.

6. Do you view rapid acquisition as an incremental process or a single time solution?
   The planning process is an annual event, so most programs are iterative based upon that annual review.

7. What SE activities did your programs include?
   Do most of the technical processes and some technical management processes including configuration control and interface management.

8. How did you decide which processes to include?
   Inclusion or exclusion of processes is based upon the level of the program in the laboratory hierarchy processes and the finish.

9. How iterative are the SE activities used in your programs?
   The SE processes are iterative and have feedback loops built into them.

10. What interactions did you see between the SE process included or excluded?
    In general the respondent stated that the less SE rigor the more problems programs have.

11. How have projects you have been involved in tailored the acquisition process?
    Tailoring was done by using the BAA or SBIR instead of normal laboratory process. They also tailor based upon the funding levels and if they require to incorporate more partners to increase funding.

12. How do you determine to what level a program needs to be tailored?
    The level of tailoring is based upon funding, time and contracting support.

13. What effects did tailoring have on the overall project?

Tailoring can have a negative effect in that you will not focus on certain areas of technology. It normally has a positive effect in that you can reach schedule requirements.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    They use a bottom up methodology and have a baseline that they use and then add to it as required.

15. What attributes does your organization use to determine how a program is tailored?
    Money, program level, technology level.

16. What interactions are observed between the attributes and the outcome of the program?
    Technology level and program level have the biggest impact on overall success of the program.

Summary of Interview #11

1. What experience do you have with rapid acquisition?
   Worked in the Northrop-Grumman EF-111 Systems Improvement office in 1994, a $1B program. The program was later killed off by Congress. Worked in the ACC weapon system program of record designated by the CSAF. This is where the interviewee heard the phrase "when skating on thin ice your best asset is speed." Interviewee's office was in charge of integrating the weapon systems.

2. What process have you seen being used to complete rapid acquisition programs?
   Programs are run ad-hoc, and managed mostly by "sheer will of personality"

3. Does your office follow the QRC process defined in AFI 63-114?
   No, the in-fighting between stakeholders slows it down too much.

4. How do these programs begin (i.e. initiation by UON/JUON, technology push…)?
   Customers come in with a JUON in hand and interviewee's organization is tasked by SAF/AQ.

5. How iterative is the rapid acquisition process that your office uses?
   Interviewee's organization works for the 80% solution and worries about the 20% after fielding. This allows the programs to cost less than the 100% solution and to be more agile to the user. "Perfect is the enemy of good enough."

6. Do you view rapid acquisition as an incremental process or a single time solution?
   Incremental solutions with interviewee's organization working the systems from cradle to grave. They are constantly chasing improvements to the systems.

7. What SE activities did your programs include?
   The DAG SE activities are not done by name, but the processes that they use meet the same needs.

8. How did you decide which processes to include?
   It's personality based or expert driven instead of lack of experience making them beholden to a process. Requirements are expert driven versus process driven.

9. How iterative are the SE activities used in your programs?
   They are all iterative, but they try to minimize the iterations to accelerate the programs.

10. What interactions did you see between the SE process included or excluded?

Reviews such as PDR and CDR are done, but they are a lot closer than normal acquisition, 2-3 months apart. 80% solution at PDR with a final solution at CDR. There is causality in everything. Sometimes the rigor is bad due to the situation of the program.

11. How have projects you have been involved in tailored the acquisition process?
    The MDA steps in and tells them how they will be done or the reporting requirements.

12. How do you determine to what level a program needs to be tailored?
    Add until the customer quits asking about a certain area. It depends on the user and the MDA.

13. What effects did tailoring have on the overall project?
    Normally accelerates the programs.

14. When determining how to tailor a program, do you start at a minimum baseline and add activities or do you start with a standard 'whole' program and remove activities?
    Interviewee's organization has a minimum baseline and then adds to it.

15. What attributes does your organization use to determine how a program is tailored?
    It's the integration of known technology and airframe. Dollar amounts and who the MDA is. User, personnel, TRL.

16. What interactions are observed between the attributes and the outcome of the program?
    High tech readiness increases likelihood of program success.

Vita

Captain David Wilson graduated from East Lake High School in Tarpon Springs, FL. He graduated from the University of Florida in 2004 with a Bachelor of Science degree in Aerospace Engineering and was commissioned in the United States Air Force from Officer Candidate School at Maxwell AFB. Captain Wilson's experience as an engineer in the United States Air Force includes conducting operational testing on the B-52 and as the squadron executive officer at Barksdale AFB. He next was the Assistant Director of Operations and the Signal's Intelligence Squadron at the National Air and Space Intelligence Center at Wright-Patterson AFB. Captain Wilson has deployed in support of Operation IRAQI FREEDOM as the Security Forces Group Executive Officer. He entered the Graduate School of Engineering and Management at the Air Force Institute of Technology in September 2012. Upon graduation, he will join the United States Air Force Nuclear Weapon Center at Kirkland AFB as a program manager.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From – To)*
27-03-2014	Master's Thesis	Sep 2012 – Mar 2014

4. TITLE AND SUBTITLE

Tailoring Systems Engineering for Rapid Acquisition

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Way
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER

AFIT-ENV-14-M-69

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Intentionally Left Blank

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

13. SUPPLEMENTARY NOTES
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14. ABSTRACT
The use of Systems Engineering (SE) is mandated by the Department of Defense and United States Air Force (USAF) policy and is to be considered under the purview of the Program Manager. A normal SE program can consist of multiple processes from user requirement generation to the verification and validation of the system under design. The SE process encompasses the entire acquisition program and can take multiple years to conduct with completion only being achieved when the program is disposed of at the end of its life. Rapid acquisition programs such as a Joint Urgent Operational Need can have timelines that are compressed to less than 24 months. This compressed timeline often necessitates the truncation or removal of tasks. This research examines the literature on how the USAF completes rapid acquisitions and compares it to the responses of twelve members of the acquisition community with experience in rapid acquisition. The data is categorized to allow for the main points to be collected explaining how the USAF tailors the acquisition and SE processes. The results showed that while some programs do follow prescribed instructions most use an ad-hoc execution process and the Systems Engineering Technical Management Processes were underutilized.

15. SUBJECT TERMS
Systems Engineering, Tailoring, Rapid Acquisition, Technical Processes, Technical Management Processes

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
REPORT	**ABSTRACT**	**c. THIS PAGE**			Dr. David Jacques (ENV)
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Standard Form 298 (Rev: 8-98)
Prescribed by ANSI Std. Z39-18