



INCREASING PILOT PRODUCTION BY APPLYING ELEMENTS OF 'LEAN
PRODUCTION THEORY' AND 'VALUE STREAM ANALYSIS' TO THE CURRENT
SPECIALIZED UNDERGRADUATE PILOT TRAINING SYLLABI

Graduate Research Paper

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AFIT-ENS-MS-17-J-046

DEPARTMENT OF THE AIR FORCE
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Graduate Research Paper

Presented to the Faculty

Department of Operational Sciences

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 Operations Management

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June 2017

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Abstract

Currently the demand to fill operational pilot billets as well as rated pilot staff billets in the USAF outweighs the “Total Pilot Force”. The attrition rate is outpacing the production and absorption rate, causing a pilot shortage. One approach to solving this problem is to increase pilot production. This study will address the possibility of shortening the Specialized Undergraduate Pilot Training (SUPT) timeline via a revised course flow to the current syllabi, which would ultimately lead to an increase in pilot production. These revisions are derived from elements of Lean Production Theory and Value Stream Analysis, which both aim to maximize efficiency by focusing on what the customer values, and eliminating waste (that which the customer does not value). Currently, there are numerous SUPT training events that all SUPT students execute that develop skills that only certain SUPT graduates need at their follow-on assignments. In order to enable the development of only the skill-sets required by follow-on Flight Training Units, certain training events could be eliminated entirely without depriving any SUPT students from the pilot skills needed at their follow-on FTUs. In other cases, training events could be delayed to follow the completion of the SUPT common core requirements.

Dedicated to my Mom.

Acknowledgments

I would of course like to thank my AFIT Advisor, Dr (Lt Col) Matthew Douglas, for routinely taking the time to provide me with advice on how to conduct this research every step of the way, as well as for his patience and mentorship. I would also like to thank my AMC Sponsor, Col John Lamontagne, for allowing me to take this project in the direction that I was most passionate about, and for trusting and supporting me. I would like to thank Mr. James Cooper for introducing me to the topic, and for putting me in touch with so many individuals who helped me with this project. Finally, I would like to thank the SUPT Squadron Commanders who welcomed me into their units so I could gather the necessary data to give this project merit.

Matthieu A. Rigollet

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I. Introduction

General Issue

The U.S. Air Force (USAF) is an organization whose mission is to “fly, fight and win in air, space, and cyberspace.” (Official USAF Website, 2016). As is the case with any and all organizations, there are basic requirements that enable mission execution. These basic requirements can be boiled down to one essential resource: money. If properly trained and equipped, people can execute any given mission. The Presidential Budgets (PB) that were enacted by Congress from fiscal year 2010 (FY10) through FY16, illustrate how USAF funds are typically allocated. Here is how the FY10 through FY16 PBs were distributed (on average) over the past seven years; Research Development Test & Evaluation (16%), Procurement (18%), Military Personnel (26%), and Operation & Maintenance (39%) (USAF Budget Overview Highlights, 2011-2017).

In order to execute its primary mission, the USAF needs highly trained people, and people in turn need the proper tools and equipment. Like most organizations, the USAF must continuously balance current requirements against future requirements with limited resources. This is extremely difficult to do, and is the crux of the USAF budget development process. Therefore, the USAF is continuously looking for ways to improve its current business practices in an effort to increase efficiency, and to never sacrifice effectiveness.

During the post-cold war drawdown, the USAF made efforts to shrink the combat air forces (CAF) community due to the reduction of the perceived threat from the Soviet Union. Examples of such efforts include the reduction of almost half of the CAF's inventory of aircraft from 1990 to 2000, the 2005 Base Realignment and Closing (BRAC) of five fighter squadrons, and the 2010 "CAF Redux" which again significantly reduced CAF aircraft inventories as well as fighter pilot billets. Drastically reducing the number of fighter aircraft reduced many operational fighter unit's absorption capacity, which in turn reduced fighter sustainment requirements, and ultimately led to the fighter pilot shortfalls that the USAF is experiencing today (Robbert et al., 2015).

More than a decade ago, with the DoD's increased involvement in combat and anti-terrorism operations, the number of personnel serving in the USAF had grown to a level that was above its authorized end strength (Hancock, 2004). Additionally, the fleet management timeline suggested that in order for the USAF to have the ability to operate in contested environments in the future, it needed to recapitalize and modernize its fleet of aircraft. It was determined that the relatively high levels of employment coupled with fleet recapitalization and modernization requirements were unsustainable. As a result, USAF "Total Force" reduction efforts for all Air Force Specialty Codes (AFSC) for Active Duty (AD), Air National Guard (ANG), and Air Force Reserve Component (AFRC) were mandated by Congress (USAF Public Affairs, 2007). Since 2004, these reductions have been realized in various forms; to include reduced accessions in overmanned career fields, voluntary separation pay, selective early retirement boards, and force shaping boards (Gettle, 2006).

The combined effect of the significant CAF aircraft reductions from 1990 - 2000, the 2005 BRACs, the 2010 CAF Redux, and the overall “Total Force” reductions that started in 2004, was a USAF end strength that struggled to sustain operations, specifically in the pilot community. One approach to reversing the effects that the USAF force reductions had on the “Total Pilot Force” (AD, ANG, AFRC) would be to increase pilot production (Robbert, et al., 2015).

In order to meet mission requirements in 2016, the USAF needed 20,307 pilots in its “Total Pilot Force” but only had 18,895 pilots in its inventory. This means that the USAF was short 1,412 pilots in 2016. (AMC/A3, 2016). By using current USAF manpower and future requirements data provided by Headquarters Air Force (HAF), the AMC/A3 Rated Force Management branch forecasts that unless the HAF addresses the variables that are driving the current and forecasted shortages, things will only get worse (see Figure 1).

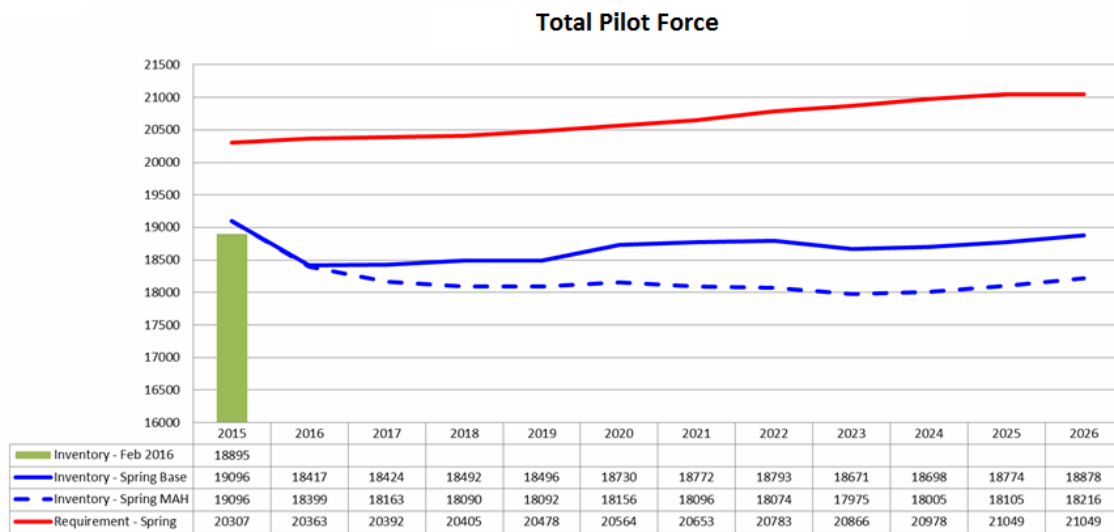


Figure 1: USAF Total Pilot Force Inventory vs Requirement (AMC/A3, 2016)

Because a pilot shortage exists, there are rated pilot billets in the USAF that must go unfilled. The current CSAF Rated Staff Allocation Plan (RSAP) dictates that flying units (both operational and training), maintain 100% of their pilot entitlements. While there are currently enough pilots in the “Total Pilot Force” to fill all required line-flying pilot/11X AFSCs, the Fighter Pilot/11F community is only able to fill 39% of the Air Operation Center (AOC) billets, 30% of their SUPT billets, and 27% of their rated staff billets. Other 11X communities such as Mobility Pilot/11M and Command, Control, Intelligence, Surveillance, and Reconnaissance (C2ISR) Pilot/11R have healthier pilot inventories, but as a result, end up filling in for the fighter pilot shortages (RSAP, 2016). These percentages will only get worse over time unless something is done to increase the USAF pilot inventory. “Under-manning Staff units could not only reduce capabilities, but it also could hurt the ability to develop leaders with the breadth and depth of experience required at the most senior levels inside and outside the Air Force” (AFI 11-412, 2009, pg. 59).

Problem Statement

Currently, the USAF operational, staff, and special duty pilot requirements outweigh the current USAF “Total Pilot Force” inventory. Additionally, due to previous USAF force structure reductions and current retention issues, pilot production and absorption rates are unable to keep up with pilot attrition rates. Ultimately, the delta between the “Total Pilot Force” requirements and the “Total Pilot Force” inventory is forecast to increase unless pilot production, absorption, and retention are increased.

Research Question

In an effort to ultimately increase annual SUPT pilot production, how could the current Primary T-6A SUPT syllabus and the Advanced T-1A and T-38C SUPT syllabi be modified in order to reduce the SUPT timeline without adversely affecting the quality of the pilot that the follow-on FTUs desire?

Research Objective

The ultimate objective of this research is to determine how the current SUPT completion timeline could be shortened without adversely affecting the quality of the pilot that the follow-on FTUs desire.

Research Focus / Scope

This study only addresses the SUPT program that is conducted at Columbus AFB (CAFB), Laughlin AFB (LAFB), and Vance AFB (VAFB) in the T-6A and/or the T-1A or T-38C. This study does not evaluate the SUPT prerequisite Initial Flight Training course that is conducted at Pueblo AFB in the DA-20, as that syllabus focuses exclusively on fundamental aviation skills, all of which apply to MWS/MDS. This study does not evaluate the Euro-NATO Joint Jet Pilot Training Program (ENJJPT), which is conducted at Sheppard AFB in the T-6A and the T-38C, as evaluating ENJJPT would introduce numerous variables that are outside the scope of this study. This study does not address the Advanced SUPT helicopter track conducted at Fort Rucker in the UH-1, as it is a single-track syllabus that only caters to two follow-on FTUs (UH-1N and HH-60). This study does not evaluate the follow-on FTUs other than to consider what basic skill-sets the follow-on FTUs want their students to possess prior to commencing training. Finally,

there are a variety of Major Weapons System/Mission Design Series (MWS/MDS) aircraft in the USAF inventory that do not apply to this study because they are outside the scope of this study (see Table 1).

Table 1: Aircraft Outside the Scope of this Research

Aircraft	Category	Reason Aircraft is not Included
T-6A	UPT Trainer	To avoid circular reasoning
T-1A	SUPT Trainer	To avoid circular reasoning
T-38C	SUPT Trainer	To avoid circular reasoning
C-32	Operational Support Airlift	Not available directly out of UPT
C-37	Operational Support Airlift	Not available directly out of UPT
C-40	Operational Support Airlift	Not available directly out of UPT
VC-25	Operational Support Airlift	Not available directly out of UPT
U-2	Intelligence Surveillance Reconnaissance	Not available directly out of UPT
RQ-1/MQ-1	Remotely Piloted Aircraft	Has specialized RPA training program
RQ-4	Remotely Piloted Aircraft	Has specialized RPA training program
MQ-9	Remotely Piloted Aircraft	Has specialized RPA training program
RQ-170	Remotely Piloted Aircraft	Has specialized RPA training program
UH-1N	Helicopter	Has separate specialized undergraduate pilot training syllabus
HH-60	Helicopter	Has separate specialized undergraduate pilot training syllabus

Investigative Questions

- 1) Based on each SUPT syllabi's design (T-6A, T-1A, and T-38C), what broad categorical aviation skills are intended to be developed in their respective SUPT students?
- 2) How do the broad categorical aviation skills that SUPT intends to develop compare to the aviation skills that follow-on FTUs desire based on their respective missions?
- 3) What is the current timeline for each SUPT syllabi in terms of track select for the T-6A syllabus, and assignment night for the T-1A and T-38C syllabi?
- 4) What training events (specific to their SUPT syllabus) are non-value added to certain SUPT graduates based on all potential follow-on assignments?
- 5) What value do Subject Matter Experts (SMEs) place on student pilot's flying training missions that do not directly correlate to the missions that they will be assigned to fly?

Assumptions / Limitations

It is assumed that by decreasing the total amount of time to complete SUPT, it is possible to increase the capacity to produce SUPT graduates, which would contribute to increasing the “Total Pilot Force”. However, it must be understood that there are more variables in this problem than just SUPT pilot production. The follow-on FTUs would have to possess the capacity to receive and train this increase in SUPT graduates. Beyond that, operational units would have to possess the capacity to absorb these new pilots as well.

When referring to production value, it must be determined who the customer is, and what they value. For the purpose of this study, the T-1A and T-38C Flight Training Squadrons (FTS) are considered the customer of the T-6A FTSS. It is assumed that the T-1A and T-38C FTSS value SUPT students with a solid understanding of the fundamentals of military aviation (e.g., transferable basic aircraft control concepts, instrument procedures, navigation procedures, and basic formation considerations). Furthermore, it is assumed that the follow-on FTUs are considered the customer of the T-1A and T-38C FTSS, and that they value SUPT graduates who have developed the advanced skill-sets that are required in order to execute the primary mission of their respective MWS/MDS (or at least proficiency in the skills that will enable rapid learning of the skills required to execute the primary mission). Additionally, it is assumed that the basic skill-sets that the follow-on FTUs value will also be valued by their respective operational units.

When it came to determining non-value added training, determining which training events could be eliminated, and determining how much time could be saved, the

researcher needed to determine the average number of events that needed to be accomplished each day given the allocated timeframe for each syllabus. To do this, the researcher grouped “Academic” events and “Ground Training” events as “Preflight Training”, and grouped “Simulator” events and “Aircraft” events as “Flying Training”. It is assumed that all preflight training events in the T-6A syllabus will be completed during the first 40 days of training, and that the flying training events will be completed during the remaining 100 days of training. It is assumed that all preflight training events in the T-1A and T-38C syllabi will be completed during the first 30 days of training, and that the flying training events will be completed during the remaining 90 days of training.

II. Literature Review

Chapter Overview

This chapter will cover the history of pilot training in terms of the two fundamental approaches to pilot training: specialized vs generalized. Additionally, the current Specialized Pilot Training (SUPT) construct will be discussed in terms of the general requirements of both the Primary (AETC Syllabus P-V4A-J, 2016) and the Advanced (AETC Syllabus P-V4A-G, 2016 / AETC Syllabus P-V4A-A, 2015) phases of SUPT. The author will also introduce the general concepts of Lean Production Theory and Value Stream Analysis.

History of Pilot Training

Since its inception, the USAF's approach to training pilots has varied between two fundamental approaches; specialized vs generalized. The premise behind specialized pilot training is that all students receive the same initial "primary phase" of training which focuses on fundamental aviation concepts that are universal to any and all follow-on aircraft, and then track to one of two "advanced phases" where focus is placed on developing aviation skills particular a specific type of mission. The premise behind generalized pilot training is that all students follow the same syllabus which covers the full range of both fundamental and advanced aviation skills required of all follow-on aircraft. The advantage of specialized pilot training is that depth of knowledge and skill is achieved in a particular type of mission, whereas breadth of knowledge and skill are sacrificed. The advantage of generalized pilot training is that breadth of knowledge and

skill is achieved in a variety of missions, whereas depth of knowledge and skill are sacrificed (Carretta, 2000 / Emmons, 1991).

From 1939-1959, the USAF took a specialized approach to pilot training. Then in 1959, the USAF switched to a generalized approach to pilot training which lasted until 1993 (Emmons, 1991 / U.S. Air Force, About Us, 2016). In this era, SUPT students attended pilot training for approximately one year. They completed the 21 week-long primary phase in the T-37, and then completed a 32 week-long advanced phase in the T-38. Similar to the current SUPT construct, assignments were determined based on student performance, student preference, instructor recommendation, and needs of the Air Force (Carretta, 2000 / AETCI 36-2605 Vol 4, 2016). This approach “exposed all students to essentially the same curriculum and produced a pilot who, theoretically, was capable of flying any of the Air Force's aircraft after a brief period of transition training” (Emmons, 1991). In 1993, the USAF switched back to a specialized approach to pilot training, which is the current construct of pilot training.

Current Pilot Training Construct

Under the current construct of pilot training, students receive specialized training that applies to the type of aircraft that they will operate following graduation, hence the title ‘Specialized Undergraduate Pilot Training’. In order to graduate from SUPT, students must successfully complete two phases of training: Primary and Advanced. Primary training is conducted in the T-6A, and Advanced training is conducted in either the T-1A or the T-38C. It takes approximately one year (11.96 months) to complete SUPT. During this time, students are exposed to various training environments to

included academics, grounds training, simulator events, and flying events. Included below is a ‘current state map’ for SUPT (see Figure 2), and a brief description of each phase of training will be discussed in the following paragraphs.

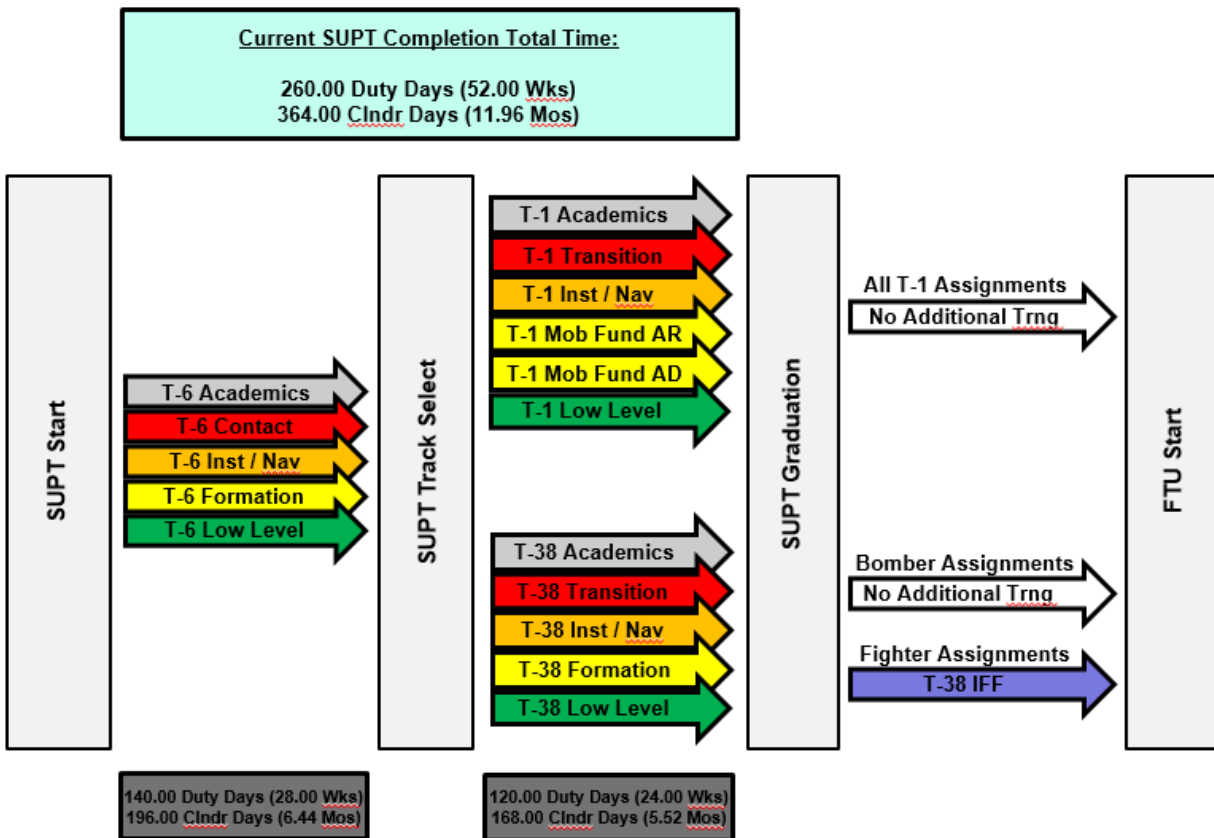


Figure 2: SUPT Current State Map

Primary Syllabus

T-6A Primary SUPT Syllabus

The objective of the T-6A primary syllabus is to “prepare graduates of this phase for the advanced phase.” The T-6A syllabus is theoretically designed to develop the basic fundamentals of aviation that will be required of all SUPT graduates. This is accomplished by completing three “sections” of flight training (contact,

instrument/navigation, and formation) where students learn the following skills; basic aircraft control, three-dimensional maneuvering, instrument approaches and procedures, VFR and IFR navigation, and basic formation. The T-6A primary SUPT syllabus consists of 159 academic events, 22 ground training events, 35 simulator sorties, and 63 aircraft sorties for a total of 279 individual events. The program is designed to be completed in 140 duty days (does not include weekends), which equates to 196 calendar days or 28 weeks (AETC Syllabus P-V4A-J, 2016).

Track Select

According to AETCI 36-2605 Vol 4, no later than five duty days prior to each SUPT class's T-6A Primary Phase completion date, AETC/A3R (Resources and Requirements Division) will notify SUPT wing commanders of the number of T-1A and T-38C slots allocated. Before SUPT students are tracked to either T-1A or T-38C, SUPT leadership takes into consideration each student's past performance, future potential, preference, IP recommendations, and needs of the Air Force. Additionally, T-6A students are only tracked once they have successfully completed all T-6A syllabus check-rides (mid-phase, final contact, instrument, and formation). This typically results in the track select results being released to students during the last week of T-6A syllabus and more specifically, on the last day of T-6A training, which is typically a Friday (2016, pg. 41-42).

Advanced Syllabi

T-1A Advanced SUPT Syllabus

The objective of the T-1A advanced syllabus is to “award commission[ed] officers the aeronautical rating of Air Force pilot and prepare them for airlift / tanker /

reconnaissance / special operation aircraft.” The T-1A track is designed for “airlift / tanker / reconnaissance / special operation” follow-on assignments (AETC Syllabus P-V4A-G, 2016, pg. 1). The T-1A syllabus is theoretically designed to develop advanced concepts of aviation typically found in the Mobility Air Force (MAF). This is accomplished by completing three sections of flight training (transition, instrument/navigation, and air mobility fundamentals) where students learn the following skills; advanced multi-engine aircraft control, instrument approaches and procedures, VFR and IFR navigation, advanced 2-ship formation, receiver air refueling, tanker air refueling, low level, and airdrop. The T-1A advanced SUPT syllabus consists of 112 academic events, nine ground training events, 24 simulator sorties, and 43 aircraft sorties for a total of 188 individual events. The program is designed to be completed in 110 duty days (does not include weekends), which equates to 154 calendar days or 22 weeks (AETC Syllabus P-V4A-G, 2016).

T-38C Advanced SUPT Syllabus

The objective of the T-38C advanced syllabus is to “qualify students for the USAF aeronautical rating of pilot and entry into follow-on training courses” and to “provide all foundation skills essential for success as combat aircrew members.” The T-38C track is designed for “high-performance jet aircraft” (AETC Syllabus P-V4A-A, 2015, pg. 1). The T-38C syllabus is theoretically designed to develop advanced concepts of aviation typically found in the Combat Air Force (CAF). This is accomplished by completing three sections of flight training (transition, instrument/navigation, and formation) where students learn the following skills; advanced multi-engine aircraft control, instrument approaches and procedures, VFR and IFR Navigation, advanced 2-

ship and 4-ship formation, and low level. The T-38C advanced SUPT syllabus consists of 66 academic events, 28 ground training events, 31 simulator sorties, and 81 aircraft sorties for a total of 206 individual events. The program is designed to be completed in 110 duty days (does not include weekends), which equates to 154 calendar days or 22 weeks (AETC Syllabus P-V4A-A, 2015).

Assignment Process

According to AETCI 36-2605 Vol 4, before T-1A SUPT students can be given a follow-on assignment, they must accomplish their transition check ride as well as their navigation check ride. Before T-38C students can be given a follow-on assignment, they must accomplish their transition check-ride, two-ship formation check-ride, and instrument/navigation check-ride (2016, pg. 42-43). These milestones represent a “no earlier than” milestone in the current SUPT assignment process. It should be noted that all T-1A and T-38C check-rides have prerequisite academic, ground training, flight simulator, and aircraft training events. According to AETCI 36-2605 Vol 4, SUPT “assignment night is no later than two weeks before graduation.” Additionally, it goes on to state that “after receiving assignments from [Air Force Personnel Center] and not later than 11 duty days before the scheduled assignment night, [Air Education Training Command Personnel Directorate] will provide the SUPT [Wing Commanders] with their respective assignment block and those of the other bases.” (2016, pg. 42). This means that SUPT Wing Commanders should get the list of follow-on assignments to be filled no later than four weeks prior to graduation.

Lean Production Theory

The fundamental concepts of lean as they pertain to production processes originated from the philosophies and business policies that the Toyota automobile manufacturing company began implementing in the 1950s (Womack, et al., 1991, pg. 20). At that time, Eiji Toyoda (a Toyota engineer) and Taiichi Ohno (a Toyota production specialist) recognized that most western automobile companies that were dominant in the automobile manufacturing industry were employing mass production techniques, and that their processes were overly tolerant of waste (Womack, et al., 1991, pg. 13).

Over the next few decades, Toyoda and Ohno focused their efforts on developing a way to produce higher quality automobiles, with greater variety, in less time, with less equipment & space, and for less money. What they developed has come to be known as the Toyota Production System (Liker, 2004, pg. 7-8 / Womack, et al., 1991, pg. 13). The TPS was eventually codified and organized in books such as “The Machine that Changed the World” by James Womak, Daniel Jones, and Daniel Ross, “Lean Thinking” by James Womak and Daniel Jones, and “The Toyota Way” by Jeffrey Liker, J. These books serve as tools that enable production and service organizations to reevaluate their processes, and to adopt a more lean approach. They illustrate how Lean Production Theory can create a smoother and more efficient production line from start to finish that takes less time, increases value, and decreases cost. Lean production is the continuous practice of “trying to link all processes – from the final consumer back to raw material – in a smooth flow without detours that generates the shortest lead time, highest quality, and lowest cost” (Womak and Jones, 2003, pg. 43 / Liker, 2004, pg. 33).

Principals of Lean Production Theory

“To be a lean manufacturer requires a way of thinking that focus on making the product flow through value-adding processes without interruption, a pull system that cascades back from the customer demand by replenishing only what the next operation takes away at short intervals, and a culture in which everyone is striving continuously to improve” (Liker, 2004, pg. 7). The researcher acknowledges that in order to become truly lean, organizations must fully embrace all five principles of Lean Production Theory: Maximize Customer Value, Minimize Value Stream, Maximize Efficient Flow, Utilize Pull System, and Pursuit of Perfection (Womak and Jones, 2003, pg. 16-25 / Murman et al., 2002, pg. 99-100). However, the researcher has selected the two principles of Lean Production Theory that could have the largest impact on this study, with the smallest investment in terms of time and money: Maximize Customer Value and Minimize Value Stream.

Maximize Customer Value

In order to maximize customer value, it is first necessary to know two fundamental things: who the customer is, and what they value. “Value can only be defined by the ultimate customer” (Womack and Jones, 2003, pg. 16). Additionally, it is important to understand that there may be customers internal to a process in addition to the end state customers. All customers must be identified, and what they value must be understood. Once customers are clearly identified, and their values clearly understood, the production process can be evaluated from this newly gained perspective of customer value. Only then is it possible to differentiate “the value added steps from the non-value added steps” (Liker, 2004, pg. 27). This sequence of events that turns raw inputs into

valuable outputs is known as the value stream, and from a lean perspective, it must be minimized (Womack and Jones, 2003, pg. 19).

Minimize Value Stream

As it was just stated, in order to minimize the value stream, it is necessary to identify all events throughout the production process from beginning to end, and then to evaluate their value from the customer's perspective towards producing the desired end state product. By doing this, three types of events be uncovered: 1) value adding events, 2) unavoidable non-value adding events, and 3) avoidable non-value adding events (Womack and Jones, 2003, pg. 20). Of these three types of events, the avoidable non-value adding events can be eliminated immediately and entirely. In a production environment, waste is any aspect of the process that does not add value to the end-state product (Liker, 2004, pg. 27). Eliminating waste while embracing value-adding processes is the fundamental goal of lean production. As stated earlier, this can only be achieved by focusing on what the customer values (Murman et al., 2002, pg. 90). A process known as Value Stream Analysis is an extremely useful tool that can be used to diagnose a production process in order to better understand specifically what events are adding value to the end-state product, and what steps are not adding value to the end-state product.

Value Stream Analysis

In order to identify waste in a process, the process must be broken down into individual steps. One way to break down a process into individual steps is known as Value Stream Analysis. "Value Stream Analysis is a method by which lean principles are applied in the examination of business processes" (McManus and Millard, 2004, pg.

1). It is the act of mapping and understanding every action/step of a process to transform materials into final product (Womak and Jones, 2003, pg. 3). The benefits of mapping are primarily that it allows one to visualize the flow of a process, which helps to highlight waste in its various forms (Womak and Jones, 2003, pg. 4). Value Stream Analysis is “a qualitative tool by which you describe in detail how your facility should operate in order to create flow” (Womak and Jones, 2003, pg. 4). The basic approach to Value Stream Analysis consists of only three steps that are continuously revisited and revised: 1) Draw a Current State Map, 2) Draw a Future State Map, 3) Create an Implementation Plan (Womak and Jones, 2003, pg. 9).

Chapter Summary

Throughout the history of pilot training, the Air Force has taken both a specialized and a generalized approach to training students. Currently, the Air Force takes a specialized approach which promotes depth of knowledge and skill in a particular type of mission. Lean Production Theory is a tool that can be used to improve almost any processes in terms of saving time and money by eliminating effort spent on unnecessary tasks. By focusing time and effort on producing what customer's value, significant increases in productivity are possible.

III. Methodology

Chapter Overview

This chapter will discuss the approach to answering the investigative questions, and consequently, the overarching research question. In order to determine how it would be possible to increase annual USAF pilot production by shortening the current SUPT timeline without adversely affecting the quality of the pilot that the follow-on FTUs desire, the researcher had to take a building block approach to collecting and analyzing data. The deliberate steps that were taken to gather and analyze data will be outlined in this chapter.

The first step was to identify all possible SUPT follow-on MWS/MDS primary missions and capabilities, and to then translate those into the basic skill-set requirements. Next, the researchers analyzed the skills that each phase of SUPT addressed in order to compare them to the skills that the FTUs desired, and to initially identify where waste might exist. Once this was complete, the researcher conducted interviews with SMEs in order to validate where waste existed within the three SUPT syllabi. Based on SME opinion, the researcher calculated the number of duty days that could be eliminated from each phase of SUPT (T-6A, T-1A, and T-38C). Then, based on average annual pilot production rates, the researcher determined how many more pilots could theoretically be produced with the time saved from eliminated training.

Up to this point, the researcher addressed shortening SUPT, however, they wanted to ensure that any modifications did not adversely affect the quality of the pilot that the follow-on FTUs desired. Therefore, the researcher continued by determining the average

annual SUPT follow-on MWS/MDS assignment allocations in order to identify which SUPT graduates from each SUPT class would be able to move onto their FTU with no additional training, and those who would require the training that had been eliminated from the SUPT common core requirements.

Determining Follow-On MWS/MDS Primary Missions and Capabilities

It was previously stated that follow-on FTUs were assumed to be the customers of the T-1A and T-38C FTS's, and that they value SUPT graduates who have developed the advanced skill-sets that are required in order to execute the primary mission of their respective MWS/MDS (or at least proficiency in the skills that will enable rapid learning of the skills required to execute the primary mission). Therefore, the researcher had to determine what the primary missions and capabilities were for each of the 25 aircraft that are available directly out of SUPT (henceforth referred to as "follow-on MWS/MDS"). To do this, the researcher performed content analysis of each follow-on MWS/MDS fact sheet from the official USAF website. The researcher reviewed each fact sheet for indicators of what the primary mission and capabilities were, and extracted salient information to a single spreadsheet. Details on follow-on aircraft primary missions and capabilities will be further discussed in Chapter IV.

Determining Follow-On MWS/MDS Basic Skill-Set Requirements

Having identified and consolidated the primary missions and capabilities of each of the follow-on MWS/MDS, the researcher translated the primary missions and capabilities into individual basic skill categories for each follow-on MWS/MDS (see Table 2). Once the researcher determined what the individual basic skill categories were,

they sought out validation from SMEs (demographics of which are available in Appendix I), who had previously been qualified in a variety of the follow-on MWS/MDS (specifically 13 of the 25 available follow-on MWS/MDS). The researcher developed a questionnaire (see Appendix P), asking the SMEs to indicate which individual basic skills were required in order to execute the mission of the follow-on MWS/MDS in which they were previously qualified in. Details on the results will be further discussed in Chapter IV.

Determining T-6A, T-1A, and T-38C Syllabus Basic Skill-Set Development

The researcher performed content analysis of the T-6A, T-1A, and T-38C syllabi in order to objectively determine the basic skills that are addressed in each individual syllabus. The purpose of analyzing each syllabus was to compare the aviation skills training that each SUPT syllabus was providing to the specific aviation skill-sets that the respective follow-on FTUs/customers valued. Details on the basic skill-set development that the T-6A, T-1A, and T-38C syllabi address will be further discussed in Chapter IV.

Data Collection

The interview was the primary method of data collection that was selected for this research for a variety of reasons. First, it enabled the researcher to collect a sample of the most current views and opinions from individuals who were determined to be SMEs of both SUPT as well as operational MWS/MDS aircraft (Creswell, 2014, pg. 246). Second, interviews allow the interviewer and the interviewee to thoroughly explore each question, possibly unveiling new ideas, and giving new direction to the research (Brenner et al., 1985. pg. 3).

The central theme of this study's interview questions was identifying the value of the following categories of primary and advanced SUPT training as they apply to the various follow-on assignments: contact/transition, instrument, high level navigation, low level navigation, formation/extended trail, air refueling, airdrop, out and back, night, and solo events. The SME responses collectively serve as evidence indicating whether or not these events could be considered waste for some or all SUPT graduates. Moreover, they serve as proprietary data that enabled the researcher to answer the aforementioned investigative questions, and ultimately the overarching research question. However, the interviews themselves in their raw format were not enough to suggest anything. The views and opinions of each SME needed to be analyzed and synthesized (Creswell, 2014, pg. 65). The final draft versions of the interview questions posed to T-6A, T-1A, and T-38C IPs/SMEs as well as the summary of the results are included in Appendices A through H.

Interview Candidates / Subject Matter Experts

Interviewees were selected based on the following criteria: 1) Their status as a current and qualified T-6A, T-1A, or T-38C IP with approximately two years of recent experience as a SUPT IP, 2) Their background/previous operational experience as an MWS/MDS IP with at least two previous assignments. By satisfying these two conditions, the researcher determined that interviewees were to be considered ideal SMEs of both SUPT and operational mission requirements. The demographics of the SMEs that were selected and interviewed can be seen in Appendix I.

Data Analysis

Once all interviews were complete, the researcher had to transform this raw data into categories or themes so they could be compared. The researcher used an approach to analyzing qualitative data that was developed by Creswell. Creswell suggests an approach that is reiterative in nature, called “The Data Analysis Spiral”. The first step in this approach is to transcribe and organize the raw data into a somewhat uniform textual format, and to centralize it into a single database. Next, the researcher reviews the material in its entirety, and reflects on it by taking notes on the main points of each interview. Once main points have been identified and outlined, the researcher interprets the data, and reduces it via a process known as coding. Following coding, the researcher synthesizes the data into a narrative or visual representation that captures their findings in a consolidated and succinct manner (Creswell, 1998, pg. 142-146 / Creswell, 2014, pg. 197-200). This process was precisely how the researcher approached analyzing the data obtained by interviewing the 19 SUPT IPs/SMEs that were selected. Details on the results of the interviews will be further discussed in Chapter IV.

Identifying and Eliminating “Waste”

By analyzing the interview data, the researcher was able to compartmentalize each of the aforementioned categories of SUPT training that were addressed during the interviews (contact/transition, instrument, high level navigation, low level navigation, formation/extended trail, air refueling, airdrop, out and back, night, and solo events) in one of three ways: 1) categories of training that were value added for all SUPT graduates, 2) categories of training that were non-value added for all SUPT graduates,

and 3) categories of training that were value added for some SUPT graduates, but non-value added for other SUPT graduates.

If 50% or less of the SMEs (for a particular SUPT syllabus) felt as though a general category of training (or individual training events within that category) was value added, than the researcher did not evaluate the amount of time that could be eliminated from the respective syllabus. If more than 50% of the SMEs (for a particular SUPT syllabus) felt as though a general category of training (or individual training events within that category) was non-value added (for either some or all SUPT graduates), than the researcher evaluated the amount of time (in days) that the current SUPT timeline could be reduced by if the training was either eliminated entirely, or shifted to follow the completion of the SUPT common core requirements (those training events that the vast majority of SUPT graduates will require for their follow-on assignment). In order to do this, the researcher had to perform a series of calculations which will be discussed in the following paragraphs. Details on how the SUPT common core requirements were determined, as well as the results of the following calculations will be discussed in chapter IV.

Calculating the Average Number of Training Events per Day

Each of the SUPT syllabi are based on four types of training: 1) Academic Training, Ground Training, Simulator Training, and Aircraft Training. For all syllabi, the researcher grouped Academic Training with Ground Training as “Preflight Training”, and grouped Simulator Training and Aircraft Training as “Flying Training”. The researcher then determined the average number of “Preflight Training” events per day as

well as the average number of “Flying Training” events per day for each syllabus by using the following formulas:

$$PT_{EVENTS} = (T_{ACADEMIC} + T_{GROUND TRAINING}) / PT_{DAYS}$$

Where:

PT_{EVENTS} = Average # of Preflight Training events per day
 $T_{ACADEMICS}$ = Total number of required Academic events
 $T_{GROUND TRAINING}$ = Total number of required Ground Training events
 PT_{DAYS} = # of days allotted to accomplish all required Preflight Training

$$FT_{EVENTS} = (T_{SIMULATOR} + T_{AIRCRAFT}) / FT_{DAYS}$$

Where:

FT_{EVENTS} = Average # of Flying Training events per day
 $T_{SIMULATOR}$ = Total number of required Simulator events
 $T_{AIRCRAFT}$ = Total number of required Aircraft events
 FT_{DAYS} = # of days allotted to accomplish all required Flying Training

Calculating the average number of training events per day for both “Preflight Training” as well as “Flying Training” (for each SUPT syllabus) was important because it enabled the researcher to calculate the total number of days that the current SUPT timeline could be shortened by once all non-value training events were identified and their associated time requirements (expressed in days) summed. This calculation will be discussed next.

Calculating the Number of Duty Days to Eliminate by Category of Training

As was previously mentioned, the researcher addressed the following general categories of training during the interviews: contact/transition, instrument, high level navigation, low level navigation, formation/extended trail, air refueling, airdrop, out & back, night, and solo events. For each of these categories of training that were determined to be non-value added for some or all SUPT graduates, the researcher

determined the number of days that the associated syllabus could be shortened by. This was done by using the following formula:

$$D_{ELIMINATED} = [(W_{ACADEMICS} + W_{GROUND TRAINING}) / PT_{EVENTS}] + [(W_{SIMULATOR} + W_{AIRCRAFT}) / FT_{EVENTS}]$$

Where:

$D_{ELIMINATED}$ = # of training days eliminated from a syllabus

$W_{ACADEMICS}$ = # of wasted academics events

$W_{GROUND TRAINING}$ = # of wasted ground training events

$W_{SIMULATOR}$ = # of wasted simulator events

$W_{AIRCRAFT}$ = # of wasted aircraft events

PT_{EVENTS} = Average # of Preflight Training events per day

FT_{EVENTS} = Average # of Flying Training events per day

Calculating the Total Number of Duty Days to Eliminate by SUPT Track

In order to determine the total number of days that each of the available SUPT tracks (“heavy / airlift / tanker” track or “fighter / bomber / attack” track), could be shortened by, the researcher summed the number of duty days that were considered non-value added from the T-6A and T-1A syllabi, and summed the number of duty days that were considered non-value added from the T-6A and T-38C syllabi.

Determining Average Annual SUPT Follow-On MWS/MDS Assignment Allocation

In order to determine the average number of follow-on assignments (in one year for CAFB, LAFB, and VAFB) for each of the 25 possible follow-on MWS/MDS, the researcher first had to determine three variables: 1) Average annual SUPT pilot production rates. 2) “Total Pilot Force” requirements for each of the following AFSCs: Fighter Pilot/11F, Bomber Pilot/11B, Mobility Pilot/11M, C2ISR Pilot/11R, and Special Operations Pilot/11S, 3) AFSC composition in terms of associated MWS/MDS. Determining annual MWS/MDS allocation was important because it enabled the researcher to determine how many SUPT graduates would be affected by eliminating

certain training events, and shortening the current SUPT timeline. Once the aforementioned variables were determined (details on how these variables were determined are included in the following paragraphs), the researcher used the following formula in order to determine the average annual number of follow-on assignments for each of the 25 possible follow-on MWS/MDS:

$$A = P \times R \times M$$

Where:

A = Average Annual SUPT Follow-On MWS/MDS Assignment Allocation

P = Average Annual SUPT Pilot Production Rate

R = AFSC Requirements as a Percentage of Total Pilot Force Requirements

M = AFSC Composition in Terms of Associated MWS/MDS

Average Annual SUPT Pilot Production Rate

According to AETCI 36-2605 Volume 4, “HQ AETC/A3RB is the primary POC for flying training production metrics”, and will produce a summary of SUPT production at the end of each fiscal year. The production metrics report contains data from each SUPT class at each SUPT base. The report includes metrics such as student entry, attrition, and graduation stats (2016, pg. 10). By performing content analysis of the production metrics reports provided by USAF HQ AETC/A3RB from FY10 to FY16, the researcher was able to determine the average annual SUPT pilot production rate (P) for CAFB, LAFB, and VAFB under the current SUPT construct.

AFSC Requirements as a Percentage of Total Pilot Force Requirements

In order to calculate individual 11F, 11B, 11M, 11R, and 11S AFSC requirements expressed as a percentage of the “Total Pilot Force” requirements (R), the researcher extrapolated historic and forecast “Total Pilot Force” requirements data (2015 – 2019) from the current USAF manpower and future requirements data provided by

Headquarters Air Force (HAF) and the AMC/A3 Rated Force Management branch. The researcher then used the following formulas:

$$\begin{aligned} 11F \% \text{ of T.F. Req's} &= 11F \text{ Req's} / \text{T.F. Req's} \\ 11B \% \text{ of T.F. Req's} &= 11B \text{ Req's} / \text{T.F. Req's} \\ 11M \% \text{ of T.F. Req's} &= 11M \text{ Req's} / \text{T.F. Req's} \\ 11R \% \text{ of T.F. Req's} &= 11R \text{ Req's} / \text{T.F. Req's} \\ 11S \% \text{ of T.F. Req's} &= 11S \text{ Req's} / \text{T.F. Req's} \end{aligned}$$

Where:

$$\begin{aligned} 11F \text{ Req's} &= \text{AD } 11F \text{ Req's} + \text{ANG } 11F \text{ Req's} + \text{AFRC } 11F \text{ Req's} \\ 11B \text{ Req's} &= \text{AD } 11B \text{ Req's} + \text{ANG } 11B \text{ Req's} + \text{AFRC } 11B \text{ Req's} \\ 11M \text{ Req's} &= \text{AD } 11M \text{ Req's} + \text{ANG } 11M \text{ Req's} + \text{AFRC } 11M \text{ Req's} \\ 11R \text{ Req's} &= \text{AD } 11R \text{ Req's} + \text{ANG } 11R \text{ Req's} + \text{AFRC } 11R \text{ Req's} \\ 11S \text{ Req's} &= \text{AD } 11S \text{ Req's} + \text{ANG } 11S \text{ Req's} + \text{AFRC } 11S \text{ Req's} \\ \text{T.F. Req's} &= 11F \text{ Req's} + 11B \text{ Req's} + 11M \text{ Req's} + 11R \text{ Req's} + 11S \text{ Req's} \end{aligned}$$

AFSC Composition in Terms of Associated MWS/MDS

In order to calculate the composition of each AFSC (11F, 11B, 11M, 11R, and 11S) expressed as a percentage in terms of the associated follow-on MWS/MDS (M), the researcher performed content analysis of the official U.S. Air Force fact sheets. This time, the researchers were looking for the “Total Force” MWS/MDS inventories. The “Total Force” MWS/MDS inventories were used as a metric because the researcher assumed that the associated AFSC requirements for all MWS/MDS directly correlates to the MWS/MDS inventories. The researcher used the following formula.

$$M = I / T$$

Where:

M = % of Individual MWS/MDS Inventory out of Associated AFSC Total MWS/MDS Inventory
I = Individual MWS/MDS Inventory
T = Associated AFSC Total MWS/MDS Inventory

Validity

In order to ensure that the research being conducted was valid, the researcher used two methods of validation throughout the completion of this study: Peer Debriefing, and

Presentation of Negative or Discrepant Information. These validity strategies helped the researcher approach the research in a more objective and accurate manner, and ultimately added validity to the study (Creswell, 2014, pg. 202).

Peer Debriefing

By periodically briefing the methods of research, their analysis of the data, and their findings with fellow peers, the researcher was able to solicit feedback, and apply it to the research going forward. Peer debriefing was accomplished both formally and informally throughout the research. The overall approach and application of theory and proposed methodology was formally reviewed to a group of peers, interview questions were reviewed prior to interviews, interview results were reviewed following interviews, and analysis was reviewed. Peers were able to interpret the research, ask questions, and propose alternative thought processes.

Presenting Negative or Discrepant Information

As was mentioned earlier, the researcher conducted interviews with SMEs on the topic of SUPT and identifying non-value added training within the current T-6A, T-1A, and T-38C syllabi. The researcher asked the SMEs about the value of each specific type of training in the syllabus that they were responsible for, and has provided a summary of the collected data in Appendices B, D, F, and H. There, it can be seen that not all SMEs agreed with each other in terms of what was value added training and what was non-value added training. Additionally, in Chapter IV the researcher will discuss which events were selected to be eliminated entirely, or moved based on the collective responses of the SMEs.

IV. Analysis and Results

Chapter Overview

This chapter discusses the results of the researcher's data collection and analysis. The basic skill-set requirements of each follow-on MWS/MDS and how they compare to the skills that each SUPT syllabus addresses are discussed. Additionally, the allocation of MWS/MDS assignments to SUPT graduates is addressed. Then based on the results of the SME interview data analysis, the SUPT events that were determined to be non-value added to some or all SUPT graduates are discussed. Finally, once all non-value added training was identified as well as which SUPT students the non-value added training applied to, the researcher had to determine how much time that the SUPT timeline could be reduced by, and ultimately how many additional SUPT students could theoretically be produced with that saved time.

Results of the Follow-On MWS/MDS Fact Sheet Content Analysis

As it was mentioned in the previous chapter, the researcher was able to determine what the primary missions and capabilities were for each of the follow-on MWS/MDS by performing content analysis of each follow-on MWS/MDS fact sheet from the official USAF website (see Appendix Q). By analyzing the follow-on MWS/MDS primary missions and capabilities, the researcher was able to identify the spectrum of basic skills that the follow-on MWS/MDS might require. It was determined that some combination of nine individual basic skills are required in order to execute the mission of any one of

follow-on MWS/MDS: instrument, navigation, formation, receiver air refueling, tanker air refueling, low level, airdrop, air-to-air targeting, and air-to-ground-targeting.

Basic Skill-Set Requirement Questionnaire Results

By compiling the results of the follow-on FTU basic skill-set questionnaire that was sent out to the various SMEs, the researcher identified the basic skill-sets that are required in order to execute the mission of each of the follow-on MWS/MDS. The questionnaire can be seen in Appendix P, and the compiled results can be seen below in Table 2.

Table 2: USAF Follow-On Aircraft Basic Skill-Set Requirements

	MWS / MDS	USAF Follow-On MWS / MDS Basic Skill-Set Requirements								
		Instrument	Navigation	Formation	Receiver Air Refueling	Tanker Air Refueling	Low Level	Airdrop	Air-to-Air Targeting	Air-to-Ground Targeting
T-1 "Heavy / Airlift / Tanker" Assignments	C-130	Y	Y	Y	N	N	Y	Y	N	N
	C-17	Y	Y	Y	Y	N	Y	Y	N	N
	CV-22	Y	Y	Y	Y	N	Y	Y	N	N
	MC-130	Y	Y	Y	Y	Y	Y	Y	N	N
	HC-130	Y	Y	Y	Y	Y	Y	Y	N	N
	KC-135	Y	Y	Y	Y	Y	N	N	N	N
	KC-10	Y	Y	Y	Y	Y	N	N	N	N
	C-5	Y	Y	N	Y	N	N	N	N	N
	E-3	Y	Y	N	Y	N	N	N	N	N
	E-8	Y	Y	N	Y	N	N	N	N	N
	AC-130	Y	Y	N	Y	N	N	N	N	N
	EC-130	Y	Y	N	Y	N	N	N	N	N
	RC-135	Y	Y	N	Y	N	N	N	N	N
	U-28	Y	Y	N	N	N	N	N	N	N
	C-21	Y	Y	N	N	N	N	N	N	N
	C-12	Y	Y	N	N	N	N	N	N	N
T-38 "Fighter / Bomber / Attack" Assignments	F-15C	Y	Y	Y	Y	N	Y	N	Y	N
	F-15E	Y	Y	Y	Y	N	Y	N	Y	Y
	F-16	Y	Y	Y	Y	N	Y	N	Y	Y
	F-22	Y	Y	Y	Y	N	Y	N	Y	Y
	F-35	Y	Y	Y	Y	N	Y	N	Y	Y
	A-10	Y	Y	Y	Y	N	Y	N	Y	Y
	B-1	Y	Y	Y	Y	N	Y	N	N	Y
	B-2	Y	Y	Y	Y	N	N	N	N	Y
	B-52	Y	Y	Y	Y	N	N	N	N	Y

SUPT Common Core Requirements

As it can be seen in Table 2 above, 25 of 25 (100%) follow-on aircraft require instrument and navigation skills, nine of nine “fighter / bomber / attack” follow-on aircraft (100%) require formation and receiver air refueling skills, and 12 of 16 “heavy / airlift / tanker” follow-on aircraft (75%) require formation and/or receiver / tanker air refueling skills. Finally, the results of the interview data analysis (which will be discussed in greater detail towards the end of this chapter), suggest that 25 of 25 follow-on aircraft (100%) require contact and transition skills (which teach basic aircraft control and three-dimensional maneuvering). These are the basic skills that make-up what the researcher refers to as SUPT “common core requirements” (contact / transition, instrument / navigation, formation, air refueling).

Results of T-6A Syllabus Content Analysis (Skill-Set Development)

By performing content analysis of the current T-6A syllabus, the researcher determined that the T-6A syllabus is designed to address four basic skills: instrument, navigation, formation, and low level (T-38C Specialized Undergraduate Pilot Training, 2015). (see Table 3).

Table 3: T-6A Syllabus Basic Skill-Set Development

Aircraft	USAF T-6A Syllabus Basic Skill-Set Development								
	Instrument	Navigation	Formation	Receiver Air Refueling	Tanker Air Refueling	Low Level	Airdrop	Air-to-Air Targeting	Air-to-Ground Targeting
T-6A	Y	Y	Y	N	N	Y	N	N	N

Results of T-1A Syllabus Content Analysis (Skill-Set Development)

By performing content analysis of the current T-1A syllabus, the researcher determined that the T-1A syllabus is designed to address seven basic skills: instrument, navigation, formation, receiver air refueling, tanker air refueling, low level, and airdrop. (T-1A Specialized Undergraduate Pilot Training, 2016) (see Table 4).

Table 4: T-1A “Heavy / Airlift / Tanker” Syllabus Basic Skill-Set Development

USAF T-1A "Heavy" Syllabus Basic Skill-Set Development									
Aircraft	Instrument	Navigation	Formation	Receiver Air Refueling	Tanker Air Refueling	Low Level	Airdrop	Air-to-Air Targeting	Air-to-Ground Targeting
T-1A	Y	Y	Y	Y	Y	Y	Y	N	N

“Heavy / Airlift / Tanker” Follow-On Mission Skill-Set Requirements

By comparing the data displayed in Table 2 against the data presented in Table 4, the researcher determined that out of the 16 possible “heavy / airlift / tanker” follow-on assignments, some combination of the seven individual basic skills that are addressed in the T-1A syllabus are required in order to execute the mission of any possible “heavy / airlift / tanker” follow-on MWS/MDS. This means that the T-1A SUPT syllabus addresses all basic skill-sets that are necessary in order to execute the mission of any one of the 16 possible “heavy / airlift / tanker” follow-on missions. However, the researcher also deduced that certain T-1A SUPT students are receiving training that will not directly contribute to the basic skill-sets that they will need at their follow-on assignment.

Results of T-38C Syllabus Content Analysis (Skill-Set Development)

By performing content analysis of the current T-38C syllabus, the researcher determined that the T-38C syllabus is designed to address four basic skills: instrument,

navigation, formation, and low level (T-38C Specialized Undergraduate Pilot Training, 2015). (see Table 5).

Table 5: T-38C “Fighter / Bomber / Attack” Syllabus Basic Skill-Set Development

USAF T-38C "Fighter / Attack" Syllabus Basic Skill-Set Development									
Aircraft	Instrument	Navigation	Formation	Receiver Air Refueling	Tanker Air Refueling	Low Level	Airdrop	Air-to-Air Targeting	Air-to-Ground Targeting
T-38C	Y	Y	Y	N	N	Y	N	N	N

“Fighter / Bomber / Attack” Follow-On Mission Skill-Set Requirements

By comparing the data displayed in Table 2 against the data presented in Table 5, the researcher determined that out of the six possible “fighter / bomber / attack” follow-on assignments, the four individual basic skills that are addressed in the T-38C syllabus, plus another three individual basic skills (receiver air refueling, air-to-air targeting, and air-to-ground targeting) are required in order to execute the mission of any possible “fighter / bomber / attack” follow-on MWS/MDS. This means that the T-38C SUPT syllabus does not address all basic skill-sets that are necessary in order to execute the mission of any one of the six follow-on missions. The three individual basic skills that are not addressed by the T-38C SUPT syllabus are addressed during Introduction to Fighter Fundamentals (IFF), or during the follow-on FTU.

Average Annual SUPT Follow-On MWS/MDS Assignment Allocation

In order to make a general assessment as to how the elimination of the aforementioned SUPT training events could affect SUPT pilot production capacity, the researcher assumed that SUPT follow-on assignments were allocated in a manner consistent with annual “Total Force” requirements. By determining average annual

SUPT production rates, AFSC requirements as a percentage of total force requirements, and AFSC composition in terms of associated MWS/MDS, the researcher determined how many SUPT graduates (collectively from CAFB, LAFB, and VAFB) would theoretically be assigned to each of the 25 MWS/MDS follow-on assignments.

Average Annual SUPT Pilot Production Rates

According to the data from the FY10 – FY16 production metrics reports provided by HQ AETC/A3RB, under the current SUPT construct, the average SUPT pilot production rate for CAFB, LAFB, and VAFB combined is 945 graduates each year. Additionally, there are 15 SUPT graduations each year (one every 15 duty days), which equates to 21 SUPT students per class on average (per base). Out of the 945 SUPT graduates, approximately 660 graduate from the T-1A “heavy / airlift / tanker” track, and 285 graduate from the T-38C “fighter / bomber / attack” track. The T-1A track accounts for 69.8% of the annual SUPT graduates (14.67 T-1A SUPT students per class on average), while the T-38C track accounts for 30.2% of the annual SUPT graduates (6.33 T-38C SUPT students per class on average).

AFSC Requirements as a Percentage of Total Pilot Force Requirements

The 2015-2019 “Total Pilot Force” AFSC requirements 5-Year average (expressed as percentages) are summarized below in Table 6. These percentages were arrived at by dividing each of their individual AFSC requirements across the “Total Force” by the “Total Pilot Force” requirements for the years 2015 – 2019, and then calculating the 5-Year average (Appendix J). These percentages were important because they illustrate how the “Total Pilot Force” is distributed across each pilot AFSC. However, SUPT follow-on assignments are given by MWS/MDS, therefore the

researcher had to break-down these AFSC requirements further into the respective MWS/MDS that are associated with each AFSC.

Table 6: AFSC Requirements

		Total Force AFSC Requirements (5-Year Average 2015 - 2019)
2015 - 2019	11F (Fighter)	28.7%
	11B (Bomber)	5.5%
	11M (Mobility)	50.5%
	11R (C2ISR)	5.2%
	11S (Spec Ops)	10.1%
	Total (Pilot)	100.0%

AFSC Composition in Terms of Associated MWS/MDS

The researcher categorized each of the follow-on MWS/MDS into either the 11F, 11B, 11M, 11R, or 11S AFSCs. Then, by dividing the individual MWS/MDS inventory by the AFSC inventory, the researcher was able to determine the MWS/MDS composition of each AFSC expressed as a percentage. The final results are displayed in Appendix O.

Results of Interview Data Analysis

As it was mentioned earlier, if more than 50% of the SMEs (from a particular SUPT syllabus) felt as though a general category of training (or individual training events within that category) was non-value added (to all or only certain SUPT graduates), then the researcher evaluated the amount of time (in days) that the current SUPT timeline could be reduced by if the training was either eliminated entirely, or shifted to follow the completion of the SUPT common core requirements. Based on this parameter, the

following categories of training were considered non-value added (to some or all SUPT graduates):

T-6A

Low Level Events

The interview data analysis revealed that 8:8 T-6A SMEs (100%) did not think low level training events in the T-6A were of significant value to all SUPT graduates since it is primarily familiarization training, it is only applicable to a small number of follow-on assignments, and was not considered necessary at that stage of development. The average number of low level sorties that these T-6A SMEs suggested could be eliminated was 2 of 2. There are a total of 5 low level training events included in the T-6A syllabus (2 academic events, 0 ground training events, 1 simulator event, and 2 aircraft events).

Extended Trail (ET) Events

The interview data analysis revealed that 7:8 T-6A SMEs (87.5%) did not believe that they would be able to accurately rack and stack a T-6A flight in terms of performance for track select after only observing the student's performance through the mid-phase, final contact, and instrument/navigation checkrides. These SMEs all thought that it would be necessary to at least see each student's performance when executing basic formation events before accurately racking and stacking them for track select purposes. However, the interview data analysis also revealed that 6:8 T-6A SMEs (75%) did not think that ET training events in the T-6A were of significant value to all SUPT graduates since the skills garnished from ET training do not directly correlate to non-fighter follow-on assignments. When asked how much time (on average) was spent on

ET training per T-6A Formation sortie, the mean response was 12.5 minutes. There are a total of 15 formation training sorties included in the T-6A syllabus. Based on the average length of ET training per sortie being 12.5 minutes, and the average T-6A formation sortie lasting 1.37 hours, there are 2.28 sorties worth of ET training (rounded down to 2 sorties). There are a total of 4 ET training events included in the T-6A syllabus (2 academic events, 0 ground training events, 0 simulator events, and 2 aircraft events).

T-1A

Low Level Events

The interview data analysis revealed that 4:5 T-1A SMEs (80%) did not think low level training events in the T-1A were of significant value to all T-1A graduates since the training is only applicable to a small number of follow-on missions, and because they felt as though the T-1 did not teach good low level habit patterns. The average number of low level sorties that these T-1A SMEs suggested could be eliminated was 3 of 3. There are a total of 8 low level training events included in the T-1A syllabus (3 academic events, 0 ground training events, 2 simulator events, and 3 aircraft events).

Airdrop Events

The interview data analysis revealed that 5:5 T-1A SMEs (100%) did not think airdrop training events in the T-1A were of significant value to all T-1A graduates since the training is only applicable to a small number of follow-on missions. The average number of airdrop sorties that these T-1A SMEs suggested could be eliminated was 3 of 3. There are a total of 6 airdrop training events included in the T-1A syllabus (1 academic events, 0 ground training events, 2 simulator events, and 3 aircraft events).

T-38C

Low Level Events

The interview data analysis revealed that 6:8 T-38C SMEs (75%) did not think low level training events in the T-38C were of significant value to all T-38C graduates since not all follow-on assignments require low level skills. These SMEs also stated that the low level training was merely an introduction to the low level environment since there is no low level checkride. The average number of low level sorties that these T-38C SMEs suggested could be eliminated was 4 of 4. There are a total of 11 low level training events included in the T-38C syllabus (3 academic events, 2 ground training events, 2 simulator events, and 4 aircraft events).

Formation Lead Events

The interview data analysis revealed that 6:8 T-38C SMEs (75%) believed that not all T-38 SUPT graduates will require such an extensive amount of formation training because they will not be lead qualified pilots for at least a year or two following their initial qualification. Therefore, they will have time to develop the fundamentals of lead by observation, participation, and briefing/debriefing over the course of their time in the wingman role. According to the T-38C syllabus, approximately one-third of the required formation events are what are called “lead” events. This type of event is designed to teach the students how to lead a formation of two or more aircraft in flight. The average number of dual formation sorties (student accompanied by IP) that these T-38C SMEs suggested could be eliminated was 4 of 26.

Solo Events

The interview data analysis revealed that 5:8 T-38C SMEs (62.5%) believed that solo training events were mostly confidence building and that no formal instruction was provided during solo. Many eluded to the belief that 12 solo sorties were not necessary to reach the required level of confidence and decision making that follow-on FTUs desire in SUPT graduates. They also indicated that much of the focus of training was getting students "safe" to solo as opposed to teaching concepts of aviation. The average number of solo sorties that these T-38C SMEs suggested could be eliminated was 4 of 12.

Night Events

The interview data analysis revealed that 5:8 T-38C SMEs (62.5%) stated that night training events are essential for all T-38C graduates to have, but that the syllabus drove an unnecessary amount of sorties. These SMEs suggested that the desired night training could be accomplished in two sorties as opposed to the four night sorties that the T-38C syllabus calls for. The average number of night sorties that these T-38C SMEs suggested could be eliminated was 2 of 4.

Identifying and Eliminating “Waste”

Following the determination of the aforementioned non-value added categories of training events, the researcher identified all associated academic, ground training, simulator training, and aircraft training events to be eliminated. The average number of academic and ground training events as well as the average number of simulator and aircraft training events for the T-6A, T-1A, and T-38C syllabi can be seen in Appendix K. These averages were important to calculating the average number of duty days that

each syllabus could be reduced by, which can be seen in Appendices L, M, and N. The T-6A/T-1A “heavy / airlift / tanker” track could be shortened by a total of 20.40 duty days, and the T-6A/T-38C “fighter / bomber / attack” track could be shortened by a total of 20.43 duty days. These results are summarized in Appendix O.

T-1A

For approximately 50% of the SUPT students who graduate from the T-6A/T-1A “heavy / airlift / tanker” track each year (approximately 330 SUPT graduates, or 35% of all SUPT graduates), the 20.40 duty days of training that could be eliminated is entirely non-value added to their follow-on MWS/MDS (E-3, E-8, RC-135, EC-130, KC-135, KC-10, C-5, C-21, C-12, AC-130, and U-28). However, for the other 50% of SUPT students who graduate from the T-6A/T-1A “heavy / airlift / tanker” track each year (approximately 330 SUPT graduates, or 35% of all SUPT graduates), the 20.40 duty days includes training that was considered value added training. Based on follow-on MWS/MDS basic skill-set requirements addressed in Table 3, the value-added training consisted of 14.42 duty days of Low level and Airdrop academic, ground training, simulator, and aircraft training events, and was considered value added to the C-130, C-17, CV-22, HC-130, and MC-130 follow-on assignments.

T-38C

For approximately 10% of the SUPT students who complete the T-6A/T-38C “fighter / bomber / attack” track each year (approximately 29 SUPT graduates, or 3% of all SUPT graduates), the 20.43 duty days of training that could be eliminated is entirely non-value added to their follow-on MWS/MDS (B-2, and B-52). However, for the other 90% of the T-38C SUPT graduates each year (approximately 256 SUPT graduates, or

27% of all SUPT graduates), the 20.43 duty days includes training that was considered value added training. Based on follow-on MWS/MDS basic skill-set requirements addressed in Table 3, the value-added training consisted of 6.42 duty days of Low level academic, ground training, simulator, and aircraft training events, and was considered value added to the B-1, F-15C, F-15E, F-16, F-22, F-35, and A-10 follow-on assignments.

V. Conclusions and Recommendations

Chapter Overview

The researcher was able to make a variety of conclusions throughout this study. It was determined that it would be possible to reduce the current SUPT timeline and to produce more SUPT graduates with the saved time. This increase in SUPT graduates would in turn increase the “Total Pilot Force”, which would at least help reduce the pilot shortage, which is a significant issue that the Air Force is currently facing. Although this research was successful in at least identifying training events within each SUPT syllabus that could be eliminated, there are many opportunities for future research on the subject that would further the initiative.

Conclusions of Research

By eliminating training events that are non-value adding to all SUPT graduates, and shifting the training events that are value added to some graduates but not all graduates to follow the SUPT common core requirements, it would be possible to shorten the current SUPT timeline. It was assessed that there are 20.40 duty days of waste within the current T-1A “heavy / airlift / tanker” track (5.98 duty day from the T-6A syllabus plus 14.42 duty days from the T-1A syllabus), and 20.43 duty days of waste within the current T-38C “fighter / bomber / attack” track (5.98 duty day from the T-6A syllabus plus 14.45 duty days from the T-38C syllabus). Based on the assessed amount of waste in each syllabus, the author recommends shortening the T-6A syllabus by 5 days, and the T-1A and T-38C syllabi 10 days each, which corresponds to the normal SUPT graduation

cycle of 15 days. This would make any SUPT timeline reductions transparent to everyone involved in the logistics of coordinating a graduation, and would allow for one more graduating class at each base each year. Included below is a ‘future state map’ for SUPT (see Figure 3).

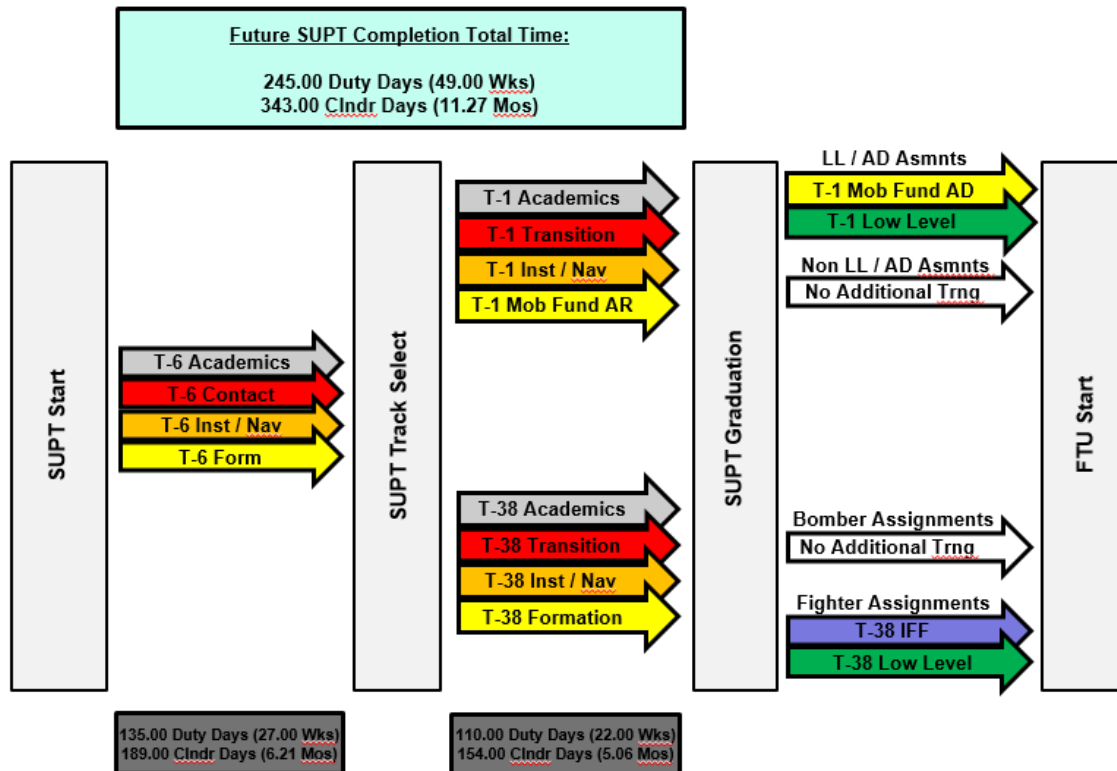


Figure 3: SUPT Future State Map

Without accounting for the training events in both the T-1A and the T-38C syllabus that were considered value added to some SUPT graduates but non-value added to other SUPT graduates, graduating an additional SUPT class each year would result in an additional 63 pilots, which is a 6.7% increase in production capacity. That means on

average, the USAF would produce an additional 44 T-1A SUPT graduates, and an additional 19 T-38C SUPT graduates.

When taking into account the training events in the T-1A syllabus that were considered value added to some SUPT graduates but non-value added to other SUPT graduates, the implications would be different. After 10 duty days are removed from the T-1A syllabus, there would be an extra 4.42 duty days to work through some of the 14.42 duty days of low level and airdrop training that is value-added to C-130, C-17, CV-22, HC-130, and MC-130 follow-on assignments. The assets (IPs and aircraft) that would be required to complete the remaining 10.0 duty days worth of training has been unaccounted for, and is outside the scope of this research. However, for each SUPT class (CAFB, LAFB, and VAFB combined), this would apply to approximately 22 T-1A students on average. The other 22 T-1A students (CAFB, LAFB, and VAFB combined) would not require the additional training.

When taking into account the training events in the T-38C syllabus that were considered value added to some SUPT graduates but non-value added to other SUPT graduates, the implications would be different as well. After 10 duty days are removed from the T-38C syllabus, there would be an extra 4.45 duty days to work through some of the 6.42 duty days of low level training that is value-added to B-1, F-15C, F-15E, F-16, F-22, F-35, and A-10 follow-on assignments. The assets (IPs and aircraft) that would be required to complete the remaining 1.97 duty days worth of training has been unaccounted for, and is outside the scope of this research. However, for each SUPT class (CAFB, LAFB, and VAFB combined), this would apply to approximately 17 T-38C

students on average. The other 2 T-38C students (CAFB, LAFB, and VAFB combined) would not require the additional training.

Significance of Research

Shortening the current SUPT timeline and increasing the number of SUPT graduates has a number of implications. As a result of shortening the current SUPT timeline, it would be theoretically possible to increase the capacity to train SUPT graduates in a given amount of time. An increase in capacity to train SUPT graduates would increase the number of SUPT graduates that could flow into each of the available follow-in FTUs each year. While the increase in production capacity may be small in comparison to the current shortage, and alone will not fix the current pilot shortages in a short amount of time, it would be an increase in production capacity that would be of minimal cost. As long as the follow-on FTUs had the capacity to receive and train these SUPT graduates, the “Total Pilot Force” would increase more than it will under the current SUPT construct. Increasing the “Total Pilot Force” would alleviate some of the stress that the USAF pilot force currently faces within operational units from all AFSCs (particularly the CAF), as well as on staff.

Recommendations for Future Research

The researcher’s recommendation for future research is to conduct similar interviews on a larger scale with a larger number of SMEs from CAFB, LAFB, and VAFB. Additionally, based on aircraft and IP availability, the researcher recommends conducting research to determine the maximum capacity to train at CAFB, LAFB, and VAFB. This would help with determining how to account for the T-1A and T-38C

training that was shifted to follow the common core SUPT requirements for each SUPT track. Additionally, the researcher recommends conducting future research on determining how beneficial the generic T-1 low level, airdrop, and receiver air refueling training is to the follow-on FTUs. This research could investigate whether or not it is necessary to conduct the training that is value added to some SUPT graduates, but non-value added to other SUPT graduates at the SUPT bases, or if it is more effective and/or less expensive to conduct this training at the follow-on FTUs in an academic environment and in a simulator. Lastly, the researcher recommends conducting research similar to what was conducted during this study to the ENJJPT program to potentially find areas in the program that are non-value added, and could therefore be eliminated.

Summary

The USAF faces a significant problem with its rated force manning, specifically with pilots. Currently, the Total Pilot Force requirements exceed the Total Pilot Force inventory. What's more, the delta between the "Total Pilot Force" requirements and the "Total Pilot Force" inventory is forecast to increase. Something must be done to reduce this delta between requirements and inventory. This study aimed to find a way to increase annual SUPT pilot production by shortening the current SUPT completion timeline (without adversely affecting the quality of the pilot that the follow-on FTUs desire).

In order to develop a detailed understanding of the current SUPT construct, the researcher examined both the Primary and Advanced phases of SUPT program by conducting content analysis of each of the associated syllabi. Then, interviews with

SUPT SMEs were conducted, and the results were analyzed. Concepts of Lean Production Theory and Value Stream Analysis were applied in order to identify training that was non-value added to certain SUPT graduates. By eliminating the training that was considered by SMEs to be non-value added to all SUPT graduates, and by shifting the training that was only value added to certain SUPT graduates to follow the completion of the common core requirements of all SUPT graduates, the researcher was able to shorten the SUPT timeline by 15 duty days. Based on the standard SUPT graduation cycle, this means that one additional SUPT class could graduate from CAFB, LAFB, and VAFB each year which means an additional 63 SUPT graduates each year on average.

Appendix A: T-6A IP Interview Questions

- 1) Do you believe that all Contact events in the T-6 Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 2) Do you believe that all Instrument events in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 3) Do you believe that all High Level Navigation events in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 4) Do you believe that all Low Level events in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 5) Do you believe that all Out-and-Back events in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 6) Do you believe that all Night events in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 7) Do you believe that the all Basic Formation events (everything except Extended Trail) in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 8) Do you believe that all Extended Trail Formation events in the T-6 SUPT Syllabus are significant value added events for all SUPT graduates? If “yes”, why? If “no”, why not?
- 9) On average, how much of time per sortie is spent on ET training during the Formation section of the T-6 syllabus?
- 10) At what point do you believe you could accurately rack & stack a T-6 flight in terms of performance for track select?
- 11) Do you think it would be possible to accurately/fairly track select after the T-6 “Mid-Phase”, “Contact”, “Instrument/Navigation” phases of Primary SUPT? If “yes”, why? If “no”, why not?

Appendix B: T-6A IP Interview Data Analysis Results

T-6A IP Interview Data Analysis Results			
Question	Response	Percentage	Reason(s)
1	Yes	8:8 (100%)	Fundamentals of aviation, Builds confidence, Builds airmanship, Transferable skills
2	Yes	8:8 (100%)	Fundamental/Essential skill that all pilots need
3	Yes	8:8 (100%)	Fundamental/Essential skill that all pilots need, How we operate in the real-world
4	No	8:8 (100%)	Familiarization only, Applicable to a small number of follow-on missions, Skill that is not necessary at that stage of development
5	Yes	7:8 (87.5%)	Teaches essential strange field operations, Teaches essential "off-script" enroute operations
5	No	1:8 (12.5%)	Too rushed, Focus mostly on instrument & navigation procedures
6	Yes	7:8 (87.5%)	Essential skill that all pilots need, Efficient platform for intro to night ops
6	No	1:8 (12.5%)	Not a necessary skill at that stage of development
7	Yes	8:8 (100%)	Increases airmanship & situational awareness, Increases confidence, Good screening mechanism
8	Yes	2:8 (25%)	Builds confidence, Teaches lead/lag/pure pursuit
8	No	6:8 (75%)	Doesn't directly correlate to necessary non-fighter skills
9	12.5 Minutes	8:8 (100%)	12.5 minutes is the average of all responses
10	After Mid-Phase Check	1:8 (12.5%)	N/A
10	After Final Contact Check	3:8 (37.5%)	N/A
10	After Formation Solo	2:8 (25%)	N/A
10	After Formation Check	2:8 (25%)	N/A
11	Yes	1:8 (12.5%)	You can determine a student's aptitude by then
11	No	7:8 (87.5%)	Need to see basic formation

Appendix C: T-1A IP Interview Questions

- 1) Do you believe that all Transition events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 2) Do you believe that all Instrument events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 3) Do you believe that all High Level Navigation events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 4) Do you believe that all Low Level events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 5) Do you believe that all Out-and-Back events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 6) Do you believe that all Night events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 7) Do you believe that all Air Mobility Fundamentals Air Refueling events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 8) Do you believe that all Air Mobility Fundamentals Airdrop events in the T-1 SUPT Syllabus are significant value added events for all T-1 graduates? If “yes”, why? If “no”, why not?
- 9) At what point do you believe you could accurately rack & stack a T-1 flight in terms of performance for aircraft assignment?

Appendix D: T-1A IP Interview Data Analysis Results

T-1A IP Interview Data Analysis Results			
Question	Response	Percentage	Reason(s)
1	Yes	5:5 (100%)	Fundamentals of aviation, Intro to CRM, Transferable skills
2	Yes	5:5 (100%)	Fundamental/Essential skill that all pilots need
3	Yes	5:5 (100%)	Fundamental/Essential skill that all pilots need, How we operate in the real-world
4	Yes	1:5 (20%)	Teaches universal 60:1 course correction rules
4	No	4:5 (80%)	Applicable to a small number of follow-on missions, T-1 doesn't teach good low level habit patterns
5	Yes	5:5 (100%)	Teaches essential mission planning skills, Teaches strange field operations
6	Yes	5:5 (100%)	Essential skill that all MAF pilots need, Intro to the challenges of night ops
7	Yes	4:8 (80%)	Increases situational awareness, Good intro to complex mission execution, Teaches wingman consideration
7	No	1:5 (20%)	Too generic and unrealistic
8	No	5:5 (100%)	Only applies to a few follow-on MWS/MDS missions
9	After Transition Check	1:5 (20%)	N/A
9	After Instrument/Nav Check	2:5 (40%)	N/A
9	Half Way Through AMF	2:5 (40%)	N/A

Appendix E: T-38C IP Interview Questions

- 1) Do you believe that all Transition events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 2) Do you believe that all Instrument events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 3) Do you believe that all High Level Navigation events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 4) Do you believe that all Low Level events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 5) Do you believe that Out-and-Back events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 6) Do you believe that Night events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 7) Do you believe that Formation events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 8) Do you believe that Solo events in the T-38 SUPT Syllabus are significant value added events for all T-38 graduates? If “yes”, why? If “no”, why not?
- 9) At what point do you believe you could accurately rack & stack a T-38 flight in terms of performance for aircraft assignment?

Appendix F: T-38C IP Interview Data Analysis Results

T-38C IP Interview Data Analysis Results			
Question	Response	Percentage	Reason(s)
1	Yes	8:8 (100%)	Fundamentals of high-performance aircraft aviation
2	Yes	8:8 (100%)	Fundamental/Essential skill that all pilots need
3	Yes	8:8 (100%)	Fundamental/Essential skill that all pilots need
4	Yes	2:8 (25%)	Teaches diligence and good crosscheck in challenging environment
4	No	6:8 (75%)	Not all follow-on MDS/MWS fly low level (B-52 & B-2)
5	Yes	8:8 (100%)	Teaches essential strange field operations
6	Yes	3:8 (37.5%)	Essential skill for all pilots, important to develop at that stage
6	No	5:8 (62.5%)	Essential skill for all pilots, but don't need as many sorties
7	Yes	2:8 (25%)	Fundamental skill for most follow-on, Transferable skill, Increases airmanship, Increases situational awareness
7	No	6:8 (75%)	B-52 and B-2 follow-on don't need as much close formation training, Formation lead sorties are unnecessary because T-38C grads won't be lead for a few years
8	Yes	3:8 (37.5%)	Critical to increasing airmanship, situational awareness, and confidence
8	No	5:8 (62.5%)	Only confidence building, no instruction provided during solo, Focus is on getting students "safe" to solo, not on instruction, 12 solo sorties are not necessary to reach required level of confidence & decision making
9	After Formation Check	7:8 (87.5%)	N/A
9	Half Way Through Formation	1:8 (12.5%)	N/A

Appendix G: Combined T-6A, T-1A, and T-38C IP Interview Questions

- 1) Do you think that a SUPT graduate who followed the T-6 / T-1 track, who was assigned to the KC-135 would significantly benefit from the Low Level training that he/she received in the T-6 / T-1 phases of SUPT at his/her KC-135 FTU? If “yes”, why? If “no”, why not?
- 2) Do you think that a SUPT graduate who followed the T-6 / T-38 track, who was assigned to the B-2 would significantly benefit from the Low Level training that he/she received in the T-6 / T-38 phases of SUPT at his/her B-2 FTU? If “yes”, why? If “no”, why not?
- 3) Do you think that a SUPT graduate who followed the T-6 / T-1 track, who was assigned to the KC-135 for 4-5 years, then cross-flowed to the C-130, would significantly benefit from the Low Level training that he/she received in the T-6 / T-1 phases of SUPT at his/her C-130 Initial Qualification? If “yes”, why? If “no”, why not?
- 4) Do you think that a SUPT graduate who followed the T-6 / T-1 track, who was assigned to the E-3 AWACS would significantly benefit from the Airdrop training that he/she received in the T-1 phase of SUPT at his/her E-3 AWACS FTU? If “yes”, why? If “no”, why not?
- 5) Do you think that SUPT student pilots would get a good enough sense of whether or not they liked close Formation flying by only completing the T-6 Basic Formation events (wing-tip, close-trail, echelon turns, cross-unders, etc ... everything except Extended Trail)? If “yes”, why? If “no”, why not?
- 6) Do you think that a SUPT graduate who followed the T-6 / T-1 track, who was assigned to the C-5 would significantly benefit from the Extended Trail training that he/she received in the T-6 phase of SUPT at his/her C-5 FTU? If “yes”, why? If “no”, why not?

Appendix H: T-6A, T-1A, T-38C IP Interview Data Analysis Results

T-6A, T-1A, T-38C IP Interview Data Analysis Results			
Question	Response	Percentage	Reason(s)
1	Yes	1:19 (5%)	Gives appreciation for terrain environment and "whole team"
1	No	18:19 (95%)	Low level is not a essential skill for KC-135 pilots
2	Yes	1:19 (5%)	Gives appreciation for terrain environment and "whole team"
2	No	18:19 (95%)	Low level is not a essential skill for B-2 pilots
3	Yes	1:19 (5%)	There would be a foundation of knowledge to build on
3	No	18:19 (95%)	Too much time between UPT and C-130 FTU, would to start from scratch
4	Yes	1:19 (5%)	Develops a basic understanding of that environment
4	No	18:19 (95%)	Airdrop is not a essential skill for AWACS pilots
5	Yes	14:19 (74%)	Most studens know whether or not they like form right away,
5	No	5:19 (26%)	Many students don't get excited about formation until comfortable with ET
6	Yes	3:19 (16%)	ET teaches energy management skills, ET teaches 3-D aspect of flying, ET increases airmanship
6	No	16:19 (84%)	ET is not a essential skill for C-5 pilots

Appendix I: SUPT IP/SME Demographics

SUPT IP/SME Demographics	
RANK	
Lt Col	13
Maj	5
Capt	1
GENDER	
Male	19
Female	0
CURRENT PLATFORM	
T-6A	8
T-1A	4
T-38	7
CURRENT QUALIFICATION	
Instructor Pilot	8
Check Pilot	2
Evaluator Pilot	9
EXPERIENCE	
SMEs with at least 1 Operational Assignment	19
SMEs with at least 2 Operational Assignments	18
Squadron Commanders	3
PREVIOUS PLATFORMS	
A-10	2
B-1	2
C-12	1
C-130	2
C-141	1
C-17	3
C-21	1
E-3	1
E-8	2
F-15	6
F-16	2
KC-10	2
KC-135	1
MC-12	1
T-1	1
T-37	2
T-38	2
PREVIOUS QUALIFICATIONS	
Aircraft Commander or Higher	19
Instructor Pilot or Higher	17
Evaluator Pilot	8

Appendix J: 2015 – 2019 Total Pilot Force AFSC Requirements

		AD Req's	ANG Req's	AFRC Req's	T.F. Req's	% of Total Force
2015	11F (Fighter)	3653	1195	491	5339	28.6%
	11B (Bomber)	934	51	51	1036	5.5%
	11M (Mobility)	4983	2384	2101	9468	50.7%
	11R (C2ISR)	795	124	66	985	5.3%
	11S (Spec Ops)	1623	120	117	1860	10.0%
	Total	11988	3874	2826	18688	100.0%
2016	11F (Fighter)	3654	1141	508	5303	28.4%
	11B (Bomber)	938	41	59	1038	5.6%
	11M (Mobility)	4940	2355	2118	9413	50.4%
	11R (C2ISR)	826	120	69	1015	5.4%
	11S (Spec Ops)	1629	127	154	1910	10.2%
	Total	11987	3784	2908	18679	100.0%
2017	11F (Fighter)	3682	1140	506	5328	28.5%
	11B (Bomber)	935	41	59	1035	5.5%
	11M (Mobility)	5044	2339	2071	9454	50.5%
	11R (C2ISR)	813	120	69	1002	5.4%
	11S (Spec Ops)	1607	127	157	1891	10.1%
	Total	12081	3767	2862	18710	100.0%
2018	11F (Fighter)	3730	1116	523	5369	28.7%
	11B (Bomber)	926	41	61	1028	5.5%
	11M (Mobility)	5016	2339	2092	9447	50.5%
	11R (C2ISR)	815	120	69	1004	5.4%
	11S (Spec Ops)	1592	126	157	1875	10.0%
	Total	12079	3742	2902	18723	100.0%
2019	11F (Fighter)	3816	1143	543	5502	29.3%
	11B (Bomber)	933	41	61	1035	5.5%
	11M (Mobility)	5001	2339	2156	9496	50.5%
	11R (C2ISR)	702	119	53	874	4.6%
	11S (Spec Ops)	1607	126	157	1890	10.1%
	Total	12059	3768	2970	18797	100.0%
						5-Year Avg
2015 - 2019	11F (Fighter)					28.7%
	11B (Bomber)					5.5%
	11M (Mobility)					50.5%
	11R (C2ISR)					5.2%
	11S (Spec Ops)					10.1%
	Total					100.0%

Appendix K: T-6A, T-1A, and T-38C Average Events per Day

T-6A Syllabus (Academic, Ground Training, Simulator, and Aircraft Events)					
	Events	Hours	Avg Event Time (Hrs) [Hours ÷ Events]	Duty Days Available	Avg Events per Day [Total Events ÷ Days Available]
Academic Trng	159	214.3	1.35	40	4.53
Ground Trng	22	22.0	1.00		
Total	181	236.3			
Simulator Trng	35	45.7	1.31	100	0.98
Aircraft Trng	63	86.6	1.37		
Total	98	132.3			
T-1A Syllabus (Academic, Ground Training, Simulator, and Aircraft Events)					
	Events	Hours	Avg Event Time (Hrs) [Hours ÷ Events]	Duty Days Available	Avg Events per Day [Total Events ÷ Days Available]
Academic Trng	112	142.4	1.27	30	4.03
Ground Trng	9	11.6	1.29		
Total	121	154.0			
Simulator Trng	24	61.4	2.56	90	0.74
Aircraft Trng	43	77.7	1.81		
Total	67	139.1			
T-38C Syllabus (Academic, Ground Training, Simulator, and Aircraft Events)					
	Events	Hours	Avg Event Time (Hrs) [Hours ÷ Events]	Duty Days Available	Avg Events per Day [Total Events ÷ Days Available]
Academic Trng	66	101.6	1.54	30	3.13
Ground Trng	28	64.0	2.29		
Total	94	165.6			
Simulator Trng	31	39.5	1.27	90	1.24
Aircraft Trng	81	99.9	1.23		
Total	112	139.4			

Appendix L: T-6A Non-Value Added Training

T-6A Non-Value Added Training				
		Events	Hours	Days Eliminated
Academic Training				
	Low-Level Navigation (CAI)	1	0.7	0.22
	Low-Level Planning Lab (MIL)	1	3.0	0.22
	Advanced Formation (CAI)	1	1.8	0.22
	Extended Trail Maneuvering (CAI)	1	0.7	0.22
Ground Training				
	None	0	0.0	0.00
Simulator				
	Low-Level Navigation Training	1	1.3	1.02
Aircraft				
	Low-Level Navigation Training	2	2.8	2.04
	Extended Trail Training*	2	3.1	2.04
TOTAL		9	13.4	5.99
	Low-Level Total	5	7.8	3.50
	Extended Trail Total	4	5.6	2.48

Appendix M: T-1A Non-Value Added Training

T-1A Non-Value Added Training				
		Events	Hours	Days Eliminated
Academic Training				
	Low-Level (IBT)	1	2.0	0.25
	PFPS Chart Preparation (IBT)	1	2.0	0.25
	PFPS Chart Lab (IBT)	1	2.0	0.25
	Airdrop (IBT)	1	1.0	0.25
Ground Training				
	None	0	0.0	0.00
Simulator				
	Low-Level Navigation Training	2	5.2	2.69
	Airdrop Training	2	5.2	2.69
Aircraft				
	Low-Level Navigation Training	3	6.4	4.03
	Airdrop Training	3	6.0	4.03
TOTAL		14	29.8	14.42
Low-Level Total		8	17.6	7.46
Airdrop Total		6	12.2	6.96

Appendix N: T-38C Non-Value Added Training

T-38C Non-Value Added Training				
		Events	Hours	Days Eliminated
Academic Training				
	Low-Level Navigation Procedures (IBT)	1	2.0	0.32
	JMPS Low-Level Mission Planning (IBT)	1	2.0	0.32
	JMPS Low-Level Planning Exercise (IBT)	1	2.0	0.32
Ground Training				
	Low-Level Navigation Training	1	2.0	0.32
	Two-ship Low-Level Navigation Training	1	2.0	0.32
Simulator				
	Low-Level Proficiency Training	2	2.6	1.61
Aircraft				
	Transition Solo Training	2	2.2	1.61
	Instrument Night Training	2	2.6	1.61
	Formation Solo Training	2	2.2	1.61
	Formation Lead Training	4	4.4	3.21
	Low-Level Navigation Training	2	2.4	1.61
	Two-Ship Low Level Navigation Training	2	2.4	1.61
TOTAL		21	28.8	14.45
	Low-Level Total	11	17.4	6.42
	Solo Total	4	4.4	3.21
	Night Total	2	2.6	1.61
	Formation Lead Total	4	4.4	3.21

Appendix O: AFSC and MWS/MDS Requirements & Total Waste by MWS/MDS

MWS / MDS	AFSC Category	AFSC Req's as % of Total Force Req's	MWS/MDS Req's as % of AFSC Req's	MWS/MDS Allocation to SUPT Grads (per year)	Total Duty Days Wasted (some or all)
B-1	Bomber / 11B	5.5%	39.2%	20.5	20.43
B-2			12.7%	6.6	20.43
B-52			48.1%	25.1	20.43
E-3	C2ISR / 11R	5.2%	36.8%	18.1	20.40
E-8			18.4%	9.1	20.40
RC-135			25.3%	12.5	20.40
EC-130			19.5%	9.6	20.40
F-15C	Fighter / 11F	28.7%	12.6%	34.1	20.43
F-15E			11.1%	30.0	20.43
F-16			51.4%	139.3	20.43
F-22			9.3%	25.1	20.43
F-35			2.3%	6.2	20.43
A-10			13.4%	36.3	20.43
C-130	Mobility / 11M	50.5%	34.6%	165.3	20.40
C-17			17.2%	82.3	20.40
KC-135			33.5%	159.9	20.40
KC-10			4.8%	22.8	20.40
C-5			4.2%	20.1	20.40
C-21			4.4%	21.2	20.40
C-12			1.2%	5.8	20.40
CV-22	Spec Ops / 11S	10.1%	25.0%	23.8	20.40
MC-130			29.9%	28.4	20.40
HC-130			14.1%	13.4	20.40
AC-130			15.8%	15.0	20.40
U-28			15.2%	14.5	20.40

Appendix P: Follow-On FTU Basic Skill-Set Requirement Questionnaire

INSTRUCTIONS: Please annotate the MWS/MDS aircraft that you were formerly qualified in under the "Aircraft" column below (if you were qualified in multiple MWS/MDS aircraft, then indicate each MWS/MDS aircraft on a separate row). Then, Copy / Paste the "YES" or "NO" cells under the respective "Follow-On FTU / Operational Unit Basic Skill Requirements" columns (Instrument, Formation, Air Refueling, etc) to indicate whether or not each "Basic Skill" is required (or highly desired) by the Follow-On FTU / Operational Unit of the MWS/MDS aircraft that you were formerly qualified in. An example has been provided for the C-130E/H/J.

Follow-On FTU / Operational Unit Basic Skill Requirements									
Aircraft	Instrument	Navigation	Formation	Receiver Air Refueling	Tanker Air Refueling	Low Level	Airdrop	Air-to-Air Targeting	Air-to-Ground Targeting
	YES	... The FTU / Operational Unit Requires this "Basic Skill"							
	NO	... The FTU / Operational Unit DOES NOT Require this "Basic Skill"							
*** EXAMPLE ***									
Follow-On FTU / Operational Unit Basic Skill Requirements									
Aircraft	Instrument	Navigation	Formation	Receiver Air Refueling	Tanker Air Refueling	Low Level	Airdrop	Air-to-Air Targeting	Air-to-Ground Targeting
C-130E/H/J	YES	YES	YES	NO	NO	YES	YES	NO	NO

Appendix Q: USAF Aircraft Primary Mission and Capabilities

	Aircraft	Primary Mission and Capabilities
T-1 "Heavy / Airlift / Tanker" Assignments	C-130	all-weather tactical airlift/airdrop
	C-17	all-weather strategic airlift, tactical airlift/airdrop
	CV-22	all-weather tactical airlift/airdrop, infiltration, exfiltration, resupply
	MC-130	all-weather tactical airlift/airdrop, infiltration, exfiltration, resupply, in-flight refueling (tanker), combat search & rescue
	HC-130	all-weather tactical airlift/airdrop, infiltration, exfiltration, resupply, in-flight refueling (tanker), forward area ground refueling
	KC-135	all-weather in-flight refueling (tanker), airlift
	KC-10	all-weather in-flight refueling (tanker), airlift
	C-5	all-weather strategic airlift
	E-3	all-weather airborne battle management, command & control, surveillance, target detection, target tracking
	E-8	all-weather airborne battle management, command & control, intelligence, surveillance, reconnaissance
	AC-130	all-weather close air support, air interdiction, armed reconnaissance
	EC-130	all-weather electronic warfare/attack, suppression of enemy air defenses, offensive counter-information
	RC-135	all-weather intelligence, surveillance, reconnaissance
	U-28	all-weather tactical intelligence, surveillance, reconnaissance
	C-21	all-weather passenger airlift
	C-12	all-weather passenger airlift
T-38 "Fighter / Bomber / Attack" Assignments	F-15C	all-weather tactical air-to-air fighter/attack
	F-15E	all-weather tactical air-to-air and air-to-ground fighter/attack
	F-16	all-weather tactical air-to-air and air-to-ground fighter/attack
	F-22	all-weather stealth air-to-air and air-to-ground fighter/attack
	F-35	all-weather stealth air-to-air and air-to-ground fighter/attack
	A-10	all-weather low altitude close air support, airborne forward air control, combat search and rescue
	B-1	all-weather long-range conventional munition bomber
	B-2	all-weather stealth, long-range conventional and nuclear munition bomber
	B-52	all-weather long-range conventional and nuclear munition bomber

Appendix R: GRP Quad Chart



Increasing SUPT Pilot Production



Introduction

Currently, the USAF operational, staff, and special duty pilot requirements outweigh the current USAF "Total Pilot Force" inventory. Additionally, due to previous USAF force structure reductions and current retention issues, pilot production and absorption rates are unable to keep up with pilot attrition rates. Ultimately, the delta between the "Total Pilot Force" requirements and the "Total Pilot Force" inventory is forecast to increase unless pilot production, absorption, and retention are increased.

Research Question

In an effort to ultimately increase annual SUPT pilot production, how could the current Primary T-6A SUPT syllabus and the Advanced T-1A and T-38C SUPT syllabi be modified in order to reduce the SUPT timeline without adversely affecting the quality of the pilot that the follow-on FTUs desire?

Advisor: Maj Matthew Rigollet

Advanced Studies of Air Mobility (ENS)
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Methodology

This GRP reviews each SUPT syllabus for value-added and non-value added training as it pertains to each of the available SUPT follow-on assignments. By conducting interviews with Subject Matter Experts, the researcher identified certain training events that could be considered "waste" according to Lean Production Theory.

Implications

By eliminating the training that is non-value added to all SUPT graduates, and shifting the training that is only value-added to some SUPT graduates, the USAF could produce an additional 63 pilots from SUPT each year.

Recommendations

Validate this research by having a professional agency conduct a similar study on a larger scale. If results are validated, make the appropriate changes to the T-6A, T-1A, and T-38C syllabi.

Analysis and Results

It was determined that it would be possible to reduce the current SUPT timeline by 15 duty days, which would in turn increase SUPT production capacity by 6.7% which equates to approximately 63 additional SUPT graduates each year. This increase in SUPT production capacity would in turn increase the "Total Pilot Force".

USAF Follow-On MMS / MDS Basic Skill Set Requirements									
	MMS / MDS	Instrument	Navigator	Formation	Receiver Attaching	Targeting	Low Level	Altitude Training	Altitude Training
F-1 "Heavy" / A-10 / "Warrior"	C-130	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
	MC-130	Y	Y	Y	Y	Y	Y	Y	Y
F-16 "Fighting Falcon" / F-35 "Lightning II" / F-22 "Raptor"	C-130	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y
	C-17	Y	Y	Y	Y	Y	Y	Y	Y





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REPORT DOCUMENTATION PAGE				Form Approved OMB No. 074-0188	
The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 15-06-2017		2. REPORT TYPE Graduate Research Paper		3. DATES COVERED (From – To) May 2016 – Jun 2017	
4. TITLE AND SUBTITLE Increasing Pilot Production by Applying Elements of 'Lean Production Theory' and 'Value Stream Analysis' to the Current Specialized Undergraduate Pilot Training Syllabi				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Rigollet, Matthieu A., Major, USAF				5d. STUDY 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, Building 640 WPAFB OH 45433-8865				8. PERFORMING ORGANIZATION REPORT NUMBER AFIT-ENS-MS-17-J-046	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Col John Lamontagne COMM: (618) 229-3315, DSN: 779-3315 john.lamontagne@us.af.mil				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 Unlimited.					
13. SUPPLEMENTARY NOTES This work is declared a work of the U.S. Government and is not subject to copyright protection in the United States.					
14. ABSTRACT Currently the demand to fill operational pilot billets as well as rated pilot staff billets in the USAF outweighs the “Total Pilot Force”. The attrition rate is outpacing the production and absorption rate, causing a pilot shortage. One approach to solving this problem is to increase pilot production. This study will address the possibility of shortening the SUPT timeline via a revised course flow to the current syllabi, which would ultimately lead to an increase in pilot production. These revisions are derived from elements of Lean Production Theory and Value Stream Analysis, which both aim to maximize efficiency by focusing on what the customer values, and eliminating waste (that which the customer does not value). Currently, there are numerous SUPT training events that all SUPT students execute that develop skills that only certain SUPT graduates need at their follow-on assignments. In order to enable the development of only the skill-sets required by follow-on FTUs, certain training events could be eliminated entirely without depriving any SUPT students from the pilot skills needed at their follow-on FTUs. In other cases, training events could be delayed to follow the completion of the SUPT common core requirements.					
15. SUBJECT TERMS Pilot Shortage, Lean Production Theory, Value Stream Analysis, Specialized Undergraduate Pilot Training, SUPT					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Douglas, Matthew A., Lt Col, Ph.D, USAF
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