AU/ACSC/2016

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

ARE YOU EXPERIENCED?

A FRESH LOOK AT THE FIFTH-GENERATION FIGHTER EXPERIENCE MODEL

by

Joseph S. Miranda, Maj, USAF

A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

Advisor: Dr. Ed Ouellette

Maxwell Air Force Base, Alabama

June 2016

Disclaimer

The views expressed in this academic research paper are those of the author and do not reflect the official policy or position of the US government or the Department of Defense. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This work would not have been possible without the unwavering support of my wife. No words could begin to acknowledge my thanks for her support, advice, and sacrifice throughout every endeavor of my career. She is my best friend and I take comfort in the knowledge that she is by my side through every challenge.

The men and women of the Air Force Personnel Center's Rated Assignments branch also deserve recognition. The thankless work accomplished by these officers and civilians enables our force to execute the mission with the right people, in the right place, at the right time. Complex human problems are uncomplicated through their efforts. In particular, I'd like to thank Colonel Russell "Torque" Garner, Lieutenant Colonel Scott "Hummer" Cerone, Mr. James Weimer, and Mr. Richard Houston for providing a phenomenal education in rated force management, and the 2014-2016 fighter assignment officers Major John "BATT" Platt, Major Nicholas "Warble" DeFazio, Major Christopher "Bow" Russell, and Major Benjamin "Showdown" Schill for their tireless efforts to reconcile the shortage in fighter experience. These unsung heroes preserve our nation's ability to project power through the greatest air and space force the world has ever known.

ABSTRACT

Experienced fighter pilots are required in many positions both inside and outside the cockpit, including squadron supervision, flight instruction, and headquarters staffs. The definition of fighter experience has changed little since its creation over thirty years ago. Based solely on flight time in either the primary weapons system or high-fidelity simulator, the definition needs to be reexamined as the USAF acquires new aircraft. Fifth generation fighter aircraft, the F-22 and F-35, provide incredible performance and capability, but also present risks to the growth of the experienced fighter pilot population. Decreased aircraft utilization rates and pilot flight time results in a substantially longer period before a new pilot achieves fighter experience.

Fifth generation utilization rates are less than fourth generation rates due to increased maintenance requirements and periodic software changes. As a result, a fifth generation pilot can take nearly 40% more time to accrue the requisite flight hours to achieve experience. As a result of longer time to experience, the pilot production pipeline is slowed and vacant pilot positions are left unfilled.

Despite flying at a slower rate, many fifth generation pilots complete the Flight Lead Upgrade along similar periods of time as their fourth generation counterparts. This upgrade teaches a pilot the leadership traits necessary to lead formations of aircraft in combat. Those same traits are qualities needed to fill experienced pilot positions.

To accurately define the quality and capabilities of the fighter pilot population, the definition of fighter experience should be amended to include completion of the Flight Lead Upgrade. The legacy hours-based model should also be maintained to account for those pilots unable to complete the upgrade.

INTRODUCTION

"Almost all categories of requirements can be filled only by experienced pilots. The essence of any definition of the term experienced pilot *is that such pilots have a thorough knowledge and understanding of the specific operational mission for which they are tasked."*[1]

More than any other military service, the United States Air Force embodies the advancements of technology available in the modern age. Fighter aircraft are essential to the projection of air power and are the cornerstone of air superiority. Equally essential are the pilots who fly these aircraft, and the need for experienced fighter pilots at training locations and strategic staff positions is insatiable.

Advancements in aeronautical technology over the past seventy years were put on display as new models of fighter aircraft entered the inventory. Engines, weapons, sensors, and aeronautical maneuverability each progressed steadily throughout that period, and the most advanced fighters now employ detection-elusive stealth technology. To help discuss groups of aircraft with similar capabilities, recent scholars have classified fighter aircraft with similar capabilities as "generations."[2] The most advanced aircraft in use today are the fifth-generation fighters F-22 *Raptor* and F-35 *Lightning II*.

Fighter pilot training methods have always focused on replicating combat. First-generation F-86 *Sabre* training included extensive live-flight dogfighting following a brief period of ground instruction.[3] Technology now available allows today's fighter pilots to train without ever leaving the ground; advanced simulators capable of replicating nearly all aspects of flight are used in conjunction with live-flight training. Network-enabled simulators from different weapons systems can be linked together to accomplish mock wars, and large force exercises

once limited to actual combat or training events like RED FLAG can be “flown” by aircrew on multiple continents.

Despite these advances, some training requirements for pilots have not kept up with the times. In particular, the definition of fighter “experience” has not changed significantly in nearly forty years. Generally defined as 500 flight hours in the primary weapons system, the current model gives little credit for missions flown in a simulator, but is not adjusted based on types of missions flown or flight leadership qualifications. Fifth-generation fighters require additional maintenance between sorties, and so those aircraft fly less often per month than their older counterparts. As a result, the time required for a fifth-generation pilot to accrue the hours necessary to meet the definition of “experience” is longer than a fourth-generation pilot.

The USAF is contending with a substantial shortfall in the fighter pilot inventory. If one assumes that the requirements for those pilots cannot be decreased, the only recourse is to increase the fighter pilot population through the aircraft training pipeline. One should note, however, that nearly all vacant fighter pilot positions require an experienced pilot. Decreasing the time required to gain to experience is therefore particularly desirable today. An examination of the current experience model proposed for use with fifth-generation fighter pilots describes how a fundamental change to the definition of “experienced fighter pilot” could utilize emerging simulator capabilities and real-world encounters to more accurately qualify the level of expertise in modern fighter units.

BACKGROUND

Fighter Generations

All jet-powered fighter aircraft employed by the USAF throughout its existence can be divided into generational groups which describe the capabilities available in the day. These generational groups allow the researcher to address technological advances common to a particular age in history, and also enable comparison to aircraft manufactured by other nations. First-generation fighters were the first jet-powered aircraft designed toward the end of World War II. Second and third-generation fighters were aircraft that entered service from the 1950s through the 1960s.

Fourth-generation fighters include aircraft developed between the end of the Vietnam War and the end of the Cold War. These aircraft comprise the vast majority of the current American fighter inventory, and include the A-10, F-15C, F-15E, F-16, and F-18. The USAF operates all models with the exception of the F-18 (operated by the US Navy and Marine Corps). Although most of these fighters were initially designed in the 1970s, each has undergone significant internal system upgrades.

Fifth-generation fighters incorporate stealth technology and advanced sensors which can detect and engage adversary aircraft at ranges beyond the capabilities of previous models. The F-22 and F-35 are fifth-generation fighters. The stealth exterior of these aircraft requires specialized maintenance not required for previous generations. This additional maintenance time decreases the number of sorties available per aircraft per month. The resulting aircraft utilization rate, or UTE, will be compared to fourth-generation rates to estimate the time to experience for a fifth-generation fighter pilot.

Fighter Experience

Following the end of the Vietnam War, researchers in the 1970s found that some units fared better than others with regard to losses during deployment. Not surprisingly, they found that units with a greater proportion of experienced aviators were more successful. To provide a measurable description to this quality, fighter "experience" was defined in aircraft-specific training regulations as 500 hours of flight time in the primary aircraft inventory (PAI, interchangeable with MWS in this writing).

The lessons of Vietnam suggest that a 100% experience level is desirable at the squadron level. Pilots regularly separate or retire from active service, however, and so a balance of experienced and inexperienced aviators is required to maintain stability within the system. Rated force managers seek to maintain a steady ratio between the two in order to allow experienced pilots to move on to fill other requirements as the inexperienced group accrues flight hours. Senior USAF leaders tasked researchers from the RAND Corporation to study the most effective distribution of experienced pilots. As a result of their recommendations current Air Force Instruction (AFI) guidance directs a distribution of 55% experienced and 45% inexperienced pilots at the squadron flying level.[4]

Between the 1980s and today, the definition of experience was modified slightly to credit flight time accrued flying other aircraft. More recently the definition was amended to include simulator time. For all fourth-generation fighters currently in the USAF inventory, the baseline definition of experience is 500 hours of primary flight time, of which 20% (100 hours) may be flown in an advanced simulator. Pilots who served as first-assignment instructor pilots (FAIPs) in SUPT are considered experienced at 300 hours, so long as they have 1,000 or more hours of instructor flight time. With the exception of USAF Test Pilot School graduates, very few pilots

are authorized to fly multiple MWS at the same time, but cross-flow between MWS is not unusual. For example, an A-10 pilot could complete F-16 training. More common are F-15E weapons system officers (WSOs) who complete SUPT and then track to fighter MWS as pilots. If previously experienced in another fighter airframe, these pilots are considered experienced in the new airframe after 100 hours of primary flight time.

Fifth-generation experience definitions follow similar guidance, but with caveats regarding previous fighter aircraft time. The following excerpt comes from AFI 11-2F-22A Volume 1, *F-22—Aircrew Training*:

> **Experienced Aircrew (EXP)—**Pilots require one of the following to be considered experienced: 500 hrs PAI, or 1,000 hrs (FP/IP/MP/EP), of which 300 are PAI, or 600 fighter hrs, of which 200 hrs are PAI, or previously fighter EXPERIENCED and 100 hrs PAI. Hours are defined as FP/IP/MP/EP time and fighter time is defined as hours logged in aircraft with an assigned AFSC of 11FX with an air-to-air radar. Hours logged in the SIM accomplishing RAP Tasking Memo approved missions will be counted as "hour" when determining experience level. RAP SIM Mission hours will not exceed 20% of the total required to meet the experienced threshold (ex: 100 RAP SIM Mission hours out of 500 hours PAI).[5]

Note that cumulative flight time in fighter aircraft only contributes to the F-22 experience calculation if previous time comes from an aircraft equipped with an air-to-air radar. This caveat results in no credit for flight time as an A-10 pilot or T-38 Introduction to Fighter Fundamentals (IFF) instructor. The F-35 experience definition does not exclude this time, and in fact specifically addresses A-10 time (the A-10 and OA-10 are not considered different aircraft):

1.5.5. Experienced Pilot (EXP)
- 1.5.5.1. An experienced pilot has one of the following:
  - 1.5.5.1.1. 500 hours Primary Aerospace Vehicle Inventory (PAI).
  - 1.5.5.1.2. 300 hours PAI with 1,000 hours (First Pilot (FP)/IP/Mission Pilot (MP)).
  - 1.5.5.1.3. 100 hours PAI and previously fighter EXPERIENCED.

> 1.5.5.2. For pilots, fighter time is defined as FP/IP/MP hours logged in aircraft while assigned an Air Force Specialty Code (AFSC) of 11FX. OA-10 is considered fighter time.
> 1.5.5.3. (N/A AFRC) Hours logged in the mission rehearsal trainer (MRT)/full mission simulator (FMS) accomplishing RTM-approved missions will be counted as ―hours‖ when determining experience level. RAP MRT/FMS mission hours will not exceed 20% of the total required to meet the experienced threshold (ex: 100 RAP MRT/FMS Mission hours out of 500 hours PAI). See the current RAP Tasking Memo for guidance on approved RAP MRT/FMS Missions and logging procedures.[6]

All pilots flying the F-35 as of the writing of this paper were previously experienced in another USAF fighter. Planned force structure changes make paragraph 1.5.5.2 particularly important, for it is likely that a large number of A-10 pilots will cross-flow to the F-35 when that weapon system is divested. The first group of pilots directly assigned to the F-35 following SUPT is projected to enter training at the end of calendar year 2016.[7] These pilots will be the first officers defined by the full 500 hours PAI requirement specified in AFI 11-2F-35A Volume 1.

Rated force managers use these definitions of experience to estimate the capacity of an MWS to *absorb* new graduates following graduation from initial qualification training. *Absorption* is a term used to describe the process by which these pilots accrue the hours required to become experienced. In order to maintain the 55% experienced / 45% inexperienced distribution described above, it is critical that the number of new inexperienced pilots produced through initial qualification courses not exceed the *Absorption Capacity* for the MWS.

Absorption capacity is directly related to the number of flying positions in existence at the squadron level, but the figure is not solely 45% of those positions. A variable number of pilots may become experienced in any given month, so the number of inexperienced vacancies is a dynamic value. The average time required for a pilot to achieve experience is called *Time to*

Experience (TTE). This value divided by the number of inexperienced positions is a squadron's absorption capacity.

The number of hours flown by each pilot in a squadron (hours per crew per month, HCM) can be used to identify the rate at which inexperienced positions are vacated through hour accrual. The syllabi for most fighter initial qualification courses includes roughly 60 hours of flight time (initial qualification time, BCRSE). The following equation illustrates this process:

$$TTE = (400 - BCRSE - HCM) \times 12 \text{ months}$$

One should note that this equation assumes a pilot will accrue the minimum number of simulator hours included in the MWS experience definition. If assigned to a location without simulator capability, the "400" value may be substituted with a full 500 hours.

WHY DOES EXPERIENCE MATTER?

Requirements

Researchers from the RAND Corporation's Project Air Force (PAF) division published several reports on rated force management issues over the past twenty years. Regarding the significance of fighter pilot experience, comments in one report state "Experienced pilots must provide appropriate supervision, instruction, and complex staffing functions of the Air Force and joint organizations."[8] The operational background from a pilot's first MWS flying assignment prepares them for follow-on duties in supervision at the squadron level, instructor duties in all phases of flying training, and headquarters staff positions. Effective absorption of new pilots is therefore an essential step in filling many USAF requirements.

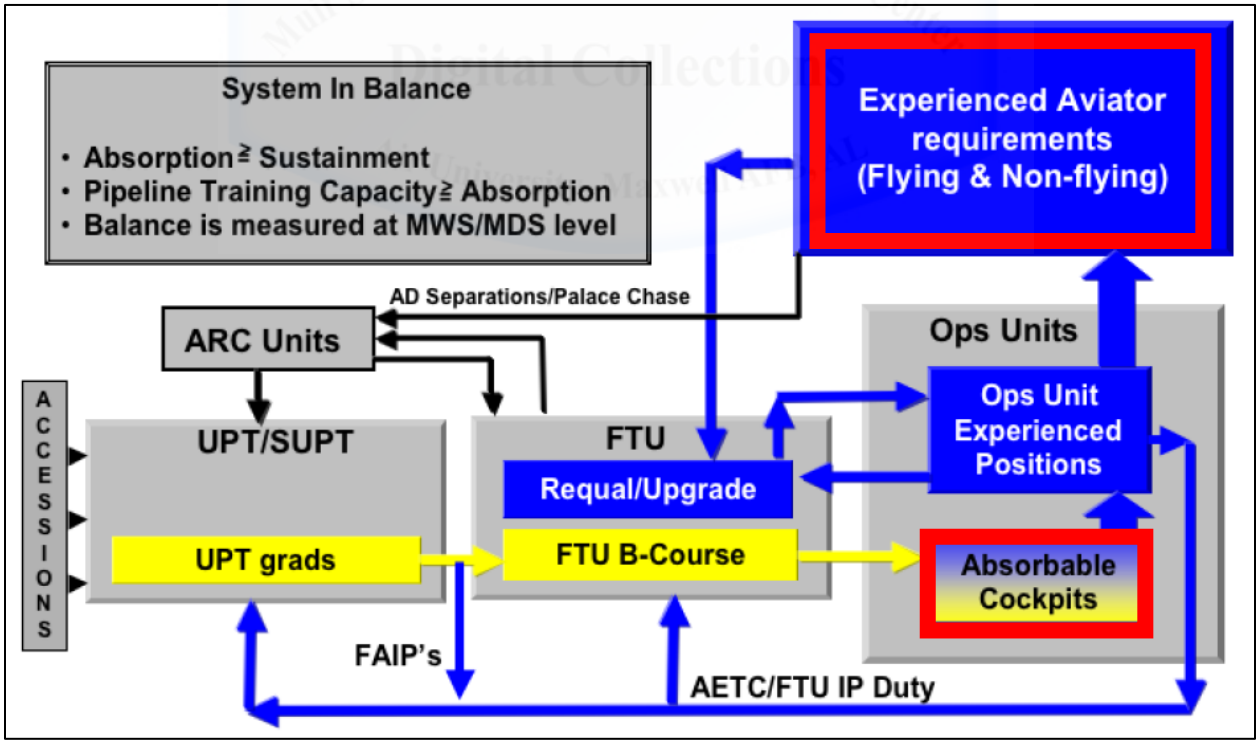

Figure 1, *Elements of the Aircrew Management System*.[9]

The red highlighted areas of the figure above illustrate the process: graduates of initial MWS qualification training must be placed in an operational unit. Absorption is complete once the pilot attains the requirements for MWS experience. The experienced pilot then fills an experienced requirement within the same unit or may be moved to fill an experienced requirement in another organization.

Roughly 3,500 requirements for fighter pilots currently exist, including flying positions in combat fighter wings, instructor duty in all phases of pilot training, operational test, and staff positions. Today's population of 2,900 fighter pilots falls well short of filling those requirements. It's important to note that nearly two-thirds of the positions described above can only be filled by experienced pilots; no one could (or should) expect an assignment to the Pentagon or Headquarters Air Combat Command immediately following initial skills training. The time required for a pilot to become experienced is therefore an important factor for rated force managers, for the sooner a pilot is experienced, the sooner an experienced position (flying or non-flying) can be filled.

Total active rated service (TARS) is the total number of years of service in a flying capacity. Each of the positions described above counts toward TARS, for many non-flying staff positions must be filled by a rated officer due to the nature of the staff work accomplished in the position. In recent years, the average TARS for fighter pilots has decreased as many officers depart active duty upon the completion of their commitment following specialized undergraduate pilot training (SUPT). Nearly all officers who depart active duty at this time are experienced fighter pilots qualified to fill other rated requirements, and generating backfill via the training pipeline takes several years. Roughly three years of training in various aircraft pass between commissioning and arrival at a fighter pilot's first operational duty location. Two to three more

years pass before that officer accrues enough flight hours to become "experienced" as defined in the current model. Initial training entry delays and breaks in training throughout the pilot training pipeline are currently under review by personnel on the Air Staff and the Air Force Personnel Center (AFPC), but no detailed review of the requirements between operational duty arrival and meeting the "experienced" threshold have been made as of this writing.

Category	Organizations		11F Req	Tgt	11F Ent
Line Flying	Line Flying Units	Fly Students/Transients/PME	438	100%	438
		Line CC Units/MPEP	1241	100%	1241
		FAIPs/IFF IPs/ETSS	597	100%	597
		11F T-38 ALFA Tours	209	67%	140
		11F T-6 ALFA Tours	140	3.50%	5
		11F AGRS/CTS/WIC/57 Wg	190	90%	171
		11F AFCENT AWC/TLP	9	80%	7
		11F RPA	66	15%	10
ALO/AMLO	ALO/AMLO (Rated req. adjusted for 13L growth)		10	100%	10
OSD/JCS/COCOMs	OSD; JCS; AFRICOM; CENTCOM; EUCOM; JFCOM; NATO; NORAD; NORTHCOM; PACOM; SOCOM; SOUTHCOM; STRATCOM; TRANSCOM		79	51%	40
Test Flying	DCMA; ACC; AFMC; AFSOC; AMC; AFOTEC		189	90%	170
Staff	SAF/HAF; ACC; AETC; AFGSC; AFSOC; AMC; PACAF; USAFE; AF Elements; Def Agencies; AFMC; AFRC; AFSC; AFSPC; ANG; AFDW; AFOTEC; AFISRA; AFSA; AFPC; USAFA; AU; IAS; ANG/AFRC Advisors		334	36%	101
Institutional Requirements	16G/R; 16F/P; 10C; 20C; 30C; 60C; 81T; 88A; 97E		77	100%	77
Total	**FY16**		**3579**	**84%**	**3007**

Table 1, *FY16 11F Requirements* (2015).[10]

As described above, only a small portion of USAF fighter pilot positions can be filled by inexperienced pilots. In fiscal year 2016, there were over 3,500 requirements of which just over 1,200 were "line fly" positions. Line fly requirements include flying positions in combat-coded fighter squadrons, support positions in training organizations like RED FLAG, and exchange positions under the military personnel exchange program (MPEP). Of these three groups, the only absorbable positions are API-1 billets in operational squadrons.[11] Therefore just over 1,000 positions (less than a third) of the total fighter requirements can be filled with inexperienced pilots. Experience growth is extremely important for long-term sustainment.

Requisite flight qualifications are also important when reviewing the table above. Fighter pilots may be categorized into three qualification groups: wingmen, flight leads, and instructor pilots (IPs). Initial qualification course graduates enter Mission Qualification Training (MQT) upon arrival at their first duty station, and once complete they are qualified as combat mission ready wingmen. The next group of pilots are flight leads, who upon completion of the Flight Lead Upgrade (FLUG) may lead formations of aircraft into combat. Flight leads may be designated as 2-ship or 4-ship leads (2FL, 4FL), signifying the maximum number of aircraft they are allowed to lead in a formation. A select number of seasoned flight leads then complete the Instructor Pilot Upgrade (IPUG), and are then qualified to teach upgrade sorties, simulators, and academics. Other qualifications and certification exist, such as Mission Commander, Function Check Flight pilot, and Flight Examiner, but the requirements and responsibilities of these pilots are not germane to this paper.

Each of the Table 1 organizations highlighted in blue requires 2-ship flight lead qualification or greater. Only Air Liaison Officer (ALO) and Remotely Piloted Aircraft (RPA)

positions may be filled by wingmen, less than 100 of the more than 3,500 total 11F requirements. It is clear that experience is not the only important factor for fighter requirements.

Use of Simulators

Many fighter wings have multiple types of simulators available. The capabilities of these systems vary greatly, from simple computer software which can replicate aircraft systems for part-task training to more advanced network-capable mission training centers (MTCs) which provide nearly 360 degrees of visual coverage along with a full mock-up of the aircraft cockpit. MTC time can be used towards fighter experience, but rudimentary simulator time cannot.

Access to MTCs was limited in the past, and many fighter squadrons planned annual trips for pilots to visit locations where the simulators were available. Over the past decade, however, MTC facilities were built at many operational locations. These facilities provide training capability typically unavailable in flight at most duty stations. For example, F-16s training for Suppression of Enemy Air Defenses (SEAD) missions require radar emissions from the ground to target surface-to-air missile systems (SAMS). Actual replication is cost-prohibitive, and ground-based emulators may not replicate the actual emissions of a true system. The MTC console operator can control a variety of SAMS in a more realistic simulated scenario.

The increase of availability for advanced simulator time not only adds to the training capability available in garrison, but as an added benefit pilots at locations with poor weather can still train on days when visibility or cloud cover prevents training flights. The research described in this paper will illustrate the ways in which current fighter squadrons use the MTC and examine if an increase in the proportion of simulator time could enhance the definition of fighter experience.

It must be noted that fifth-generation simulators use different terminology. Fourth-generation aircraft use the MTC described above. F-22 training instructions describe a "Full Mission Trainer" (FMT) which makes up part of an MTC when linked to other FMTs.[12] F-35 simulator variants use a different naming convention. A stand-alone advanced simulator is called a "Full Mission Simulator" (FMS) and linked versions make up a "Mission Rehearsal Trainer" (MRT).[13] To avoid confusion, in this paper the stand-alone variant for all generations will be called an "advanced simulator" and linked simulators will be called the MTC.

Evaluation Framework

Simulator use helps grow the experienced fighter pilot population, but as discussed above many experienced positions require advanced flight qualifications in addition to flying hours. Since there are a limited number of absorbable cockpits, the TTE equation provides the best estimate of experience growth for a given MWS. The analysis which follows will illustrate TTE differences between aircraft generations.

A pilot's flying qualification is not factored into the current hours-based experience definition. 300 MWS flight hours are the baseline prerequisite for entry into the FLUG, but flight time is not the predominant factor for section. Rather, pilots who "demonstrated tactical proficiency as a wingman" with the potential to lead formations of aircraft in combat are selected by the squadron commander.[14] Operations Group commanders may approve FLUG entry for high-performing pilots with less than 300 MWS hours.[15]

Since FLUG entry timing is far more subjective than the black-and-white definition of experience, the hours accrued by FLUG completion varies across and within MWS. Analysis of actual flight hours of inexperienced flight leads will show how (or if) those values differ from the baseline 500-hour experience definition. Both experience and qualification are important

requirements for the organizations highlighted in Table 1, and therefore a disparity in flight hours may suggest amendments to the definition of experience.

ANALYSIS

Aircraft Utilization (UTE)

The average number of hours flown by a pilot each month is the most important factor used to determine how long it will take to become experienced. Many sub-factors affect HCM as well: weather, operations tempo, and leave are just a few examples. Average monthly hours tend to fluctuate throughout the year for all pilots. For instance, winter months tend to have lower average values due to poor weather and holiday breaks. More hours are flown during good-weather summer months, and since all operational bases are located north of the equator, additional sorties can be flown during periods of greater daylight.

A separate aircraft metric closely matches HCM: aircraft utilization rate, or UTE. This figure is the average number of sorties flown by one aircraft assigned to a squadron. Most fighter squadrons have between 18 and 24 primary aircraft assigned (PAA). UTE is simply the number of total sorties flown by the squadron divided by PAA. Fourth generation aircraft fly around 18 sorties per month, or 18 UTE. Greater UTE rates lead to greater HCM for all pilots assigned to the unit.[16]

In order to maintain the stealth properties of fifth generation aircraft, additional inspections and cleaning are required after every sortie. Grease or dirt on the skin of a fifth generation aircraft can significantly affect its radar cross-section. Time between sorties is therefore significantly greater than the time required for fourth generation aircraft. As a result, each aircraft flies less often than would be possible were that maintenance not required.[17] Fielding of software updates also reduces the number of sorties flown, as aircraft are removed from the flying rotations to undergo updates. Both of these factors reduce the number of sorties

available per aircraft, and accordingly UTE rates for fifth generation aircraft are much less than their legacy counterparts.

There is an important distinction to be made in the type of sorties produced by fourth and fifth generation aircraft. Air-to-air missions require adversary targets—other aircraft—commonly referred to as "red air." Fourth generation units dedicate some percentage of monthly UTE to red air missions in support of training. Many fifth generation units, however, have collocated T-38A adversary air (ADAIR) squadrons which provide target training. T-38A sorties are significantly less expensive than fifth generation sorties, and prevent negative training potential from fighting stealth versus stealth.[18] ADAIR sorties flown by a different unit do not factor into the UTE flown by the fifth generation unit. As a result, a greater percentage of flying time is spent gaining actual proficiency in the MWS.[19]

Fourth and Fifth Generation TTE Comparison

The significant difference between fifth and fourth generation UTE can also be observed through analysis of those pilot's TTE. SUPT classmates who both track into fighters following graduation may become experienced at different times. The following examples use actual MWS TTE to compare notional pilots from the F-15C and the F-22.

Lieutenant Smith graduated the F-15C initial qualification course at Klamath Falls, Oregon with 56.1 F-15C hours in December 2014. Arriving at RAF Lakenheath, UK in January, 2015, he accrued an average of 14.2 hours per month.[20] Since he was able to fly 100 hours in the simulator, he only requires 343.9 additional flight hours to become experienced. He should be experienced 24 months after arrival, or January 2017.

Lieutenant Jones was Lieutenant Smith's SUPT classmate and graduated from the F-22 initial qualification course at Tyndall AFB, Florida with 48 hours in the F-22. She arrived at Elmendorf AFB, Alaska in January 2015 and subsequently accrued 10.5 hours per month.[21] She also completed 100 hours in the simulator and so only requires 352 hours to become experienced. She should be experienced 33 and a half months after arrival, or mid-October 2017.

The number of hours flown in F-15C and F-22 initial training differs, but not enough to significantly factor into TTE. The eight-hour difference is less than a month for any fighter. It's worth noting that students fly less hours in the F-22 initial skills syllabus than in any other MWS course; the number of simulators, however, greatly exceeds those of other MWS. The F-35 syllabus is still under review and the number of hours flown during initial training is unknown. Since the missions flown by that aircraft closely follow those flown in the F-16, it's likely that the same number of hours will be flown (69), although the use of advanced simulators may reduce that value.

In another comparison, a notional F-16 pilot from the same SUPT class deployed to a contingency location shortly after arrival at his first operational duty station. This pilot arrived at Shaw AFB, South Carolina with 69 F-16 hours and then accrued an average of 31.2 hours per month.[22] Since he will complete 100 total simulator hours, he will be experienced after flying 331 additional hours in the F-16—just over 10 months after arrival, or mid-November 2015.

AEF deployments for all aircraft increased following the attacks of September 11, 2001 and, later, the invasion of Iraq. Air superiority fighters like the F-22 and F-15C saw little action over the past decade, but F-22 units are now deploying regularly in support of Operation INHERENT RESOLVE. The first operational USAF F-35 squadron will not reach initial

operational capability until later this year, and that aircraft will not be deployed until full operational capability is declared some years later. Fourth generation air-to-ground and multirole aircraft remain the workhorses of USAF combat operations, and F-15E, F-16, and A-10 pilots will likely continue to accrue hours more quickly than their fifth generation counterparts as long as deployments continue.

Flight Lead Upgrade Timing

As discussed above, 300 hours is the baseline minimum for FLUG entry. In practice, unit commanders apply more subjective criteria to identify selectees. Pilots might not begin FLUG until well after accruing 300 hours, or may enter the program earlier with an OG/CC waiver. For example, current F-16 FLUG requirements are:

6.2.2. The following minimum flying hours are required prior to entering FL upgrade training:

6.2.2.1. 300 hours F-16, or
6.2.2.2. 200 hours F-16 with 400 hours IP/FP/MP in a 11Fxx, 11K3C, or 11K3D, 11K3F AFSC, or
6.2.2.3. 50 hours F-16, if previously qualified as a 11Fxx AFSC flight lead.[23]

All other fighter MWS have similar prerequisites. As of 1 May 2016, there are 37 inexperienced 2- or 4-ship flight leads in the F-15C, A-10, and F-22 (28 2FLs, 12 4FLs).[24] Hours PAI varies from 154 to 494, but it's also important to note that this information reflects the hours of pilots qualified as of the publication of their respective unit's Letter of Qualifications (LOX), not upon FLUG completion. Flight leads with higher PAI totals may have completed the FLUG several months prior to LOX publication. MWS averages are listed below, and a detailed list may be found in Appendix B.

MWS	2-ship		4-ship	
	Number of FL	Hours	Number of FL	Hours
F-15C	4	302	3	378
A-10	10	442	1	454
F-22	14	293	8	381
Average	9	346	4	404

Table 2, *Average Hours PAI (Inexperienced Flight Leads), 1 May 2016*.[25]

At 302 and 293 respectively, the average number of hours PAI for F-15C and F-22 2-ship flight leads is close to the baseline 300-hour course entry requirement. A-10 average hours exceed that value, but as with the F-16 TTE example above, hours accrued in combat result in a comparatively higher value. It's also worth noting that FLUG programs vary according to the needs of the organization, and pilots may be entered directly into a 4-ship FLUG without completing a 2-ship upgrade prior.

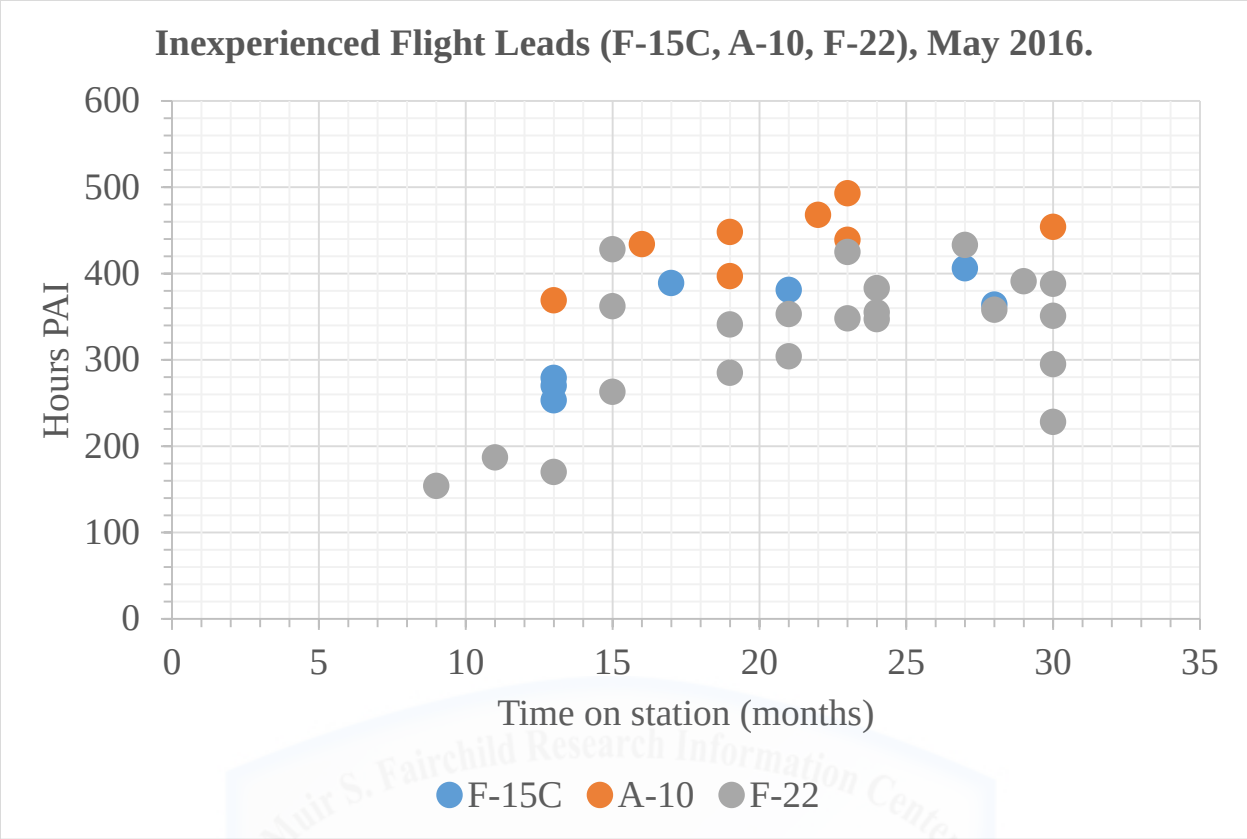

Figure 2, Inexperienced Flight Leads (F-15C, A-10 F-22), 1 May 2016.[26]

A graphical distribution of today's inexperienced flight leads highlights disparities between fourth- and fifth-generation pilots. Closer examination of F-22 flight lead hours shows that a disproportionate number of pilots qualify as flight leads with less flight hours than their fourth generation counterparts, including three 2FLs with less than 200 hours PAI.

In contrast, time on station at the first duty location (the same value generated from the TTE equation) is more uniformly distributed across the three MWS. The F-22 has one outlier who entered the FLUG at 9 months TOS, but pilots from both the A-10 and F-15C became flight leads just after a year of operational duty. The visual difference in hours PAI between MWS pilots with the same TOS illustrates the disparity in hours accrual between fourth and fifth generation pilots.

RECOMMENDATIONS

The current definition of fighter experience falls short of meeting the requirements for most experienced fighter pilot positions. Achieving "experience" in a fighter aircraft only reduces supervision requirements, but an experienced pilot is not qualified to fill "experienced" requirements unless they also have requisite flight qualifications. The definition of fighter experience should therefore be amended to address flight lead qualification.

The examples above show that fourth and fifth generation pilots do accrue hours at different rates, but in spite of those differences selection for the FLUG occurs at similar dates after arrival at a pilot's first operational duty station. Since the data shows that most pilots complete FLUG before 24 months TOS, one could simply infer that the experience definition could be based on time alone, i.e. once a pilot is on station for 24 months, he or she is experienced.

Such a definition is not recommended, for some pilots will never achieve flight lead qualification. Unfortunate deployment timing or other operational constraints may preclude completion, and in some cases a simple lack of aptitude means the upgrade will never start. Inept pilots should be considered for formal flight evaluation boards if their performance is sub-standard, but in certain situations their experience could be valuable to other organizations. Redefining fighter experience to require flight lead qualification would force rated managers and MWS assignment officers to keep such pilots in absorbable cockpits in perpetuity. Therefore, the baseline 500 MWS hour definition should be maintained so that experienced wingmen may be released to fill ALO, RPA, or other requirements.

It's also worth noting that the upgrade entry requirements listed in the previous section do not include hours accrued in a flight simulator. Each major command establishes monthly and annual training requirements which include events to be completed in the MTC, but those requirements are unrelated to selection for the FLUG. Inexperienced pilots will surely increase proficiency with increased MTC use, but the data analyzed does not suggest any benefits will be gained by adjusting FLUG entry requirements.

Flight qualification should be included in the definition experience through the inclusion of "or upon completion of a Flight Lead Upgrade" to MWS-specific training volumes. The inclusion of this verbiage will shorten the average TTE for all MWS, for all pilots will still be categorized as "experienced" once the current hours PAI requirements are met but could become experienced earlier if FLUG is complete. Increasing the experienced population benefits the overall fighter community because more absorption is possible when TTE decreases. More absorption leads to an increase in overall fighter pilot population, thereby reducing the gap between inventory and requirements.

Some may reject this proposal as a way to send young pilots to non-flying staff positions. It is true that a greater number of pilots would be available to fill such positions, but one should also note that a greater number of young pilots would be available for flying duties in units like AETC Introduction to Fighter Fundamentals (IFF) instructors, Aggressors, and international exchange programs. These programs can be quite competitive during each assignment cycle. Staff position managers can retain "quality-control" of officers selected to fill experienced requirements through the Assignment Management System requisition process by specifying mandatory qualification or proficiency

CONCLUSION

Operational experience is a requisite for more than two thirds of the fighter pilot positions currently funded in the USAF. As the service works to close the gap between pilot inventory and requirements, the importance of expedient growth of the experienced pilot population cannot be overstated. The acquisition of fifth generation fighter aircraft increases the capability and survivability of the nation's pilots, but also presents new challenges as those pilots fly at rates below their legacy peers. Today's experience definition must be amended to reflect the actual capacity of today's pilots to meet the demands of experienced positions.

The current time-based definition of fighter experience does not address the quality of training gained in the accrual of flight hours. As contingency deployments continue to be the norm for many of today's fighter pilots, rated managers must recognize that flight hours accrued may lack the variety of training which would have been accomplished in flights at home station alone. In contrast, the use of companion adversary air units to support fifth generation operating locations increases the quality of home station flight hours for those pilots, but that quality could degrade as the participation of fifth generation aircraft in contingency operations increases.

Disparities in training and variations in average time to experience can be addressed through a simple adjustment of the experience definition. Pilots who successfully complete the flight lead upgrade demonstrate the proficiency and leadership qualities required in the majority of experienced fighter pilot requirements. The data discussed in this paper proves that many pilots complete this upgrade prior to accruing the requisite hours to achieve experience as defined in MWS training instructions. Justification for accelerated upgrade completion might stem from advanced simulator use, the support of adversary aircraft, or simply a greater level of proficiency as compared to previous generations based on the quality of initial training. In the

end, however, factors influencing inexperienced upgrade timing are irrelevant to the changes recommended in this document.

Modernizing the definition of fighter pilot experience through the addition of flight lead qualification will help arrest the growth of average time to experience for fifth generation pilots while preserving the benefits of today's definition. Maintaining a baseline 500-hour requirement accounts for those pilots unable to complete the flight lead upgrade prior to that time; whether precluded by operational constrains or proficiency, those pilots may still be considered for other experienced positions. Additionally, the true level of capability in a unit will be measured more accurately. Unit status reports provided to rated managers and combatant commanders will reflect the true usable level of experience available. Most importantly, this change will not dilute the quality of experienced fighter pilots, but rather will enhance the population with officers qualified to complete the duties of an experienced pilot.

APPENDIX A

Terminology and Acronyms

Absorption – process by which pilots become experienced in a MWS. Operational flying positions in a combat unit are the only positions which inexperienced pilots can fill.

Combat Systems Officer (CSO) – USAF rated officers not qualified as pilots. Previously called "navigators," these officers are graduates of Undergraduate Combat Systems Officer Training and perform duties as navigators, electronic warfare officers, or weapons system officers on a variety of USAF MWS.

Experienced requirement – any rated position which requires MWS experience. Aggressors, rated staff, and SUPT instructor duty (excluding FAIPs) are examples of experienced requirements.

First Assignment Instructor Pilot (FAIP) – SUPT graduate selected to remain at the training location as a flight instructor. FAIPs are selected for MWS training three years after instructor training.

Flight Lead (FL) – a pilot qualified to lead multiple aircraft of the same MWS.

Flight Lead Upgrade (FLUG) – syllabus program through which Flight Leads become qualified.

Fifth-generation – the most modern fighter MWS fielded today. F-22 and F-35 are fifth-generation fighters.

Fourth-generation – the most prevalent fighter MWS fielded today. F-16, F-15C/E, F-18, and A-10 are all fourth-generation fighters. Occasionally called "legacy" fighters by fifth-generation pilots.

Fighter Training Unit (FTU) – also called the "B-course" (basic course), this course is the initial qualification training for a fighter MWS.

Introduction to Fighter Fundamentals Course (IFF) – fighter lead-in training flown in the T-38C. Prerequisite for MWS initial qualification.

Large Force Engagement (LFE) – eight or more aircraft flying together in one operation. Aircraft may be separate MWS.

Major Weapons System (MWS) – a specific aircraft. F-22, F-35, B-52, and A-10 are each examples of MWS.

Mission Commander – a pilot qualified to lead a large force engagement.

Mission Design Series (MDS) – collection of similar MWS. B-2s and B-52s are separate MWS of the Bomber MDS.

Specialized Undergraduate Pilot Training (SUPT) – one-year basic skills training for pilots. Officers are awarded pilot wings upon completion and may stay at the training location as FAIPs or move to initial qualification in an MWS.

Total Active Rated Service (TARS) – a rated officer's total number of years of service in a flying capacity.

Time to Experience (TTE) – the amount of time in years required for a pilot to achieve the MWS definition of experience. Time begins upon arrival at first operational duty station following initial operational training in the MWS.

Utilization Rate (UTE) – the average number of sorties flown by an MWS in one month.

Weapons System Officer (WSO) – CSO selected for a fighter MWS. The F-15E is currently the only USAF's only WSO MWS.

APPENDIX B

Inexperienced Flight Lead Hours by MWS, 1 May 16.[27]					
Pilot	**MWS**	**Hours**	**TOS (Months)**	**2FL**	**4FL**
1	F-15C	364	28		x
2	F-15C	270	13	x	
3	F-15C	406	27	x	
4	F-15C	279	13	x	
5	F-15C	381	21		x
6	F-15C	253	13	x	
7	F-15C	389	17		x
8	A-10	493	23	x	
9	A-10	397	19	x	
10	A-10	369	13	x	
11	A-10	434	16	x	
12	A-10	448	19	x	
13	A-10	468	22	x	
14	A-10	439	23	x	
15	A-10	454	30		x
16	F-22	263	15	x	

17	F-22	391	29		x
18	F-22	348	23	x	
19	F-22	228	30	x	
20	F-22	353	21	x	
21	F-22	433	27		x
22	F-22	295	30	x	
23	F-22	425	23	x	
24	F-22	428	15		x
25	F-22	304	21	x	
26	F-22	362	15	x	
27	F-22	355	24		x
28	F-22	341	19	x	
29	F-22	351	30		x
30	F-22	383	24		x
31	F-22	154	9	x	
32	F-22	187	11	x	
33	F-22	170	13	x	
34	F-22	285	19	x	
35	F-22	388	30	x	
36	F-22	347	24		x
37	F-22	358	28		x

Notes

(All notes appear in shortened form. For full details, see the appropriate entry in the bibliography.)

1. Marken, Taylor, Ausink, Hanser, Anderegg and Wickman, *Absorbing Fighter Pilots*, 21.
2. Air Power Doctrine Centre, "Five Generations of Fighter Aircraft," 1-2.
3. Coram, *Boyd: The Fighter Pilot Who Changed the Art of War*, Chapter 3.
4. AFI 11-412, *Aircrew Management*, 25.
5. AFI 11-2F-22A Volume 1, *F-22A--Aircrew Training*, 69.
6. AFI 11-2F-35A Volume 1, *F-35A--Aircrew Training*, 9.
7. Mr. John G. Wigle, rated program analyst, Department of the Air Force, email to the author, 10 March 2016.
8. Marken, Taylor, Ausink, Hanser, Anderegg and Wickman, *Absorbing Fighter Pilots*, 102.
9. AFI 11-412, *Aircrew Management*, 20.
10. Mr. Michael Torino, rated program analyst, Department of the Air Force, presentation to the CSAF Rated Summit, 16 September 2015.
11. Ibid.
12. AFI 11-2F-22A Volume 1, *F-22A--Aircrew Training*, 15.
13. AFI 11-2F-35A Volume 1, *F-35A--Aircrew Training*, 62-64.
14. AFI 11-2F-16 Volume 1, *F-16--Aircrew Training*, 44.
15. Ibid, 2.
16. Marken, Taylor, Ausink, Hanser, Anderegg and Wickman, *Absorbing Fighter Pilots*, 16.
17. Ausink, Taylor, Bigelow and Brancato, *Investment Strategies for Improving Fifth-Generation Fighter Training*, 15.
18. Carnelo, "Tyndall AFB takes F-22 pilot training to the next level."
19. Ibid.
20. Automated Aircrew Management System HCM averages, 2015-2016.
21. Ibid.
22. Ibid.
23. AFI 11-2F-16 Volume 1, *F-16--Aircrew Training*, 44.
24. Ibid.
25. F-15C, A-10, F-22 Fighter Squadron Letters of Qualification, email to the author, May 2016.
26. Ibid.
27. Ibid.

BIBLIOGRAPHY

Air Combat Command Instruction (ACCI) 21-118. *Logistics Maintenance Performance Indicator Reporting Procedures*, 2 August 2012.

Air Education and Training Command Instruction (AETCI) 21-105. *Logistics Performance Measures Reporting Procedures*, 18 March 2013.

Air Force Instruction (AFI) 11-2F-16, Volume 1. *F-16--Aircrew Training*, 20 April 2015.

Air Force Instruction (AFI) 11-2F-22A, Volume 1. *F-22A--Aircrew Training*, 19 May 2006.

Air Force Instruction (AFI) 11-2F-35A, Volume 1. *F-35--Aircrew Training*, 13 September 2010.

Air Force Instruction (AFI) 11-412. *Aircrew Management*, 10 December 2009.

Ausink, John A., William W. Taylor, James H. Bigelow and Kevin Brancato. Investment Strategies for Improving Fifth-Generation Fighter Training. Santa Monica, CA: RAND Corporation, 2011.

Carnelo, Wilson. "Tyndall AFB takes F-22 pilot training to the next level." *Air Force News*, 30 July 2014. http://www.af.mil/News/ArticleDisplay/tabid/223/Article/486936/tyndall-afb-takes-f-22-pilot-training-to-next-level.aspx

Coram, Robert. *Boyd: The Fighter Pilot Who Changed the Art of War*. New York: Hachette Book Group, 2002.

"Five Generations of Fighter Aircraft." *Pathfinder Air Power Development Centre Bulletin* issue 170, January 2012.

Marken, Richard S., William W. Taylor, John A. Ausink, Lawrence M. Hanser, Clarence R. Anderegg and Leslie Wickman. Absorbing and Developing Qualified Fighter Pilots: The Role of the Advanced Simulator. Santa Monica, CA: RAND Corporation, 2007.

Torino, Michael (rated program analyst, Department of the Air Force). Interview with the author, 16 September 2015.