THE EFFECTS OF OPERATIONALLY LIMITED ENVIRONMENTS ON PRIMARY FLIGHT TRAINING AT THE COLLEGIATE LEVEL

By

KEVIN M BURSAW

Bachelor of Science in Professional Flight Technology
Purdue University
West Lafayette, Indiana
2013

Master of Business Administration
University of Miami
Coral Gables, Florida
2020

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF EDUCATION
July, 2022

THE EFFECTS OF OPERATIONALLY LIMITED ENVIRONMENTS ON PRIMARY FLIGHT TRAINING AT THE COLLEGIATE LEVEL

Dissertation Approved:

Dr. Mallory Casebolt

Dissertation Advisor

Dr. Chad Depperschmidt

Dr. Timm Bliss

Dr. Donita Shaw

ACKNOWLEDGEMENTS

I would like to thank several people for helping me get this far. First, my family. For Candita, Chiara and soon to be new baby. Candita, thank you for all the encouragement, support, and patience you have given me over the last two years. I literally could not have done this without you. The help editing and developing my writing skills have made all the difference in the world. I can't imagine life without you. For Chiara, thank you for your patience! I know there's been a lot going on, but you have been awesome! I hope to continue to share this passion for aviation with you for years to come. To my parents I want to say thank you as well. During COVID when I had this crazy idea to start a doctorate, you let me bounce ideas off of you and provided a ton of needed courage. You have always been there, every step of the way. Between editing, listening and the encouragement, I also could not have done this without you. Thank you for giving the background in my faith to do this as well. God was much needed at different points throughout this degree. For Joe and Alissa Cress. We have all come a long way from undergraduate studies at Purdue, and I wouldn't want it any other way. From the pile of rocks pep talk to always having someone to talk to about this when needed, I cannot say thank you enough.

Acknowledgements reflect the views of the author and are not endorsed by committee members or Oklahoma State University.

Name: KEVIN M BURSAW

Date of Degree: JULY, 2022

Title of Study: THE EFFECTS OF OPERATIONALLY LIMITED ENVIROMENTS ON PRIMARY FLIGHT TRAINING AT THE COLLEGIATE LEVEL

Major Field: APPLIED EDUCATIONAL STUDIES

Abstract:

Scope and method of study: The purpose of this national research study was to examine the effects that COVID-19 had on primary flight training at the collegiate level. This study was to determine how pilot production was affected by the pandemic and its associated lockdowns and mitigation measures to help see the ripple effects it caused and construct a plan for sustained operations should another pandemic happen.

Findings and conclusions: The data was collected from 10 FAA Part 141 collegiate flight schools that offered a four-year bachelors degree and operated their own fleet of aircraft were analyzed for the findings and conclusions in this study. The findings of this research have the potential to impact the program size, infrastructure, and standard operating procedures at Part 141 flight schools. Additionally, this study has the potential to help forecast the future pilot supply coming out of these schools and analyze where part of the pilot shortage may be happening.

TABLE OF CONTENTS

Chapter Page

Chapter Page

LIST OF TABLES

Table Page

CHAPTER I

INTRODUCTION

On Tuesday, September 11, 2001, at 8:46 AM, the aviation industry changed forever. Since the first aircraft hit the World Trade Center, the industry has seen a massive pilot shortage. It started shortly after the attacks in 2001. The first event that contributed to the pilot shortage was the closure of United States (US) airspace and then the demand for travel dried up with risk-averse vacationers and businesses halting most revenue travel (Ito and Lee, 2004). This was followed by massive layoffs and furloughs for the airline industry. In 2008, another major global event resulted in another round of furloughs and layoffs, the Great Recession (Stark et al., 2008). To help put into perspective what these events did to global pilot supply, Murray (2021) writes that new pilot certifications fell 30 to 40 percent after major industry events like 9/11 and the Great Recession. 2001 and 2008 greatly affected the airline industry. In 2020, the biggest shock to flying operations occurred, a global pandemic; SARS-CoV-2 (COVID-19). As a result of COVID-19, countries imposed strict lockdowns; people stayed in their homes for months, and massive layoffs and furloughs again followed for pilots (Statista, 2020).

The Boeing Company, in their 2020 Pilot and Technician Outlook, say that even though there is a temporary surplus of qualified pilots, the long-term recovery of the industry will keep demand strong, and a shortage will exist again soon. The Boeing Company (2020) predicts that 763,000 pilots will need to be trained globally between the years 2020 to 2039 to meet demand. With all this training needing to be done, one must ask an important question. New and unknown risks came with COVI

19, and with the associated lockdowns to try and stop the spread of the virus, pilots could not get into the aircraft to fly; just how much training was lost during that time, and how far did the pipeline get set back?

Statement of the Problem

In March of 2020, COVID-19 became widespread and declared a pandemic by the World Health Organization. Within a few days most countries in the world went into some form of lockdown that kept people from leaving their homes. Included in this was the global aviation industry, most notably Part 141 collegiate flight training schools with Private Pilot's License (PPL) programs in the United States that make up a part of the beginning of the pipeline. Students were sent home and schooling placed online. Flight courses were not able to be completed during the lockdowns. This directly affects the pilot production in the US. The goal of this study is to quantify how much training was being done before the pandemic hit, and how much was lost as a result to compare and contrast pre and post pandemic flight training. This research also sought to identify safety measures that were implemented as a result of COVID-19, as well as the amount of training that was regained after implementation of those measures. Finally, this research seeks to identify what the US pilot production currently is at the collegiate level.

This study sought to help collegiate flight programs to effectively address any future issues on schooling and training and to utilize program resources to meet maximum possible production levels from their programs. In researching previous literature on this topic, it was found that no study of primary flight training in an operationally limited environment has been attempted since the pandemic was declared. The last global pandemic was the Spanish Flu in 1918, just a few short years after the airplane had been invented and primary flight training techniques were still being developed. Global aviation has never faced a test like the one it has in the last two years.

Purpose of the Study

The purpose of this study was to compare the level of primary flying training in Part 141 collegiate flight programs before, during and post COVID-19 pandemic, as well as what measures were taken to mitigate the risk of contracting the virus, and how much training was regained from those measures.

Research Questions

To understand the effects of the COVID-19 pandemic on primary flight training, the following research questions were developed to guide this study:

1. To what extent did the global pandemic affect collegiate flight programs' flight training?
2. What measures did collegiate flight programs take to resume in person flight training?
3. How effective were those measures in resuming student flight hours?

Significance of the Study

The aftereffects of the COVID-19 pandemic sent shockwaves across the global aviation industry. The aviation industry has never experienced a prolonged worldwide shock to all parts of the training pipeline like it did during the pandemic. This study focused on the beginning of the training pipeline at Part 141 flight schools to help understand what amount of training was lost, as well as successful mitigation measures taken to regain effective training. Part 141 flight schools were utilized in this study because these schools are a common starting point for an individual desiring to be a professional pilot. The Part 141 schools, as opposed to Part 61 schools, have a more rigorous structured curriculum that result in a degree and the ability for students to test for their Airline Transport Pilot (ATP) certificate at 1,000 hours instead of 1,500 hours (Federal Aviation Administration, 2020). At the present time there has not been a study done on primary flight training in operationally limited environments. The goal of this study was to help give the aviation industry insight into the status of the training pipeline at Part 141 schools, as well as possible ways to continue

training if in a similar situation in the future. Further studies will be able to be conducted from this research.

Limitations

This study was limited to responses from Part 141 approved collegiate flight schools with a four-year program that results in a bachelor's degree. No non-collegiate programs, private training or military training programs were surveyed. In addition to this, the Part 141 schools must have operated their own fleet of aircraft. No Part 141 flight schools with fleets that were fully or partially operated by a Fixed Base Operator were included. The researcher assumed that the answers received were all done voluntarily and were complete and honest.

Definition of Terms

This section provides terms and their definitions that are used in this study.

Airline Transport Pilot (ATP) Certificate: The highest rating the Federal Aviation Administration will give an individual as a pilot. Holders of the certificate must have passed the written, oral, and practical exams, as well as be at least 23 years old and of good moral character. Total flight time must be equal to or greater than 1500 hours.

Federal Aviation Administration (FAA): The governing body of the US for aviation. This organization sets rules, regulations and policy as well as administers exams.

Federal Aviation Regulations (FARs): The rules set by the FAA that govern aviation in the US.

Part 141: The FAR governing the implementation and operation of flight schools in the US.

Personal Computer Aided Training Device (PCATD): A concept to use commercially available computer software and hardware to aid in the training of new pilots.

Private Pilot License (PPL): The first step after the student pilot certificate on the way to an ATP certificate. The requirements are to be at least 17 years of age, pass the written, oral, and practical exams, as well as be able to read, write and understand English. In addition to this, required flight time is equal to or greater than 40 total hours with at least 20 hours flown dual with an instructor and at least 10 hours flown solo. Applicants must also hold a valid student pilot certificate before testing for this certificate.

SARS-CoV-2019 (COVID-19): The coronavirus found in late 2019 that turned into a global pandemic in March of 2020. Included in this was a lockdown on a worldwide scale.

Student Pilot Certificate: The first certificate a new pilot will hold. Requirements are to pass an FAA medical exam, be at least 16 years of age, and be able to read, write, and speak English. This certification is required prior to the first solo flight.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Reviewed in this section is a look at the current state of the US pilot training pipeline, current techniques and procedures used in primary flight training in the US, and future technology and emerging techniques to use during primary flight training. All of this is included to give as clear a picture of what the US pilot training pipeline looked like from 2019-2021, which was the period researched in this study.

The State of the United States Pilot Training Pipeline

Citing a study done right before the COVID-19 pandemic outbreak, Caraway (2020), notes that the Federal Aviation Administration (FAA) has projected that North America needs to train 360,000 pilots by 2037 to meet forecast demand and growth. These projections are backed up by Lutte et al. (2013) who projects a shortage of 95,000 pilots in the United States alone in the next 20 years, as well as by the Boeing Pilot and Technician Outlook 2020-2039, whose estimate comes to 763,000 pilots needed by the end of 2039. This includes replacements for retirees and people leaving the industry due to the COVID-19 pandemic (Boeing Pilot and Technician Outlook 2020-2039, 2020). Boeing (2020) details the pre-pandemic cadet programs and bonuses that airlines were using to fight the shortage before the sharp decline in travel. The report also cites the current surplus of qualified crewmembers, (due to the low pandemic travel level), but also notes that historically, (citing recoveries from 9/11 and the 2008 financial crisis), demand will once again outpace supply (Boeing

Pilot and Technician Outlook 2020-2039, 2020). Couple this shortage with Lutte et al.'s (2013) forecast of 45,000 pilot retirements during the same timeframe and the potential for a serious shortage of qualified personnel to operate advanced aircraft could potentially exist for the US pilot training pipeline.

To further compound this situation, Lutte et al. (2013) and Depperschmidt (2013) researched the effects of Public Law 111-216's passage in the US Congress that will deter new pilots from not only entering the industry, but also choosing to discontinue training before they achieve their ATP Certificate and get hired at a major airline. Caraway (2020), again citing an FAA study, says that to end this shortage of pilots, the industry must bring in 36,683 pilots every year until 2037. Casebolt et al.(2015), doing similar research on Public Law 111-216, found that from a recruitment standpoint, collegiate flight students have a negative perception of the law and expressed views that it would have negative effects on retention and recruitment into the industry.

Another forecast from Klapper and Ruff-Stahl (2019) goes more in depth on the projected shortage. When airlines do not have the manpower to crew jets they park them, leading to lost revenue from less passenger capacity, thus violating capacity-purchase agreements (CPAs) with major airlines (Klapper & Ruff-Stahl, 2019). These CPAs are vital to the regional airlines' revenue stream (Klapper & Ruff-Stahl, 2019). Looking at Klapper and Ruff-Stahl's (2019) models it can be seen that the regional airline industry, as a whole, will contract by 2023 due to lack of pilots. Their forecast predicts a shortage of 5,333 pilots in best case scenarios, and a shortage of 8,000 pilots in worst case scenarios (Klapper & Ruff-Stahl, 2019). Klapper and Ruff-Stahl (2019) go on to state that the major airlines will start to focus on cutting regional airline contracts and providing bridge programs to new pilots to enter their firms. It is important to note that these numbers are all pre-COVID, as no other peer reviewed studies have been done to date after the effects of the pandemic took effect. These numbers could be drastically different.

To help get a glimpse into the post-COVID-19 world of aviation, Stalnaker and Usman (2021) note that, while COVID-19 is not over yet, by early 2022, demand for air travel will be back at 2019 levels (Stalnaker & Usman, 2021). Stalnaker and Usman (2021) go on to say that the loss of flight training and new trainees during the lockdowns the United States could be facing an even bigger shortage than predicted. This is backstopped by Murray (2021) who looked at the falling percentages of new pilot certifications after 9/11. Using the 30 to 40 percent drop in certifications after 9/11, Murray projects a loss of 25,000 to 35,000 current and future pilots (Murray, 2021).

Primary Flight Training

Pilot training in the United States is governed by the Federal Aviation Regulations (FARs). These regulations are released yearly with any associated changes. The 2021 version of the FARs cite the following requirements:

For the private pilot single engine airplane land section of the training, 35 hours of aircraft training minimum, of which three must be cross country hours (one cross country taken must be more than 100 nautical miles away), three hours must be night flights, three hours must be instrument training and three hours must be done in preparation for the practical exam (FAR/AIM, 2021). In addition to this, 20 hours of the 35 must be done with a Certified Flight Instructor (CFI), and 10 takeoffs and 10 landings to a full stop must be done at an airport (FAR/AIM, 2021). Finally, five hours must be flown solo, to include three takeoffs and landings to a full stop at an airport with an operable control tower, as well as a solo cross country (FAR/AIM 2021).

The private pilot single engine airplane land section of ground school must cover, according to the FARs, accident reporting, applicable subjects in the Aeronautical Information Manual and Advisory Circulars (ACs), aeronautical charts for navigation, radio communications, recognition of critical weather situations, safe and efficient operation of aircraft, effects of density altitude on aircraft performance, weight and balance calculations, aerodynamics, aircraft systems and preflight

information collection (FAR/AIM 2021). Part 141 schools must also perform stage checks and end of course checks in keeping with the FAA approved curriculum (FAR/AIM 2021).

New student pilots, completing a curriculum including the FAR/AIM section for PPLs, must be taught a solid foundation in situational awareness and Aeronautical Decision Making (ADM) as early as possible using blended instruction techniques to encourage the inception and retention of higher order thinking skills (Robertson, 2005). Lack of ADM training was found by the FAA to be causal to poor decision making by pilots (FAA, 1991). Looking at years of research, the FAA (1991) found that student pilots who had received ADM training had 10 to 50 percent fewer judgmental errors operating aircraft. This seminal Advisory Circular on ADM addresses the five hazardous attitudes in aviation, stress, risk management, identification, and instruction in ADM (FAA, 1991). To be able to effectively teach ADM and the operation of any aircraft, it is imperative to understand the learning styles of collegiate aviation students. These learning styles, with the exception of freshman, are generally the converger and assimilator learning styles of the Kolb Learning Style Inventory (Kanske & Brewster, 2001). It is also important to note that this learning style emerges right after the freshman year and that most of the students that do not move towards this style generally drop flight training and move onto other studies (Kanske & Brewster, 2001). The reason that this is important to note is not only because freshman are generally the students in the PPL courses, but also for the creation of effective Scenario Based Training (SBT) for flight courses.

SBT, in comparison to the traditional Maneuver Based Training, was found to lead to an increase in Aeronautical Decision Making (ADM) (Doskow, 2012). Doskow (2012) notes that SBT can be used in any phase of flight training and produce increased ADM results. A study by Allen (2008) of flight school incident data provides the reason that ADM through SBT is important. Allen (2008) notes that one of the biggest hurdles a new pilot must overcome is landing the aircraft. CFIs must keep in mind when teaching that new pilots lack the needed experience to make smart and safe decisions (Allen, 2008). With Doskow's (2012) study showing the increase in ADM, programs

should consider implementing SBT in their training to accelerate student pilots' learning and the growth of the safety culture in the industry.

Taking advantage of the advances in SBT, the FAA recently implemented a new syllabus. In October 2007 FAA released the FAA/Industry Training Standards (FITS) Generic Private Pilot Airplane Single Engine Land Syllabus. This syllabus uses real-world scenarios to train brand new pilots in a competency-based program, instead of just a purely maneuver-based proficiency approach (FAA, 2007). One of the biggest changes in the FITS syllabus from the normal flow of flight training that the world is used to, is that when a pilot trainee shows competency in an area of the curriculum, they move on, regardless of how many flight hours it takes to achieve this competency (FAA, 2007). This training was created to address the introduction of Technically Advanced Aircraft (TAA) in the training environment (FAA 2007). The FAA's (2007) training goals, completed through SBT, include Higher Order Thinking Skills, ADM, Situational Awareness (SA), use of Flight Automation, Task and Risk Management, and Planning and Execution, as well as multiple other categories. SBT and Single Pilot Resource Management are patterned off of Line Oriented Flight Training or Crew Resource Management courses already in existence (FAA, 2007). The syllabus released by the FAA (2007) must be completed in an airplane, and parts of the curriculum can be completed in an Aviation Approved Training Device if desired. Throughout the document are developed scenarios for CFIs to give their students on the ground and in flight, as well as maneuvers to practice and patterns to fly (FAA, 2007).

As syllabi advance, it is important to note, that as time has gone on, school has started moving online more frequently (Prather, 2007). In particular aviation degrees have moved online in a distance learning format. Whereas flight hours must still be done in the actual aircraft, most ground school classes can be done on the internet. A study by Prather (2007) reviewed the history of distance learning, from its roots in correspondence classes at the turn of the century, to today's online degrees, while theorizing what the future of collegiate aviation distance learning might look like. The author

found that there were only 24 colleges in the United States and Canada offering online aviation courses, and only four of these had completely online degrees (Prather, 2007). Prather (2007) also notes that none of these degrees are of the professional pilot nature due to the required flight training not being available except in-person. However, in the future possibilities section of his paper, Prather (2007) talks about how distance learning will be able to enable persons of different demographics and in remote locations, that normally would not have the opportunity to explore aviation education at the collegiate level, be able to participate in greater numbers. At the time of this paper, only a handful of Part 141 flight schools were exploring or implementing distance learning in collegiate aviation.

The distance learning model for aviation can raise a question about instructor continuity and its effects on flight students. A study done by Goff (2013) on United States Air Force pilots flying the T-1A out of Columbus Air Force Base showed that, out of 144 students surveyed, there was a statistically significant negative effect on grades with exposure to excess numbers of flight instructors. The data presented a one-point degradation, in checkride scores, per extra instructor that the student pilot flew with (Goff, 2013). This study helps illustrate a closely held belief in the aviation industry that a student should fly with a lower number of flight instructors in training to help build and refine critical skills (Goff, 2013).

The Future of Primary Flight Training

As technology and techniques advance in the industry, so do potential teaching and learning methods. This is extremely well illustrated by the use of commercially available Electronic Flight Bags (EFBs) and/or charts. Babb (2014) surveyed student pilots at universities about the use and limitations of EFBs by student pilots. It was found that not only were EFBs seen as a money saving measure by these students, but over 90 percent of those surveyed expected to have to use them during their piloting career (Babb, 2014). Over 80 percent of those surveyed were using EFBs already (Babb, 2014). Additionally, over 90 percent used the same application, Foreflight, for their electronic charts

(Babb, 2014). Babb (2014) also found that over 90 percent of the student pilots were using iPads over any other form of tablet commercially available. While looking at the limitations of the EFBs, 33 percent of users reported problems in flight ranging from simple battery power limitations, to screen glare, to loss of cell service (Babb, 2014). The most prevalent issue noted was the overheating of devices (Babb, 2014). Some of these issues were rectified with users flying with backup charts or charging devices in-flight (Babb, 2014). When Babb (2014) looked at those surveyed who didn't use EFBs, he found that the majority didn't because they had no device (tablet) to put the EFB on (cost was not a factor in the lack of device).

Babb (2017) continued research into EFBs at collegiate aviation programs. The Babb (2017) suggests that EFBs must be considered an aircraft system and treated like an extension of the avionics (Babb, 2017). For this, Babb (2017) recommends emulating air carriers' rules to regulate EFB usage among students, with regulations pertaining to current chart downloads, stowage of the EFB when not in use, and required battery dispatch levels. Diving deeper into this quandary, Babb (2017) looked at whether student pilots in a PPL course are even allowed by their flight schools to use EFBs in training or on check rides. Whereas there is no uniformity found among collegiate aviation programs' use of EFBs for any level of training, Babb (2017) found that flight programs with more detailed EFB policies generally had a more positive view of EFB usage. The author states that EFB training at air carriers is also poor and that collegiate aviation programs should be the beginning of the required training for this new extension of the airplane (Babb, 2017). However, it was also found that most participants felt that training on normal paper charts during the learning phase of flight planning was needed to effectively use EFBs (Babb, 2017).

In order to provide clarity to the EFB quandary that some collegiate flight programs found themselves in, Embry-Riddle Aeronautical University researchers looked at the possible increase in pilot workload using EFBs. Two different scenarios were used in the study as well as paper charts and EFBs (Dattel et al, 2020). Participants were seated in a Cessna 172 simulator and given either an EFB

or paper charts, then exposed to one of two different scenarios (an expected flight path vs an unexpected reroute given last second by ATC) (Dattel et al, 2020). After this scenario was finished, participants were asked to fill out the National Aeronautics and Space Administration's Task Load Index survey (Dattel et al, 2020). Dattel et al (2020) found that the EFB did not increase pilot workload during either of the scenarios, however it was noted that all participants had a PPL certificate or higher rating, and were familiar with the EFB software.

Looking further into the future, the issue of Virtual Reality (VR) becomes more prevalent. Fussell and Truong (2020) took a look at the possibility of using VR for flight training. Admitting that VR use in aviation is still extremely new and not as much is known about VR devices in comparison to the simulators and training devices currently in use (Fussell & Troung, 2020). The authors express their belief that, if VR is validated like simulators were when they were new, there is a place for VR in an aviation SBT environment (Fussell & Troung, 2020). Surveying 42 currently enrolled flight students at Embry-Riddle Aeronautical University's Daytona Beach campus, Fussell and Troung (2020) found that if students did not perceive that the VR simulation would require extra effort, and/or if the students believed that the VR would enhance their overall training, they were more apt to use the VR to help augment their existing curriculum.

In a different study on VR flight training, 41 students from Carleton University in Canada were studied using traditional aviation simulation versus VR (Lawrynczyk, 2018). Flying three laps of a traffic pattern in both the traditional simulator and the VR goggles, participants were asked about the realness of the simulation, cognitive load, and their perceived level of cybersickness, if any occurred (Lawrynczyk, 2018). In addition to this, participants wore a wrist mounted heartrate monitor to help gauge their cognitive load by tracking the pulse rate (Lawrynczyk, 2018). What was found was surprising. The traditional simulator still provided the needed learning, but the VR was found to give the user a higher cognitive load, closer to one that a pilot might experience in the real aircraft, thus providing better training overall (Lawrynczyk, 2018). When looking at heart rate and user

reported cognitive load, Lawrynczyk (2018) was able to take a major step towards validating the use of VR as an equal or better flight training device to be used in the future. It should be noted however, that Lawrynczyk (2018) did not compare the VR training to actual in-flight training, thereby keeping the VR to a simulator only level.

Meshing the new VR technology and the student's possibility of using it more regularly, as well as the collegiate aviation model, Karp (2000) writes about the Aviation Education Reinforcement Option (AERO). AERO is designed to increase the retention of critical information long-term with an emphasis on the use of Personal Computer-based Aviation Training Devices (PCATD) (Karp, 2000). Karp (2000) talks about how the classroom is the critical link between the flight line and comprehension of material. He stresses that lecturing is important, but that students should be grouped into small units and led through instruction and exercises together, culminating in the use of PCATDs to help reinforce the lessons taught (Karp, 2000). The earlier the PCATD can be used after the lesson, the better the long-term retention due to the hands-on, auditory, and visual learning styles incorporated in their use (Karp, 2000).

Karp (1996) goes on to write a broader theoretical perspective on the future of primary flight training. He reviews the current technology and pilot training programs around the world while posing questions about the ability to use collaborative education techniques, identifying, and adapting training to the spectrum of all students' learning abilities, and the use of emerging technology early on in training in the classroom (Karp, 1996). The findings were that the majority of students were hands-on learners, with significant sections of the studied population being visual or aural learners (Karp, 1996). As for collaborative education, Karp (1996) found that 80 percent of students preferred a lecturer to a facilitator during classroom work. The most significant part of the study was the almost 90 percent of students who desired the use of emerging technology in their training, because of its ability to help them to reinforce learned concepts (Karp, 1996). Karp (1996) noted that this finding seemed to correlate to the high number of hands-on learners in the studied population. Karp (1996)

goes on to recommend that university level aviation programs change to a heavier use of simulation and radio procedures practice. Additionally, it was suggested that a greater emphasis on modern powerplants, mission preparation and emergency procedures be implemented (Karp, 1996). Karp (2000) follows with a discussion about PCATDs as the way of aviation training's future. The PCATD was theorized as a crossover from the classroom setting to the flight line (Karp, 2000). This device would enable students to learn by their own learning style, at their own pace, from the lessons taught to the practical application and proficiency they would need to demonstrate in-flight (Karp, 2000). Karp (2000) stressed the PCATD as essential to the reinforcement of learned aviation knowledge and the success of his AERO model.

Theoretical Perspective

The theory that informs this study is the experiential learning theory which was developed by David A. Kolb (1984). Experiential learning theory, put simply, is learning from a person's life experiences (Kolb, 2984). Kolb (1984) used the theories of Dewey, Lewin and Piaget to forge a complete model of the experiential learning process. In this process, Kolb points out five major points. Kolb (1984) says that experiential learning is best conceived as a process and not in terms of outcomes. Expounding on this first point, the author goes on to talk about how ideas are not a stagnant element, but that they are formed and modified as a person has new experiences (Kolb, 1984). The second point Kolb (1984) brings up is that experiential learning is a continuous process. Learning will be derived from a person experiencing routine and new things every day (Kolb, 1984). Kolb's (1984) third point is that the learning process comes from a person's ability to adapt to conflicts that happen in life. A person, according to Kolb (1984), must be able to take previously learned concepts/theories, then take input from conflict between real life and the concepts/theories, and adapt the concepts/theories to solve the conflict presented to them. At the resolution of the conflict, the person must then reflect on the experience to finish the learning process (Kolb, 2918). The fourth of Kolb's (1984) points is that interactions between environments and people are heavily

involved with the experiential learning process. This is best described as a person learning in the real-world environment, rather than that of a laboratory (Kolb, 1984). Finally, Kolb (1984), in his fifth point, defines learning as the process of creating knowledge. This means a person creates knowledge from objective and subjective experiences in life (Kolb, 1984).

The principles of the experiential learning theory can be applied to the research questions in the following way. The first research question has the most application of the three, as the other two questions deal with the resolution to the first question. To understand this, one must understand the term airmanship. Airmanship is an extremely nebulous term in the aviation world and can be applied to almost anything from navigation to basic aircraft knowledge. The best way to describe it, as it is never described other than basic terms, is that of being able to use knowledge and experience to problem solve before and during flight operations for the successful completion of an attempted flight.

Summary

Looking at the current pilot shortage, as well as where the training has been and is going, (including new techniques), it can be seen that even without COVID-19, the industry was changing. COVID-19 accelerated those changes at an alarming rate. The pandemic created an operationally limited environment that presented an opportunity to use these new techniques to help ease the pilot shortage. The question is, what does the pipeline look like now that the COVID-19 pandemic hit, evolved, and is receding. This study seeks to answer that question.

CHAPTER III

METHODOLOGY

Introduction

This section describes the methodology for the analysis of the effects of Operationally Limited Environments on Primary Flight Training at the Collegiate Level. This will be a mixed methods study.

Research Design

This study was designed with the intent to explore just how much training was lost during the COVID-19 pandemic and what a plan could be in similar situations in the future to help diminish the training lost.

Experiential learning theory applies here in all five of Kolb's points. To summarize, Kolb (1984) talks about learning being a continuous process of generating knowledge and adapting to conflicts between environmental stimuli and a person. The person uses these experiences and adapts them for use to solve problems they are presented with. During a training flight, this is *exactly* what happens to a student pilot. Put simply, airmanship is the total accumulation of experiential learning a pilot has had up to the present time. The more experiences a student has in an aircraft, the more they build their knowledge through experiential learning. Therefore, in the aviation industry, it is universally accepted that the number of hours a person has flown determines their level of expertise and ability to qualify for ratings. When looking at the first research question about how training was

affected by COVID-19, the researcher is looking at just how many experiences did not take place due to the virus forcing schools to cancel training flights, (learning experiences), for student pilots.

Extrapolating on experiential learning theory, a 13-question research survey (Appendice A) was developed and asked for the number of flight hours flown and percentage of fleet usage, (in semester increments), with the goal being to compare pre-COVID-19 training to training during the outbreak as well as post pandemic and during the implementation and evolution of mitigation measures. The Spring 2019 to Fall 2021 semester range was selected to give a full three semesters of pre-COVID-19 data to compare to three full semesters during COVID-19, and three full semesters during which new variants emerged and the pandemic started to recede. The answer given to the flight hours question helped set a historical baseline that was used as a comparison to the hours flown during the different phases of the pandemic. Additional questions added the data of total enrollment and certificate completion numbers in PPL programs to ascertain what the drop off in production was during the same time period. Questions were asked about the size of the Part 141's aircraft fleet, their utilization and if the number of aircraft impeded the return to instruction in any way. These questions provided clarity on the usage of aircraft for training, and if they were a factor in any lost training. Further questions were asked about if aviation professionals were included in the creation of COVID-19 mitigation plans. Additional questions were asked about training cessation and resumption dates to accurate ascertain what semesters were most affected by the lockdowns. Finally, open-ended questions about what mitigation measures were used to reduce virus transmission were asked. The first question was to see what measures were implemented to keeping training continuing during this time period, the second question asked what mitigation measure was most effective, the third question was reserved for any personal comments on COVID-19 response, while the fourth free response question asked if there were any non-COVID related issues that affected flight operations during the nine semesters surveyed.

Participants

Part 141 approved collegiate flight schools offering a four-year program culminating in a bachelor's degree and operating their own fleet of aircraft were the research population for this study. These schools were identified for contact off of the FAA Part 141 school online database. This survey was of schools themselves and not the student pilots.

Data Collection

The data collection for this study proceeded with three steps. To begin with, the researcher identified and emailed Part 141 collegiate flight schools in the US from the FAA online database. Next, the researcher contacted the identified school's Chief Flight Instructor be email (Appendice B) and asked for their willingness to participate in the study. Following this, a survey with the research questions was emailed with a consent form (Appendice C), to the flight schools willing to participate in the study. Schools had 30 days to respond to the survey. A two-week reminder was sent within 14 days of the survey being opened to the collegiate flight schools. After the time period for replying had elapsed, the researcher removed any identifying information from the schools and analyzed the data that was returned. Data collection and final analysis was be completed by the early May 2022.

Reliability and Validity

Reliability was established with trustworthiness. Trustworthiness is the name given to the four criteria that, if attained, will allow "increased confidence in the rigorousness of the findings" (Lewis-Beck et al., 2004, n.p.). "Credibility refers to the plausibility of an account" (Lewis-Beck et al., 2004, n.p.). In addition to this definition, credibility is one of the four trustworthiness criteria (Lewis-Beck et al., 2004). To help establish trustworthiness in this study, the researcher followed the four criteria. The first criteria was credibility. The researcher established this by having three other collegiate aviation professionals screen the survey questions before they was published. In addition to this, the researcher took input provided by the aviation professionals to amend the questions as

needed. Transferability was attained by the specific wording of the survey questions, and final analysis and plan, so that they could be applied to flight schools in different populations. Dependability and confirmability were met by keeping detailed digital logs of all the research study design and data collection processes. In addition to this, validity was established from three collegiate aviation professionals, (two of which have over 10 years of service in the industry), and their suggestions were used in the final version of the survey that was sent out to the Part 141 flight schools.

Data Analysis

This study was a mixed methods study. This approach is best described as the combination of the qualitative and quantitative methods. Hesse-Biber (2010) writes about the sequential explanatory design to be used here. For the quantitative approach used here, the researcher started with quantitative data collection and analysis, followed by qualitative data collection and analysis, immediately followed by findings (Hesse-Biber, 2010). The data in this study was analyzed with the use of descriptive statistics as well as thematic analysis techniques. Descriptive Statistics was used for depicting the basic elements of a set of data such as the mean or range (American Psychological Association, 2022). For this research, the data was used as a timeline to help illustrate where programs were during the pandemic, instead of in a quantitative capacity.

Thematic analysis, although sometimes disorganized, are best due to their theoretical flexibility (Lester et al., 2020). Lester et al. (2020) discusses how the thematic analysis approach allows the researcher to talk in comprehensive illustrative terms when referring to their research. The process for thematic analysis generally has seven phases; preparing data, transcribing data, becoming familiar with the data, memoing, coding, moving from codes to categories and categories to themes, and making the analytic process transparent (Lester et al., 2020). This process allowed for the ability to use the qualitative data to construct the off-the-shelf plan for operations in an operationally limited

environment. An inductive approach was used with the qualitative data. Thomas (2006) indicates how inductive thematic analysis allows themes to emerge without being bound by the preconceptions of the researcher. In addition to this, the inductive approach "are intended to aid in understanding of meaning in complex data through the development of summary themes or categories from raw data" (Thomas, 2006, p 239). With this, the qualitative data was collected, and responses coded into themes for the study.

This study was used to compare program's flight hours each semester to each other before COVID-19 hit, during the pandemic, and as new variants emerged, and mitigation measures were implemented and evolved and the pandemic drew to an end. Survey questions about student pilot enrollment, PPLs completed, aircraft fleet size and aircraft fleet utilization were analyzed in the exact same measure. The results were compared to each other to determine what the effect of the pandemic was on primary flying training and the outlook ahead. Free response questions in the survey were not statistically analyzed but provided needed data on mitigation measures taken to help develop an off-the-shelf flexible plan for continued training in the event another operationally limited environment arises.

Ethical Issues and Assurances

This research study was conducted in accordance with the Institutional Review Board (IRB) requirements established by the Oklahoma State University Office of University Research Compliance (URC). IRB approval (Appendice D) (IRB Application Number: IRB-22-16) was obtained by the researcher from the URC before any research was conducted and before any data was gathered.

Possible ethical issues included disclosure of information and/or metrics from the participants and confidentiality issues involved with COVID-19 mitigation measures and reputation of the university due to the highly competitive nature of the industry and the potential political implications

of how COVID-19 was handled at each school. Each possibility was mitigated with the use of an anonymous survey and the assignment of pseudonyms for respondents. Respondents had to view and digitally sign a consent form explaining these measures, and that the survey was completely voluntary. Those schools that chose to participate clicked on the "I consent to continue" button to take the survey. IRB protocol has been followed and complied with by the researcher. All quantitative and qualitative data has been redacted and secured.

Summary

This survey was screened by collegiate aviation professionals before being sent out to the flight schools. Now that responses to this survey are collected and analyzed, it will allow the industry to step back and view the last few years of COVID-19's ripple effects across the pilot production pipeline. This study sought to give clarity to long term strategic planning for collegiate flight programs and airlines alike, by providing a look at the production of Part 141 collegiate flight schools across three years and before, during and at the end of a global pandemic. This data could be used by the airlines and colleges alike to help plan for student enrollment, resource allocation and future hiring, scheduling and growth. This study also aimed to help the industry understand where the current pilot shortage could be occurring in the overall training pipeline.

CHAPTER IV

FINDINGS

Introduction

Chapter IV presents the data gathered by the survey in order of the questions as they were asked on the research instrument. The research instrument asked 13 questions of both quantitative and qualitative nature. There were five questions that were quantitative, and eight questions that were qualitative. Answers were given in either a multiple response format, or a free response text box format.

Participating Institutions and Response Rate

The research sought information from part 141 collegiate flight schools that offered curriculum in professional pilot/flight. Because of the sensitivity of the information shared, and the high level of competition in the industry, participating flight schools remained anonymous, and the data collected was redacted of any identification information and a pseudonym was assigned for respondents from letters A through J. Of the initial 40 flight schools contacted, only 10 Chief Flight Instructors chose to participate in the study, resulting in a response rate of 25 percent. This response rate was due to reports from recipients that indicated that their part 141 schools did not want to disclose their information, specifically reported flight hours or student enrollment, for fear of use against them in a competitive market. Of the 10 respondents, 30 percent gave an incomplete answer to at least one question. School I numbers reflect the total numbers of their entire flight program, not just the PPL program like similar respondents.

Reported Flight Hours

Question one of the research survey, answered by multiple-choice, asked part 141 schools to report their flight hours flown during nine semesters to compare pre-COVID-19 training to during COVID-19 training. Table 1 shows the reported flight hours for Schools A through J. The table gives a breakdown of the flight hours flown, per semester, by the 10 respondents. Schools F and J declined to respond to this question. For comparison, the 2019 pre-COVID-19 semester was used as a baseline. This question sought to identify a difference in flight hours flown pre-COVID-19 pandemic to determine what the loss of flight training, if any, was in PPL programs.

Table 1

Reported Flight Hours

Reported Flight Hours										
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Spring 2019	401-600	over 1400	over 1400	1001-1200	201-400		201-400	0-200	over 1400	
Summer 2019	0-200	over 1400	over 1400	1001-1200	0-200		0-200	0-200	over 1400	
Fall 2019	401-600	over 1400	over 1400	1001-1200	201-400		401-600	0-200	over 1400	
Spring 2020	201-400	over 1400	over 1400	1001-1200	201-400		201-400	0-200	over 1400	
Summer 2020	0-200	over 1400	over 1400	1201-1400	0-200		0-200	0-200	over 1400	
Fall 2020	401-600	over 1400	over 1400	1201-1400	201-400		201-400	0-200	over 1400	
Spring 2021	401-600	over 1400	over 1400	1201-1400	201-400		201-400	0-200	over 1400	
Summer 2021	0-200	over 1400	over 1400	1201-1400	0-200		201-400	0-200	over 1400	
Fall 2021	401-600	over 1400	over 1400	1201-1400	201-400		201-400	0-200	over 1400	

Sustaining training in the operationally limited environment was approached in different ways. Table 1 shows variations among different flight schools pre, during, and post COVID-19. Ninety percent of flight schools reported that their flight hours were the same or even greater during the emergence of COVID-19. Fifty percent reported meeting their 2019 semester numbers, while 10 percent, (School D) exceeded them. School A reported a decrease in hours from Spring 2019 from 401-600 hours to 201-400 hours, (a 40 percent loss), in the Spring 2020 semester. School D showed a 15 percent increase in reported hours from 1001-1200 to 1201-1400 hours flown beginning with the Summer 2020 semester and continuing throughout the rest of the survey period. Seventy percent of programs reported the same summer semester hours for all three years, with the exception of School D.

Reported Student Enrollment

The second question of the research survey asked schools about their student enrollment numbers over the three years surveyed. Question two was multiple-choice and the data desired by question two was quantitative and asked to compare the student enrollment from the pre-COVID-19 year to the first two years of COVID-19. Table 2, *Reported Student Enrollment,* shows the reported student enrollment, (in semester increments), in the part 141 PPL programs. Ninety percent of the schools surveyed responded, while 10 percent declined to provide an answer. School J was the school that abstained. School I reported total student enrollment in their entire flight program, not just PPL program enrollment. Similar to Table 1, Table 2 also used the 2019 semester data points for comparison. This question sought to identify changes in student enrollments to investigate if flight students dropped training or new enrollment as a result of the pandemic.

Table 2

Reported Student Enrollment

Reported Student Enrollment										
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Spring 2019	26-50	101-125	over 200+	76-100	26-50	0-25	0-25	0-25	0-25	
Summer 2019	0-25	101-125	over 200+	76-100	0-25	0-25	0-25	0-25	26-50	
Fall 2019	26-50	101-125	over 200+	76-100	26-50	0-25	26-50	0-25	26-50	
Spring 2020	26-50	101-125	over 200+	76-100	26-50	0-25	0-25	0-25	26-50	
Summer 2020	0-25	126-150	over 200+	101-125	0-25	0-25	0-25	0-25	26-50	
Fall 2020	26-50	126-150	over 200+	101-125	26-50	0-25	26-50	0-25	26-50	
Spring 2021	26-50	126-150	over 200+	101-125	26-50	0-25	0-25	0-25	26-50	
Summer 2021	0-25	126-150	over 200+	101-125	0-25	0-25	0-25	0-25	0-25	
Fall 2021	26-50	126-150	over 200+	101-125	26-50	0-25	0-25	0-25	26-50	

Question two asked flight schools about their student enrollment in PPL flight courses. Eighty percent of schools reported the same enrollment or an increase in enrollment. Schools A, C, E, F, G, and H, (60 percent of respondents), all reported the same number of students in relation to their pre-COVID-19 semesters. Thirty percent of schools reported an increase in student enrollment in some capacity. Of that 30 precent, two respondents, starting in the Summer 2020 semester, reported an increase in student enrollment that continued throughout the remainder of the surveyed semesters. School B went from a student enrollment of 101-125 from Spring 2019 to Spring 2020. School B increased their student enrollment in Summer 2020 18 percent to 126-150 for the rest of the survey

period. School D, in Summer 2020, went from 76-100 students to 101-125 students in their PPL program, a 22 percent increase. Both schools increase in enrollment came within the same semester. School I reported their student enrollment as 0-25 students in Spring 2019 and 26-50 from Summer 2019 to Spring 2021. This was a 66 precent increase. School I then reported that they declined in enrollment to 0-25 for Summer 2021 and increased to 26-50 the following semester.

Reported Student Certificate Completion

Part 141 schools were asked to report student completion numbers in their PPL programs in question three of the research survey. This quantitative data was needed to compare the student completion numbers from the three pre-COVID-19 semesters to the six semesters finished in the operationally limited environment, and was answered in a multiple-choice format. Table 3 shows the survey results for reported flight certificate completion. These results are broken down by semester. The certificate completed was the PPL, the first major certificate a student pilot earns. School I reported all certificates completed by their institution, not just PPLs. For comparison, the 2019 semester was used. This question sought to identify if there was a decline in student flight certificate completions during the pandemic.

Table 3

Reported Certificate Completion

Reported Certificate Completion										
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Spring 2019	26-50	76-100	51-75	51-75	26-50	0-25	0-25	0-25	26-50	
Summer 2019	0-25	76-100	76-100	51-75	0-25	0-25	0-25	0-25	26-50	
Fall 2019	26-50	76-100	51-75	51-75	26-50	0-25	0-25	0-25	26-50	
Spring 2020	0-25	76-100	26-50	51-75	26-50	0-25	0-25	0-25	0-25	
Summer 2020	26-50	101-125	51-75	76-100	0-25	0-25	0-25	0-25	0-25	
Fall 2020	26-50	101-125	51-75	76-100	26-50	0-25	0-25	0-25	26-50	
Spring 2021	26-50	101-125	51-75	76-100	26-50	0-25	0-25	0-25	0-25	
Summer 2021	26-50	101-125	76-100	76-100	0-25	0-25	0-25	0-25	51-75	
Fall 2021	26-50	101-125	51-75	76-100	26-50	0-25	0-25	0-25	26-50	

Twenty percent of schools answered the certificate completion question by showing a 22 precent and 28 precent growth respectively during the Summer 2020 semester. This new higher completion rate was maintained during the subsequent semesters until the end of the survey period. School A reported a 66 percent dip in completions during the Spring 2020 (the beginning of COVID-19) semester and a 65 precent growth, (from 0-25 to 26-50 student completions), for both Summer semesters in 2020 and 2021. School C reported lower student completion numbers of 40 percent in the Spring 2020 and Summer 2020 semesters, but then returned to mirror their 2019 numbers of 51-75 student completions in the Spring and Fall 2021 semesters and 76-100 student completions in the

Summer 2021 semester. Ten percent of schools that participated showed the same number of certificate completions as year 2019. Thirty percent of respondents (Schools F, G, and H) showed the same certificate completion for every semester surveyed, regardless of year. School I reported a 26-50 student completions for their 2019 semesters. A loss in completions, (66 percent), occurred during the Spring 2020, Summer 2020, and Spring 2021 semesters. Completions rose during Summer 2021 by 40 percent from Summer 2019 and by 80 percent from Summer 2020. Completions returned to the 2019 baseline level for School I in Fall 2021.

Reported Fleet Size

The fourth question of the research survey looked to see what the size of part 141 schools' aircraft fleets were during the nine surveyed semesters to see if aircraft had been bought or divested of during COVID-19. To respond to question four, part 141 schools chose answers in a multiple-choice format. Table 4 shows the reported aircraft fleet size for each surveyed part 141 school. The fleet size is shown as the total number of aircraft each part 141 school had in each of the nine semesters surveyed. School J did not respond to this question. The 2019 semester, which was pre-COVID-19, was used for comparison. The purpose of this question was to identify if part 141 schools divested or invested in new aircraft based on the new operationally limited environment and their return to in-person instruction.

Table 4

Reported Aircraft in Fleet

Reported Aircraft in Fleet										
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Spring 2019	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Summer 2019	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Fall 2019	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Spring 2020	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Summer 2020	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Fall 2020	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Spring 2021	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Summer 2021	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	
Fall 2021	11-20	31-40	over 50+	31-40	11-20	11-20	11-20	11-20	41-50	

One hundred percent of Part 141 Flight Schools that answered the survey reported the same number of aircraft in their fleet for all semesters surveyed.

Reported In-Person Instruction Cease and Restart Dates

The research survey queried schools the dates they ceased and restarted in-person flight instruction in question five. The qualitative data this question petitioned was for the purpose of seeing for how long a period were not able to give in-person instruction, and was answered in an open response text box format. In person flight instruction cessation was reported by 80 percent of flight schools who answered the survey. Twenty percent, (two flight schools), did not shut down in-person

flight instruction during any of the nine semesters surveyed. Fifty percent of respondents reported shutting down in-person flight instruction in March of 2020. Schools E, H, and J restarted their in-person flight instruction in July of 2020 and School G returned in May 2020. Ten percent of schools, (School I), did not report any return date. Twenty percent of part 141 schools reported in-person instruction cessation dates in April 2020 and returns in May 2020. School A only reported a return date to instruction in June 2020 and no cessation date was reported.

Size of Institutions Fleet Impeding Return to Instruction

Question six of the research survey asked part 141 schools if the size of the schools' fleet was detrimental to returning to in-person instruction. Question six was a yes or no question that sought to find if large fleets of aircraft were difficult to maintain with maintenance and/or mitigation measures during the operationally limited environment. This question was asked to determine if the size of a school's fleet was detrimental to returning to in-person instruction. One hundred percent of part 141 schools surveyed reported that the size of the aircraft fleet was not a detriment to returning to in-person instruction for flight training.

Reported Fleet Utilization

The seventh question of the research survey sought to see what schools' aircraft fleet utilization was during the nine surveyed semesters, to see how the fleets were utilized pre-COVID-19 and during the operationally limited environment that emerged. This quantitative data was gathered by a multiple-choice answer format. Table 5 displays part 141 schools' fleet utilization as a percentage in semester increments. The intent of this question was to identify how flight schools' fleets were being used pre-COVID and if there was any decline in fleet usage after the onset of the pandemic.

Table 5

Reported Fleet Usage

Reported Fleet Usage										
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Spring 2019	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%		81%-100%	81%-100%
Summer 2019	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%		81%-100%	81%-100%
Fall 2019	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%		81%-100%	81%-100%
Spring 2020	81%-100%	61%-80%	61%-80%	81%-100%	81%-100%	61%-80%	61%-80%	81%-100%	61%-80%	81%-100%
Summer 2020	81%-100%	61%-80%	61%-80%	81%-100%	81%-100%	61%-80%	61%-80%	81%-100%	61%-80%	81%-100%
Fall 2020	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%
Spring 2021	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%
Summer 2021	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%
Fall 2021	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%	81%-100%	61%-80%	81%-100%	81%-100%	81%-100%

Seventy percent of part 141 schools answered that they experienced zero changes during any semester from Spring 2019 to Fall 2021. Thirty percent of schools reported a decline in fleet utilization from 81-100 percent in the Fall 2019 semester to 61-80 percent during the Spring and Summer 2020 semesters. School C returned to 81-100 percent aircraft fleet utilization during the Fall 2020 semester and continued at this level for the remainder of the survey.

When Did Schools Return to 100 percent Fleet Utilization

Question eight requested the dates that the part 141 schools returned to 100 percent aircraft fleet utilization. Question eight was an open text box for schools to respond. Two flight schools, (20 percent), reported that they never shut their flight programs down, so they did not have a return to 100 percent fleet utilization, as they continued flight operations. Thirty percent of part 141 schools responded that they returned to 100 percent fleet utilization during the Summer 2020 semester,

whereas all but one of the respondents all returned in Fall 2020. School I, did not return to 100 percent fleet utilization until the Fall 2021 semester, but also reported that during that same semester they operated approximately 30 percent above their original forecast hours. School G responded that they never returned to 100 percent fleet utilization due to scheduled and unscheduled maintenance during the surveyed semesters. Overall, 90 percent of schools were able to achieve 100 percent fleet utilization after the Spring 2020 semester where COVID-19 emerged.

Reported Self-Mitigation Measures

The ninth question of the research survey sought to identify mitigation measures part 141 schools took to gather qualitative data on the measures that flight schools took to help return to in-person flight instructions. This question was an open text box that allowed for individual responses from schools. The reported mitigation measures question was asked in an attempt to gather qualitative data on the measures that schools took to help return to in-person flight instruction. This data was intended to help give illustration to questions about flight hours flown, student enrollment and certificate completions, as well as fleet utilization.

A few mitigation measures that were identical were present among part 141 schools' responses, however there were multiple variances as well. Ninety percent of schools reported the use of sanitization of the cockpit and/or simulators between uses. School J mentioned that the initial sanitization plan, (cleaning before and after a flight), was having a damaging effect on some displays in their cockpits therefore, as a result, their institution changed to just sanitizing after flights. Eighty percent of those flight schools surveyed, (Schools A, C, E, F, G, H, I, and J), all implemented mask requirements for aircrew in the aircraft. Schools B and D did not report any mask requirements. Schools F and J reported phased reopenings from Spring 2020 to Fall 2021, with School J's only current restriction to stay home if an individual is sick.

School I responded with an eight-page plan that went through every facet of the School's plan for sustained operations during COVID-19. This included restricted entry points, screening, and social distancing, as well as a discipline plan for repeated violations from personnel. Social distancing measures were included by 60 percent of part 141 schools. Schools A, I, and H all altered their dispatch plans as self-mitigation measures. School H staggered the takeoffs to reduce the amount of people at dispatch at one time as well as also put up clear barriers of plastic to further limit contact between the dispatcher and the students and instructors. School F had a phase-in strategy to help limit the amount of people in the dispatch area at the same time. Additionally, School F recalled five students at a time based on where they were in the syllabus when the Summer 2020 semester began. As ratings were issued to those five students, another 5 students were recalled. After two weeks of this, and no positive cases, students were called back 10 at a time. Pre-COVID-19 student capacity resumed in the Fall 2020 semester.

Were Aviation Professionals Included in COVID-19 Decision Making

Qualitative data was requested by question ten in a yes or no format. Question ten asked whether aviation professionals were included in COVID-19 decision making, and was done with the intent to add clarity to how mitigation plans were made, and if any professional who had experience and understanding of the industry was included to help make a workable plan. One hundred percent of schools that responded to the survey reported that aviation professionals were included in some capacity in the decision-making process during the onset of COVID-19 and the emergence of subsequent variants.

Most Effective Mitigation Measure

Question eleven, answered by free response in an open text box sought to ascertain what mitigation measures were the most effective for part 141 schools to return to, and sustain, in-person operations. The question of most effective mitigation measure was used with the goal to provide part

141 schools' view as to what worked for them and what did not out of their mitigation plans. When asked what was perceived by the Part 141 Schools as the most effective mitigation measure Schools C, D, and E, (30 percent), all reported that they did not believe any measure was more effective than others. Twenty percent of schools, (Schools B and F), reported that their most effective measure was the sanitation guidelines utilized. School B also reported the screening measures as an equally effective tool. It is worth noting that School B not only reported in this section that they never had an increase in the spread of the virus, but operational tempo increased during 2020 and 2021. School G responded that quarantine was their most effective measure, whereas Schools I and J talked about how their return-to-work plans made the difference above other measures. School A reported that instituting a culture of reporting and testing helped them manage the pandemic better than any other measure. Additionally, School A reported their discontinuance of masks and gloves in their aircraft after one semester due to the lack of air conditioning and environmental factors. School A reported that they saw a decrease in infection rates after the lifting of the mask and glove requirement, even as subsequent variants emerged.

Personal Comments

The twelfth question of the research survey petitioned schools for any information they wished to share about their operations or experiences in the operationally limited environment that were not covered by previous questions. This question was answered by in a free response text box. Schools E and J reported that none of their mitigation measures seemed to make a noted difference. School J reported that "hindsight tells me it was a waste of time and energy". On the opposite side of this, School A doubled down on their establishment of a culture of testing and reporting as the way to make it work, as long as the plan for implementation was not too difficult. School G reiterated their plan to sanitize cockpits and other regularly touched surfaces in aircraft. School H talked about how their students had the option to pause their training if they did not feel safe in the training

environment, and School I referenced their COVID-19 operations eight-page guide again as their difference maker throughout the survey period.

Non-COVID-19 Related Factors

The final question of the research survey asked if there were any non-COVID-19 related factors affecting data that were known by part 141 schools who responded to the survey. This data was solicited to help clarify the quantitative data reported in previous questions. Non-COVID-19 related factors affecting flight training were asked for from every school. Only 20 percent of schools had any non-COVID-19 related factors affecting their operations throughout the survey period. School D reported that factors, (including COVID-19), did not lead to a decrease in flight training, but that their entire program grew by 20 percent. School A reported a major ice and hail storm in Spring 2021 that affected their training that semester only, and School F reported frequent issues due to unscheduled maintenance as a factor of delayed flight training in Summer 2021 and Fall 2021.

CHAPTER V

CONCLUSIONS

Introduction

The focus of Chapter V is to provide conclusions based on the data reported by Part 141 Flight Schools to see how much training was lost from their programs as a result of the COVID-19 pandemic. This data is based upon the voluntary answers of FAA Part 141 Collegiate Flight Programs located in the US that have a four-year bachelor's degree and operate their own fleet of aircraft. This self-reported research survey is important because the data captured in it is difficult to obtain by any other means. Self-reported research can obtain this hard-to-get data and help develop an accurate picture of events and responses to them (Turkkan, 2000). The benefit from this is that part 141 schools can understand where their production is currently at, devote resources where needed, and plan for the future/protect themselves from additional potential shutdowns.

Summary of Research

This study looked at the number of flight hours reported flown, student enrollment, student certificate completion rate, aircraft fleet size and aircraft fleet usage, over a nine-semester period. The nine-semester period was chosen to compare pre-COVID-19 metrics to post. The three 2019 pre-COVID-19 semesters were used for comparison to the final six semesters surveyed to see the effects of COVID-19 on flight training at the collegiate level. This research also sought mitigation measures take during the COVID-19 pandemic. Forty programs were initially contacted seeking their participation in this research as this is the population that met the study criteria. Ten of the 40 part

141 programs contacted responded, resulting in a 25 percent response rate. Two schools gave incomplete answers. The results of this survey were extremely one-sided as most schools did not report the lower numbers of flight hours, student enrollment and certificate completions that the researcher expected.

Research Question 1

Research Question 1 was to what extent did the global pandemic affect collegiate flight programs' flight training? The answer to this was that training was somewhat negatively affected for the approximate length of one semester, and then rebounded extremely fast to pre-COVID-19 rates or, in some cases, greater than pre-COVID-19 rates. This showed a resiliency not previously known about part 141 schools and the beginning of the US pilot training pipeline.

Flight Hours

The results to this research question were very different from what the researcher expected. Originally, it was thought that there would be a large decrease in the number of flight hours flown, due to the lockdowns all over the world in other sectors. This was not the case for collegiate flight schools. Multiple schools reported no loss of hours, and in some cases reported more hours flown than during their pre-COVID-19 2019 semesters. In most cases, the amount of training that was potentially lost was negligible, however this does not account for the quality of the training that was accomplished. In a few cases, training was not lost but gained.

Quantitative data was gathered on how many flight hours were flown by each part 141 school over the course of nine semesters for three years, 2019-2021. The data gathered showed that only one school reported a decrease in flight hours. With the exception of that one school, other schools that participated in this study reported that their hours flown in PPL courses were either the same as or greater than their hours flown before the onset of the COVID-19 pandemic. This means that, even with the lockdowns, flight schools managed to continue to fly while during the COVID-19 pandemic.

This was unanticipated, as it was not expected for the training pipeline to be able to adapt this quickly to a new type of training environment. The reason that this result was so unexpected was because the new operationally limited environment was borne out of the COVID-19 lockdowns in March 2020. These lockdowns were unprecedented, as their goal of flattening the curve of infection rates involved restricting *all* people to their homes and pausing normal human interactions (Onyeaka et al., 2021). It is not known at this time what the cause of the greater number of flight hours flown was due to. This could be due to students that did not complete their originally scheduled courses being held back and more students in PPL flight courses than normal, or due to more students applying and being admitted than the flight schools normally allow.

Student Enrollment

When answering the second question on the survey about student pilot enrollment, the same answer was received as the previous survey question. Again, only one school reported a decrease in student enrollment in their PPL program. The other schools equaled or exceeded their pre-COVID-19 enrollment numbers. This helps illustrate what the pipeline looked like during the onset of COVID-19 and the emergence of subsequent variants. Additionally, this helps to continue to demonstrate that the beginning of the US pilot training pipeline is adaptable when operationally limited environments occur. Again, the reason for the increases in enrollment is not known. It could be due to excess students in the pipeline from lockdowns still looking to complete their PPL flight courses or greater enrollment than normal.

Student Completions

The third survey question looked at what the PPL completion numbers were for all nine semesters. Yet again, the results added more evidence that the start of the pipeline fared well during the onset and continuance of the pandemic, with one notable exception. PPL completion numbers were the same or greater for all but 20 percent of the respondents, showing again that the pipeline was

adapting fairly quickly. However, this is lower than the student enrollment and hours numbers reported and does not match up perfectly. The conclusion can be drawn in some cases that, whereas flight hours weren't lost, it may have taken more flight hours than average to complete a PPL. This could signal a possible degradation in training that may need to be planned for. Only quantity of training was studied during this research, not quality, which may have been negatively impacted in some way. Worth mentioning again is that there may also have been some students left over from the normal PPL completion timeline due to the lockdowns. This possibility would also have led to a higher completion number than pre-COVID-19 semesters.

Aircraft Fleet Size

Looking at aircraft fleet size, this study aimed to see if schools decided to either cut down on the number of aircraft to help with the return to training, or if the number had to be reduced because there were not enough students to fly them. All schools operated the same number of aircraft throughout the nine surveyed semesters. There were no additions or subtractions to fleets either. This could signify that, even with a surge in students and flight hours, the current fleet size was sufficient to continue normal operations without any significant changes.

In-Person Instruction Dates

In investigating when in-person flight instruction ceased and resumed, there were a multitude of answers from part 141 schools. Two schools chose not to cease in-person instruction at all. All other schools cancelled their in-person instruction either in March or April of 2020, coinciding with the lockdowns. The latest return date was July of 2020. The average length of time that a Part 141 school shut down their in-person operations was two months. This could help explain why the flight hours reported by these part 141 schools were not decreased, as originally thought. The pipeline was extremely resilient in returning to work in-person.

Fleet Size and Utilization

Part 141 schools reported that the size of the fleets did not impede the return to in-person instruction. This means that even with mitigation measures in place, including the sanitization of aircraft, that there was not a detrimental effect on sortie generation. On the quantitative side of this data, part 141 schools reported numbers in line with the flight hours question. Ninety percent of the respondents utilized their fleets from 81 to 100 percent during the entire nine semesters. The conclusion can be drawn from this that fleets were utilized effectively, even with COVID-19 restrictions, to help flight programs continue training. Looking at when these part 141 schools returned to 100 percent aircraft fleet utilization, the earliest were the part 141 schools that did not shut down, and the latest was in Fall 2021. Conclusions can be drawn that fleet size did not play much of a factor in the return to in-person instruction, and that fleets were used much like they were pre-COVID. Maintenance was able to be maintained as well during this time period. Overall, these data points help display what is now emerging as a sign of the resiliency of the collegiate aviation industry that was not previously known.

Research Question 2

Research Question 2 was what measures did collegiate flight programs take to resume in-person training? Results from the research survey showed that part 141 schools used a multitude of different mitigation measures, throughout COVID-19, to resume and sustain operations in the operationally limited environment. These measures were not stagnant, but constantly evolving to fit the safety protocols in place at different schools, as well as to meet the goal of in-person flight training and certificate completion.

Aviation Professionals' Role

Five questions from the research survey focused on helping answer the second research question. The first question asked was, "Were any aviation professionals or faculty included in the decision making for COVID-19 mitigation measures?". One hundred percent of schools responded

with an affirmative “yes”. All of the responding part 141 schools’ utilized aviation professionals, in some capacity, to help craft mitigation plans for continued operations in the operationally limited environment that COVID-19 presented.

Mitigation Measures

To mitigate and combat the COVID-19 pandemic and to remain operable, a majority of part 141 schools mandated masks during training. However few schools did not mandate masks. According to the results of this study schools without a mask mandate were also the schools that reported growth during COVID-19. It is unknown at this time if their response and mitigation of COVID-19 led to program growth. Schools sanitized aircraft and/or simulators and in some cases elected to institute some sort of restricted entry point, screening process and social distancing measures. One school went as far as providing their eight-page guide to mitigation and return-to-work plan. This guide and the other responses, (some on a small scale, with others very large scale), show that mitigation measures in place were able to save at least some amount of training. Again, this only speaks to the quantity of training, not the quality. It cannot be determined that, even with the mitigation measures in place during in-person instruction, that the instruction was as effective as it was pre-COVID, only that training did occur.

A minority of schools altered their dispatch procedures to help alleviate crowding during dispatch and possible transfer of COVID-19. It is unknown what this did to the flow of the operations, but in terms of limiting contact in the flight environment it succeeded. One school implemented a phase-in strategy to return to in-person instruction. Other schools did not report their flight hours, but had steady student enrollment and certificate completion rates, meaning that possibly their strategy allowed them to at least not lose enrollment or certificate completion. Overall, every institution handled the new operationally limited environment in a different way. From the metrics

given, it seems that the part 141 schools that managed to do the best were the ones with the least amount of mitigation or the simplest mitigation plan.

Most Effective Mitigation Measures

When asked which mitigation measure were the most effective, schools reported some similar responses. The majority of respondents reported that no one measure seemed to be better suited to overcome constraints than any other; quarantines, return to work plans, culture changes or sanitization guidelines made the difference in the long run. No school reported the vaccine as the most effective measure. One school believed that their sanitization helped them return to instruction quicker. The same school also believed that they believe their sanitization aided in not having any increase in the virus spreading and actually in increasing their operational tempo. This remark aligns with their reported figures for flight hours. According to these results, it can be inferred that sanitization plans were a positive factor in keeping students flying and could possibly be beneficial if replicated at other part 141 schools. Comparison of participants responses to flight hours show that the school that claimed their culture change was the defining factor, lost the greatest number of hours flown of all of the schools. The same school also did not return to their 2019 numbers as soon as the other participants, it took much longer.

The last response was from School A which reported the largest drop in hours during any of the nine semesters surveyed, but was back to 2019 pre-COVID-19 numbers during their final four semesters. It could be concluded that this measure may not have been as effective in the short-term, but long term, it is worth noting that School A altered their plan drastically after only a semester and had positive results. School A discontinued the use of all masks and gloves in cockpits after only a semester due to their perceived uselessness, and discomfort in un-airconditioned aircraft. This removal of mitigation measures led to a self-reported decrease in infections, including during the spread of additional variants. It could be assumed as a result of this study that less restrictive

measures were the most effective at reestablishing and sustaining operations in this schools new operationally limited environment.

Personal Narratives

Part 141 schools had the chance to add personal comments about their mitigation measures to capture any additional data that was not asked in the previous questions. Responses varied. Schools that made their own return-to-work plans, and had them evolve as the virus ran its course, seemed to really believe that these plans were a driving factor in keeping their training pipelines open. Signs of mental fatigue can be seen in some responses from schools. This is interesting because this study did not look at what sustained operations in an operationally limited environment would do to the pilots themselves and seems to have arisen as a data point. This would be worth further study. Overall, those schools that answered this question seemed to use their answer to justify other answers, such as mitigation measures taken, from earlier questions.

Non-COVID-19 Related Factors

In an attempt to explain any loss of flight hours that was not due to COVID-19, schools had the option to bring attention any non-COVID-19 related factors that may have impacted their number of flight hours flown. The only things reported were a major hail storm and an increase in normal maintenance issues. Both of these issues would have affected flight hours for the schools reporting them. When compared with the flight hours flown and the fleet utilization, it can help explain the loss of some of the training or fleet utilization during certain time periods in the survey. Eighty percent of part 141 schools did not report any non-COVID related factors affecting training. This helps establish the that the hours reported by the 80 percent were only majorly affected by COVID-19, and shows what that did to the beginning of the pipeline.

Research Question 3

Research Question 3 asked how effective were those mitigation measures in resuming student flight hours? All mitigation measures showed some sort of effectiveness, as evidenced by the return to pre-COVID-19 numbers, leading the conclusion of the third research question to be that the simplest and least restrictive measures were the most effective in a shorter time span. Schools with more complex plans either posted an initial decrease in hours or were able to continue operations to their normal levels, albeit with a much greater effort and use of resources. The more complex plans, in some cases, included additional staffing requirements and the use of physical barriers to help protect personnel, but did not discuss plans for implementation, just their use. This would have disrupted any normal operations flow personnel were used to, possibly leading to lost training as procedures were rebuilt to accommodate complex plans. Some measures, such as not shutting down and repeated sanitization of aircraft and simulators, were more effective than others. There were some schools that had extremely simple plans to mitigate the effects of the pandemic. These schools showed a tendency to not only continue to fly their 2019 pre-COVID-19 hours, but in some cases to exceed them. More complex and detailed plans led to a lower effectiveness in the short term but worked in the long term.

Conclusions

The goal of this study was to define how consecutive years of sustained operations during a pandemic affected the collegiate flight training pipeline. An initial thought before conducting this research was that collegiate flight training followed suite to the rest of the world and economy, and hours flown, student enrollment, and certification completion was negatively affected. This study revealed the resilience of the US pilot training pipeline because the results showed it was not negatively affected overall. Only 10 percent of schools showed any loss of flight time and only 10 percent showed any decrease in student enrollment. All of these decreases were made up within one

to two semesters time and all schools were at or above their pre-COVID-19 numbers by the beginning of the 2021 calendar year.

When examining fleet size as a factor in training, results revealed it did not hinder returning to in-person instruction. Only 20 percent of schools responded that they encountered a decline in fleet usage, (during the Spring 2020 and Summer 2020 semesters), and one of those schools reported non-COVID factors as their reason for a decline in fleet utilization. The other school had a complex return-to-work plan that, while effective, hindered their ability to fully utilize their fleet for two semesters.

According to the results from this study, schools that were less restrictive accomplished more training in flight hours flown, as well as in student completions. In addition to production, it is interesting to note that the less restrictive part 141 schools reported less infections and spread of the virus. It is important to note that 90 percent of schools reported sanitization measures, with only one school showing a loss of flight training. The sanitization measures, (which were used by both schools that showed program growth), made a positive impact in the return to in-person instruction and sustained operations during the operationally limited environment.

Looking at the beginning of the US pilot training pipeline during COVID-19, the earliest stage of the pipeline has shown the ability to adapt and overcome major world events in the emergence of long term operationally limited environments. The pipeline has never been tested like this over its development and sustainment. This was unanticipated. The beginning of the pipeline has also demonstrated the ability for growth during the shock that the new environment presented faculty and students. In the opinion of the author this resiliency is commendable.

Summary

The COVID-19 pandemic had great effect on the amount of effort FAA Part 141 schools had to expend to continue training. There were three emerging themes that took shape from sustained

operations during the pandemic. These themes were that of perseverance, evolving mitigation/experiential learning at a flight school wide level, and frustration. Part 141 schools spent time and resources crafting and executing plans for COVID-19 mitigation. These plans ranged from simply sanitizing highly touched surfaces like aircraft and simulators and wearing personal protective equipment, to highly detailed plans with adaptive measures depending on the health state of the student population. As the pandemic went on, these schools learned from their experiences throughout the nine surveyed semesters about how their plans worked or hindered them. There was no consensus on which mitigation measure was the most effective overall. No mention was ever made of the vaccine making any difference, which was surprising to the researcher. What was found was that the simplest plans seemed to make the most difference in the ability to return-to-work. Schools with more complex plans seemed to post an initial loss of flight hours and took longer to recover to a normal operations tempo. When reported complex plans were altered to simpler in execution, flight hours and training numbers returned to baseline numbers. However, it needs to be noted that the length of time that these Part 141 schools operated in their new environments, (from the collected qualitative data), seemed to take a mental toll on the faculty. Frustration was evident in some of the responses, especially those dealing with COVID-19 mitigation measures.

Overall, the training looks to have progressed at a mostly normal rate in the short and long term, with the only drop-in hours in 10 percent of the schools occurring for two semesters at most. Twenty percent of schools showed program growth, (in both flight hours and student enrollment), after the initial onset of COVID-19 and have continued to operate at this heightened level through the end of the survey period. It was found that schools' aircraft fleets were not a limiting factor in returning to normal operations tempo, with only 10 percent of respondents reporting any drop in fleet capacity due to COVID-19 during the entire nine semesters surveyed. COVID-19 had much less of a negative effect on the beginning of the US pilot training pipeline than was initially thought. In some cases, because of the ingenuity and perseverance of students and faculty, the beginning of the pipeline

not only survived, but flourished. In the event another operationally limited environment arises in the future, these lessons learned need to be heeded to keep the pipeline open and to keep new aviators in the air, continuing to build airmanship and not let their skills degrade.

Recommendations

Based on the findings and conclusions of the study, the researcher offers the following recommendations.

Recommendation 1: Collegiate flight Part 141 schools should be prepared for possible growth in their primary flight courses. Even in the face of massive layoffs and furloughs in the aviation industry, students continued their primary flight courses, and in some cases, more students enrolled in the primary flight courses. Resources need to be looked at, (as economically and institutionally feasible as possible), for accommodating this possible growth including aircraft, simulators, instructors, and airspace available. VR would be worth looking into as a cheaper simulator alternative to help with growth.

Recommendation 2: The goal of this research project was to provide a detailed flexible off-the-shelf plan for the emergence of another operationally limited environment. Upon the analysis of the data, the simplest plan and execution was found to be the best option for continuing training. The following is recommended as an off-the-shelf flexible plan for sustained operations.

1. For operating in an environment with a transmissible virus, such as COVID-19, plans need to be kept simple. Mitigation for the virus could include more social distancing or use of personal protective equipment. To help keep these plans simple, new technology should be leveraged and built into existing programs' infrastructure. EFBs should be required of each student. This is not only to give students experience with them before use in the airlines, but provides a way to send schedules, deconflict takeoff times, and possibly dispatch aircraft, leading to less use of resources to fortify

dispatch areas against sickness. This leads to less sanitation needed if everyone uses their own equipment. Additionally, this provides a platform for controlled entry screening if desired.

2. In terms of instruction, if in-person courses need to be paused for a time, current online learning infrastructure should be used for non-flying. If distance learning is not currently available for online aviation courses, research on possible implementation is recommended. This will allow students to continue to progress in their non-flying coursework and be ready to fly as soon as the option presents itself, thus keeping the return-to-work timeline short. Additionally, this will allow flight briefs and debriefs socially distanced if desired. The EFB would be an ideal platform to perform this. If further program growth is desired or required, the online option would provide an ideal launch platform.

3. If students or faculty are sick, they should refrain from attending in-person instruction, either in the classroom or aircraft/simulator. The structure of how faculty and students are organized needs to be addressed. Instructors and students should be grouped together in groups of a 3:1 student to instructor ratio, with three instructors per group. This would help mitigate any social distancing concerns if one person in a group gets sick and a quarantine period is needed, while leveraging instructor continuity with the ability to quickly disseminate pertinent information.

4. Takeoff times should be staggered to help alleviate congestion in small areas and the ramp and airspace.

5. A sanitization option for post-flight operations should be implemented, with care to make sure that the sanitization is not harming the aircraft.

6. Lessons learned from COVID-19 and any further experiences should be shared by *all* Part 141 flight schools. Whether or not the protective measures are implemented by all schools is irrelevant. The lessons learned should be passed to help the population progress and continue training. This will help the population keep better situational awareness and potentially mitigate any major

safety or operational issues that may arise as operationally limited environments evolve, and schools adapt to continue sustained operations.

Recommendation 3: This research presented the researcher with the answers sought by the research questions, but also presented several additional areas of research that were not apparent until after the data was analyzed. The research may provide a launching platform to study other parts of the pipeline and alternative methods of flight school operations and primary flight training.

Recommendations for Further Research

1. A study needs to be done on COVID-19's effect on all stages of the pilot training pipeline. Whereas the pipeline grew in its initial phases, a significant pilot shortage still exists. Research needs to be done to determine where new pilot's drop out of the training pipeline before they make it to the regional or major airlines. This research could help determine not only the overall effect of operationally limited environments on flight training at all levels but help forecast the ripple effects the environments have on the pipeline as a whole and where to flex resources and additional help to retain pilots to finish their training.

2. Military and non-collegiate programs should be studied to see a more complete picture of what COVID-19 did to the US pilot training pipeline. This would allow for better forecasting for pilot production and a clearer understanding of the ripple effects heading through the pipeline right now.

3. A study should be commissioned to determine the effectiveness or quality of the training that was achieved during the operationally limited environment. This could be looked at through the lens of how many additional rides students needed to complete training over the average number needed, or how many students failed checkrides. This study could show that, whereas the number of hours flown ended up being a normal or greater amount, the flight training itself was not as effective as the flight training done pre-COVID-19. This information would be beneficial for planning for the ramp-up of operations after a pause.

4. A look at safety incident rates needs to be done. With a pause in operations, and a with flying being a perishable skillset, potential safety incidents could have arisen. Such a study could help determine a predictive model for equipment failures or poor decision making. The results of this research could help formulate maintenance plans as well as timely safety briefs or special interest items for aircrew to review before returning to operations or, as operations ramp-up again to a normal tempo, leading to an overall safer flight environment.

5. Further research is needed on sanitizing solutions and their effect on aircraft equipment. Research should be conducted on what different sanitizing solutions do to the aircraft instruments in the cockpit as well as research into high sanitization rates and their effect as well. Research could determine that there are more caustic solutions or higher rates that lead to early replacement of instruments and what resource planning would need to take place to keep aircraft flying.

6. Further study is recommended on the mental side to see what the effects of long-term operations in operationally limited environments. Some fatigue was evident in the responses from certain part 141 schools and needs to be researched to see what happens during sustained operations in an operationally limited environment

REFERENCES

Allen, R. T. (2008). Study of flight school pilot incident data: Implication for educators. *Collegiate Aviation Review*, 26(2), 91–. https://doi.org/10.22488/okstate.18.100381

APA Dictionary of Psychology. (2022). American Psychological Association. https://dictionary.apa.org/descriptive-statistics

Babb, T. A. (2014). The prevalence and limitations of electronic charts in university flight training. *Collegiate Aviation Review*, 32(2), 14–. https://doi.org/10.22488/okstate.18.100453

Babb, T. A. (2017). Electronic flight bag policies at collegiate aviation programs. *International Journal of Aviation, Aeronautics, and Aerospace*, 4(4), 8–.

Boeing. (2020). *Pilot and Technician Outlook 2020-2039*. Boeing. https://www.boeing.com/resources/boeingdotcom/market/assets/downloads/2020_PTO_PDF_Download.pdf

Caraway, C. L. (2020). A looming pilot shortage: It is time to revisit regulations. *International Journal of Aviation, Aeronautics, and Aerospace*, *7*(2), 3–. https://doi.org/10.15394/ijaaa.2020.1470

Casebolt, M. K., Bliss, T. J., & Depperschmidt, C. L. (2017). The impact of public law 111-216: Perceptions of U.S. collegiate flight students. *Collegiate Aviation Review*, 35(1). https://doi.org/10.22488/okstate.18.100474

Dattel, A., Suppiah, S., Liu, D., Lee, S. & Vincenzi, D. (2020). Impact of electronic flight bag (EFB) on single pilot performance and workload. *International Journal of Aviation, Aeronautics, and Aerospace*, 7(4), 4–.

Depperschmidt, C. L. (2013). Public law 111-216: Effects of new legislation on collegiate aviation flight training programs. *Collegiate Aviation Review*, 31(1), 1–. https://doi.org/10.22488/okstate.18.100434

Doskow, M. G. (2012). Analysis of the impact of scenario-based training on the aeronautical decision making of collegiate flight students. ProQuest Dissertations Publishing.

Federal Aviation Administration. (2020). *Pilot Training: ATP Certificate*. https://www.faa.gov/pilots/training/atp/

Federal Aviation Administration. (2021) *Federal Aviation Administration - Pilot Schools*. Retrieved December 20, 2021, from https://av-info.faa.gov/PilotSchool.asp

Fussell, S. G. & Truong, D. (2020). Preliminary results of a study investigating aviation student's intentions to use virtual reality for flight training. *International Journal of Aviation, Aeronautics, and Aerospace*, 7(3), 2–.

Goff, E. M. (2013). *Effects of instructor continuity on a large-scale pilot training program*. ProQuest Dissertation Publishing.

Hesse-Biber, S. (2010). *Mixed-methods research: Merging theory with practice*. Guilford Press.

Ito, H., & Lee, D. (2005). Assessing the impact of the september 11 terrorist attacks on U.S. airline demand. *Journal of Economics and Business*, 57(1), 75–95. https://doi.org/10.1016/j.jeconbus.2004.06.003

Kanske, C. A., & Brewster, L. T. (2001). The learning styles of college aviation students. *Collegiate Aviation Review*, 19(1), 62–. https://doi.org/10.22488/okstate.18.100298

Karp, M. R. (1996). Theoretical aviation training for future airline pilots: A look to the future. ProQuest Dissertations Publishing.

Karp, M. R. (2000). University aviation education: An integrated model. *Collegiate Aviation Review*, 18(1), 1–.

Klapper E. S., & Ruff-Stahl, H. K.. (2019). Effects of the pilot shortage on the regional airline industry: A 2023 forecast. *International Journal of Aviation, Aeronautics, and Aerospace*, 6(3), 2–. https://doi.org/10.15394/ijaaa.2019.1321

Kolb, D. (1984). Experiential Learning: Experience As The Source Of Learning And Development.

Lawrynczyk, A. (2018). *Exploring virtual reality flight training as a viable alternative to traditional simulator flight training*. [Master's thesis, Carleton University]. Carleton University Research Virtual Environment.

Lester, J. N. Cho, Y., & Lochmiller, C. R. (2020). Learning to do qualitative data analysis: A starting point. *Human Resource Development Review*, 19(1), 94–106. https://doi.org/10.1177/1534484320903890

Lewis-Beck, B. A., & Liao, T. F. (2004). *The Sage encyclopedia of social science research methods*. SAGE

Lutte, R., Higgins, J., Lovelace, K., Bjerke, E., Lounsberry, N., Friedenzohn, D., Pavel, S., Chase, B. & Craig, P. (2014). An investigation of the united states airline pilot labor supply. *Journal of Air Transport Studies*. 5. 53.10.38008/jats.v5i2.68.

Murray, G. (2021). *After Covid-19, Aviation Faces a Pilot Shortage*. Oliver Wyman. Retrieved June 22, 2021, from https://www.oliverwyman.com/our-expertise/insights/2021/mar/after-covid-19-aviation-faces-a-pilot-shortage.html#:%7E:text=In%20a%202019%20Oliver%20Wyman,pilots%20as%20a%20key%20risk.&text=Nearly%20overnight%2C%20with%20the%20outbreak,has%20provided%20a%20momentary%20reprieve.

Onyeaka, H., Anumudu, C. K., Al-Sharify, Z. T., Egele-Godswill, E., Mbaegbu, P. (2021). COVID-19 pandemic: A review of the global lockdown and its far-reaching effects. *Science Progress*, 104(2). https:doi.org/10.1177/00368504211019854

Prather, C. D. (2007). Distance learning in collegiate aviation: A survey of the historical, theoretical, and contemporary aspects. *Journal of Aviation/Aerospace Education and Research*, 17(1). https://doi.org/10.15394/jaaer.2007.1435

Robertson, C. L. (2005). Development and transfer of higher order thinking skills in pilots. ProQuest Dissertations Publishing.

Stalnaker, T., & Usman, K. (2021). *Airline Economic Analysis 2020 - 2021*. Oliver Wyman. Retrieved June 22, 2021, from https://www.oliverwyman.com/our-expertise/insights/2021/mar/airline-economic-analysis-2020-2021.html

Stark, L., Hosford, M., & Barrett, K. (2008, June 5). *Layoffs Continue for Airlines in Crisis*. ABC News. https://abcnews.go.com/Business/BusinessTravel/story?id=5004322&page=1

Statista. (2020, August 26). *Thousands Of U.S. Pilots Face Furloughs This Fall*. Statista Infographics. https://www.statista.com/chart/22690/us-pilot-furloughs-due-to-covid/

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. American Journal of Evaluation, 27(2), 237–246. https://doi.org/10.1177/1098214005283748

Turkkan, J. S. (2000). General Issues in Self-Report. In Stone, A. A., Turkkan, J. S., Bachrach, C. A., Jobe, J. B., Kurtzman, H. S., and Cain, V. S. (Eds.), *The Science of self-report: Implications for research and practice* (pp. 3-7). Taylor and Francis.

United States. Federal Aviation Administration. (1991). *Advisory Circular: Aeronautical Decision Making*. U.S. Dept. of Transportation, Federal Aviation Administration.

United States. Federal Aviation Administration. (2007). *FITS Generic Private pilot ASEL Syllabus*. U.S. Dept. of Transportation, Federal Aviation Administration.

United States. Federal Aviation Administration. (2021). *Federal Aviation Regulations/Aeronautical Information Manual*. U.S. Dept. of Transportation, Federal Aviation Administration.

Weiss, N. (2016). *Introduction to Statistics* (10th ed.). Pearson

APPENDICES

Appendice A

Research Questionnaire

The Effects of Operationally Limited Training Environments on Primary Flight Training at the Collegiate Level

In March 2020, the SARS-CoV-2 (COVID-19) virus was declared a global pandemic. Countries were forced to issue strict lockdowns to attempt to control the spread of the virus. The effect of this on aviation training was unprecedented. In-person flight instruction at collegiate institutions ceased for a period and then slowly returned. As students and instructors returned to fly, different had different mitigation measures they implemented and then adapted for the ever changing conditions that COVID-19 present the industry with.

I. Student Load

1. What was the total number of hours flown (by semester) by students in a Private Pilot's License program for the following semesters? (Spring 2019-Fall 2021)

- Spring 2019

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Summer 2019

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Fall 2019

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Spring 2020

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Summer 2020

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Fall 2020

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Spring 2021

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Summer 2021

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

- Fall 2021

[ ] 0-200 [ ] 201-400 [ ] 410-600 [ ] 601-800 [ ] 801-1000

[ ] 1001-1200 [ ] 1201-1400 [ ] over 1400+

2. What was total student enrollment in the Private Pilot's License program (by semester) for the following semesters? (Spring 2019-Fall 2021)

- Spring 2019

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Summer 2019

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Fall 2019

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Spring 2020

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Summer 2020

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Fall 2020

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Spring 2021

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Summer 2021

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Fall 2021

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

3. How many students (by semester) finished a Private Pilot's License during the following semesters? (Spring 2019-Fall 2021)

- Spring 2019

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Summer 2019

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Fall 2019

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Spring 2020

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Summer 2020

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Fall 2020

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Spring 2021

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Summer 2021

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

- Fall 2021

[ ] 0-25 [ ] 26-50 [ ] 51-75 [ ] 76-100
[ ] 101-125 [ ] 126-150 [ ] 151-175 [ ] 176-200 [ ] over 200+

II. Fleet Usage

4. How many aircraft were in the institution's fleet during the following semesters (Spring 2019 to Fall 2021)?

- Spring 2019

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Summer 2019

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Fall 2019

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Spring 2020

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Summer 2020

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Fall 2020

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Spring 2021

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Summer 2021

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

- Fall 2021

[ ] 1-10[ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] over 50+

5. On what dates did in-person flight instruction cease and resume during COVID-19 for the following period? (Spring 2019-Fall 2021)

6. Did the size of the institution's fleet impede the return to in-person flight instruction?

Yes [ ] No [ ]

7. At what aircraft fleet capacity (by semester) did the institution utilize the fleet when in-person flight instruction resumed? (Spring 2019-Fall 2021)

- Spring 2019

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Summer 2019

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Fall 2019

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Spring 2020

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Summer 2020

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Fall 2020

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Spring 2021

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Summer 2021

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

- Fall 2021

[ ] 0%-20% [ ] 21%-40% [ ] 41%-60% [ ] 61%-80% [ ] 81%-100%

8. During what semester did the institution return to 100 percent fleet utilization?

III. Mitigation Measures

9. What COVID-19 mitigation measures were taken by the institution during the following semesters? (Spring 2019-Fall 2021)

10. Were any aviation professionals or faculty included in the decision making for COVID-19 mitigation measures?

Yes [ ] No [ ]

11. What proved to be the most effective mitigation measure to help students return to in-person flight instruction?

12. Personal comments on mitigation measures taken to get student pilots back into the cockpit with an instructor.

13. Were there any non-COVID related factors that impacted flight operations from the Spring 2019 semester to Fall 2021?

[ ] Yes [ ] No

If yes, what?

Appendice B

Research Email

Dear Chief Flight Instructor:

I am conducting a national research study designed to examine the effects of the COVID-19 pandemic on the US pilot training pipeline at the collegiate level. The purpose of this research is to investigate what the effects of the worldwide pandemic has been on student flight hours logged, student enrollment, graduation rates and aircraft fleet usage. The result will be a look at the state of the pipeline and a flexible off-the-shelf plan that could be used in similar situations to continue training. The participants for this research study will consist of Chief Flight Instructors at US collegiate aviation Part 141 schools that offer a 4-year degree. The participants will complete a brief ten minute online research instrument through Qualtrics The Effects of Operationally Limited Environments on Primary Flight Training at the Collegiate Level (attached for your review). The information given by participants is confidential. If you are willing to participate in this study, please fill out the survey. If another individual at your institution is better suited to complete this survey, please forward this email to that individual.

Your willingness to participate and support this research study is greatly appreciated.

Oklahoma State University, Office of University Research Compliance, has approved this research study (IRB Protocol:IRB-22-16).

I sincerely request your participation in this national research study.

If you have question or concerns, please do not hesitate to contact me.

Respectfully,

Kevin M. Bursaw

Doctoral Candidate
Oklahoma State University
317-509-9696

Appendice C

Consent Form

Department of Educational Foundations, Leadership, and Aviation

CONSENT FORM

The Effects of Operationally Limited Environments on Primary Flight Training at the Collegiate Level

Key Information

Study Purpose: To study of effects of COVID-19 on the US pilot training pipeline at the collegiate level

Major Procedures of the Study: Survey of flight hours, enrollment, certificate completion and aircraft fleet usage as well as COVID mitigation measures used to return to in person flight instruction.

Duration of Participation: 10 min

Significant Risks: Minor Risks

Potential Benefits: View of US pilot production and creation of off-the-shelf plan for sustained operations during operationally limited environments in the future.

Compensation: None

Background Information

You are invited to be in a research study of the effects of COVID-19 on the US pilot training pipeline at the collegiate level. You were selected as a possible participant because you are an FAA certified Part 141 flight school that offers a four-year degree. We ask that you read this form and ask any questions you may have before agreeing to be in the study. Your participation is entirely voluntary.

This study is being conducted by: Kevin Bursaw, Department of Educational Foundations, Leadership and Aviation, Oklahoma State University, under the direction of Dr. Mallory Casebolt, Department of Educational Foundations, Leadership and Aviation, Oklahoma State University.

Procedures

If you agree to be in this study, we would ask you to do the following things: Please fill out a 10 minute survey on your flight hours flown, student enrollment, certificate completion and aircraft fleet usage, as well as any COVID mitigation used to return to in person flight instruction. This is a 13-question anonymous survey asking only for metrics from the university flight program.

Participation in the study involves the following time commitment: 10 minutes to fill out the survey.

Risks and Benefits of being in the Study

The study involves the following foreseeable risks: Possible risks associated with participation are a minor risk of reputation of the university. In order to assist with the offset of these risks, the survey will be anonymous, and no university will be identified. Pseudonyms will be used in the dissertation when referring to a program. No table will exist of the participants with their answers.

The benefits to participation are: The benefits which may reasonably be expected to result from this study are the creation of a flexible off-the-shelf plan for sustained operations in the event of another pandemic or other operationally limited environment. In addition to this, the study will aid in resource planning for future pilot classes. We cannot guarantee or promise that you will receive any benefits from this study.

There is a potential risk of breach of confidentiality which is minimized by the use of an anonymous survey.

Compensation

You will receive no payment for participating in this study.

Confidentiality

The information your give in the study will be stored anonymously. This means that your name will not be collected or linked to the data in any way. Only the researchers will know that you have participated in the study. The researchers will not be able to remove your data from the dataset once your participation is complete. The information that you give in the study will be handled confidentially. Your information will be assigned a pseudonym. When the study is completed and the data have been analyzed, the participant list will be destroyed. Your name will not be used in any report

We will collect your information through Qualtrics. This data will be stored on a password protected computer and/or encrypted on Oklahoma State's Microsoft OneDrive. When the study is completed and the data have been analyzed, the list of participants will be destroyed. This is expected to occur no later than August 2022. This informed consent form will be kept for three years after the study is complete, and then it will be destroyed. Your data collected as part of this research project, will not be used or distributed for future research studies.

The research team works to ensure confidentiality to the degree permitted by technology. It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. However, your participation in this online survey involves risks similar to a person's everyday use of the internet. If you have concerns, you should consult the survey provider privacy policy at https://www.qualtrics.com/privacy-statement/.

It is unlikely, but possible, that others responsible for research oversight may require us to share the information you give us from the study to ensure that the research was conducted safely and appropriately. We will only share your information if law or policy requires us to do so.

Voluntary Nature of the Study

Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time. The alternative is to not participate. You can skip any questions that make you uncomfortable and can stop the interview/survey at any time. Your decision whether or not to participate in this study will not affect your anything but the final results of the survey.

Contacts and Questions

The Institutional Review Board (IRB) for the protection of human research participants at Oklahoma State University has reviewed and approved this study. If you have questions about the research study itself, please contact the Principal Investigator at Kevin Bursaw, kevin.bursaw@okstate.edu. If you have questions about your rights as a research volunteer or would simply like to speak with someone other than the research team about concerns regarding this study, please contact the IRB at (405) 744-3377 or irb@okstate.edu. All reports or correspondence will be kept confidential.

You will be given a copy of this information to keep for your records.

Statement of Consent

I have read the above information. I have had the opportunity to ask questions and have my questions answered. I consent to participate in the study.

If you agree to participate in this research, please click the button labeled "I consent to continue".

Appendice D

IRB Approval

Oklahoma State University Institutional Review Board

Date:	01/11/2022
Application Number:	IRB-22-16
Proposal Title:	The Effects of Operationally Limited Environments on Primary Flight Training at the Collegiate Level
Principal Investigator:	Kevin Bursaw
Co-Investigator(s):	
Faculty Adviser:	Mallory Casebolt
Project Coordinator:	
Research Assistant(s):	
Processed as:	Exempt
Exempt Category:	

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,

Oklahoma State University IRB

VITA

Kevin Michael Bursaw

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECTS OF OPERATIONALLY LIMITED ENVIRONMENTS ON PRIMARY FLIGHT TRAINING AT THE COLLEGIATE LEVEL

Major Field: Applied Educational Studies

Biographical:

Education:

Completed the requirements for the Doctor of Education in your Applied Educational Studies at Oklahoma State University, Stillwater, Oklahoma in July, 2022.

Completed the requirements for the Master of Business Administration at University of Miami, Coral Gables, Florida in 2020.

Completed the requirements for the Bachelor of Science in your Professional Flight Technology at Purdue University, West Lafayette, Indiana in 2013.

Experience:

Captain United States Air Force
Euro-NATO Joint Jet Pilot Training T-6A Instructor Pilot
KC-10A Aircraft Commander with 5 combat deployments
2,000+ Total Time, 110 combat missions
Commercial Pilot with Instrument, Multi-Engine
KC-10A Assistant Chief of Tactics /Instructor
Mobility Electronic Combat Officer Qualified
KC-10A Chief of Scheduling
Assistant Director of Operations 908 Expeditionary Air Refueling Squadron
T-6A Flight Commander and Innovation Team Lead