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Collegiate Training Initiative - Training Methods as a Predictor to Success

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COLLEGIATE TRAINING INITIATIVE – TRAINING METHODS AS A PREDICTOR TO SUCCESS

by

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DISCLAIMER

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This thesis, submitted by Stephen M. Robello is in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

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This thesis is being submitted by the appointed advisory committee as having met all the requirements of the Graduate School at the University of North Dakota and is hereby approved.

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Stephen M. Robello
April 20, 2017

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ABSTRACT

This research project studied the tools and requirements of the Air Traffic – Collegiate Training Initiative (AT-CTI) schools and how they affect the outcome of training at the FAA Academy, the first assigned facility and second facility prior to certification. The Air Traffic Collegiate Training Initiative (AT-CTI) has been in place for over 25 years, training college students to get a recommendation to apply for a Federal Air Traffic Controller career. From 2014-2016, the hiring practices changed from a three-track method to a two-track method which took away the AT-CTI hiring path and combined it with applicants who had no experience. The AT-CTI graduates are hired with only a small advantage over those who apply under a general public vacancy, who have no knowledge of air traffic control procedures. A successful AT-CTI program will provide a higher level of success and cost savings to the FAA/taxpayers.

This study surveyed participants who attended CTI schools and how the training they received affected their training success at the FAA Academy, first facility, and second facility. The variables which were studied included, the type of courses, labs, training tools, pilot certificates, and instrument ratings. Using binary logistic regression and chi square tests, measures of significance were identified at each stage of training to determine the best methods of instruction/tools that CTI schools should be using to ensure their graduates future success.

Applicants that have had tower courses, tower labs and tower simulation tended to have more success at the FAA Academy. Those applicants with flight training also had more success with training; they were 8.7 times more likely to be successful at the FAA Academy. Statistical testing showed no significance was found in any other phase of

training; however, the results do indicate interesting changes from one stage to another. If the FAA would be able to better leverage the CTI program to predict if an applicant will be successful based on the training they received, the FAA could see a cost savings.

CHAPTER I

INTRODUCTION

The Federal Aviation Administration (FAA) is continually modifying how they hire air traffic control specialists based on the evaluation and analysis of current and past data. Due to the stressful and lengthy nature of training, the FAA has in place for air traffic control specialists, an order of priorities to ensure the highest rate of success followed by diversity in the workforce. In 1988, two studies were completed to review the training of Air Traffic Control Specialists (Means et al., 1988; Northern NEF, Inc., 1988). Both studies recommended the FAA explore "nonfederal, post-secondary institutions (i.e., two- and four-year colleges and universities) to develop and test academic programs for training fundamental skills and knowledges related to air traffic control (ATC)." (Means et al., 1988; Northern NEF, Inc., 1988). These studies initiated the development and implementation of the collegiate training initiative (CTI).

To be an FAA approved CTI Institution, schools must apply when the Federal Aviation Administration (FAA) makes a vacancy announcement out. The collegiate training initiative has initial guidelines and qualifications that each school must meet in their application, but there still exists diverse methods in which each school utilizes. Upon graduation from college, CTI students are grouped along with applicants who have no aviation knowledge or air traffic experience.

Currently, there are two avenues in the controller hiring process: prior air traffic control specialist (ATCS) experience (those individuals who have at least 52 weeks of certified air traffic control experience) and no prior ATCS experience (those individuals who are not required to have prior air traffic control experience.) (FAA, 2016) Prior to

2014, there were three avenues of hiring to become an air traffic controller: 1) military controlling experience, 2) CTI graduate from an FAA approved CTI School, and 3) no prior experience. The reason for the change from three hiring paths to two hiring paths as stated, "The Federal Aviation Administration says it changed the process and added a personality test, called the Biographical Questionnaire, as the initial screening in the hiring process, in order to get the best possible job candidates." (Ruud, 2016) The CTI program gives no advantage for paying to attend CTI school to gain valuable air traffic control (ATC) knowledge prior to entering the Federal Aviation Administration (FAA). The biographical questionnaire groups all applicants into the same pool, and the FAA is seeing an increase in candidates with no experience passing the biographical questionnaire than those with experience.

In the literature review, the history and process of hiring will be examined, as well as how having a pilot certificate benefits a trainee, and past studies on training at FAA Academy versus direct-to-facility hires. The different types of training provided is a valuable resource the FAA should use to their advantage to leverage strong, knowledgeable controllers who will in turn be cost effective to the agency.

Purpose of the Study

The purpose of this study was to determine the validity of the CTI program and training methods deployed in the different CTI programs. This paper explored how the different types and requirements of training provided at CTI approved schools differs in the outcome of training at the FAA Academy and in the field. The importance of this study is to show how valuable the CTI program is, and how the program can be used to the FAA's advantage in numerous ways. The research can show differences in training

tools/methods provided to create competition among CTI schools to show that their graduates achieve the most successful pass rate with minimal amount of training time to possibly ascertain direct to facility hire under a new and improved CTI qualification program.

Research Questions

Do the success rates at the FAA Academy, First Facility, and Second Facility, differ between participants who:

1. Completed a class on tower, radar or non-radar procedures?
2. Completed a lab for tower, radar, or non-radar?
3. Utilized a Projector Tower Simulation, Table Top (with Model Airplanes), Desktop Computer Simulator, or Strip Boards (non-radar)?
4. Earned a pilot certificate?
5. Earned an Instrument Rating?

Literature Review

The Air Traffic Collegiate Training Initiative (AT-CTI) has been around for more than 25 years, yet the program itself has had little change in the way it regulates what is taught above the minimum requirement, devices and methods used to teach, and how the FAA hires from within the Collegiate Training Initiative (CTI) pool of applicants. The FAA estimates the number of controllers that will be lost (defined in Table 1) between 2016 and 2025 is 11,943 which is according to the controller workforce plan (FAA, 2016). Because the number of estimated controllers needed in the next nine years, a method needs to be put in place to reestablish the CTI program as a hiring path.

However, first a review of the CTI program is needed to see where the program started and where it is today in order to make recommendations for continued success.

Figure 1. Controller Loss Summary

(Federal Aviation Administration, 2016a)

LOSS CATEGORY	LOSSES: 2016 - 2025
Retirements	4,050
Resignations, Removals and Deaths	493
Developmental Attrition	1,590
Academy Attrition	3,101
Promotions/Transfers	2,709
TOTAL	**11,943**

History of the ATC Hiring Process

Prior to 1964 an air traffic control applicant had to be selected from the application process, pass a medical exam, pass academy training, and the facility training. Facility training consists of classroom instruction, lab scenarios, and passing a certification check ride on every position in the applicant's area of specialty. During the application process, the applicant is ranked based on their 1) pre-employment experience, 2) educational background, and an 3) interview with an ATC management official. The highest points were given to those with prior ATC or aviation experience. If no aviation experience was present in the application, then either a four year college degree or at least three years of general progressive work experience was required (Cobb & Nelson, 1974).

Between 1964 and 1968 the application process changed when the FAA requiring applicants to take the U.S. Civil Service Commission Air Traffic Aptitude Screening Test. Depending on their previous experience there were specific minimum scores that needed to be obtained to qualify for selection. Once the scores were calculated, additional points were added based on the applicants work experience (Cobb & Nelson, 1974; Jorgenson, 2013; Pavel, 2012).

In 1968, the FAA waived the U.S. Civil Service Air Traffic Aptitude Screening Test for applicants with "highly specialized" experience due to the 100 percent increase in air traffic and only a 10 percent increase in controller staffing (Rose, Jenkins, & Hurst, 1978). Those that met the "highly specialized" experience were placed directly into training at the FAA Academy. Due to this, there was an increase in the influx of white males with military experience and a lack of diversity(Boone, 1978). The FAA then created the Predevelopment "150" to diversify the workforce. This was a one year program which was successful at increasing women and minorities in the controller workforce (Boone, 1978).

In 1973, the FAA's Civil Aeronautical Medical Institute (CAMI) conducted two studies comparing the success rate between those classified as "highly specialized" and those who had no aviation experience. The findings of those studies showed that those who were classified as "highly specialized" had a higher success rate at the FAA Academy; however they had a slightly higher attrition rate post-academy (Cobb, Lay, & Bourdet, 1971; Cobb, Mathews, & Nelson, 1972). Due to this finding the, U.S. Civil Service Air Traffic Aptitude Screening Test was reinstituted regardless of whether or not applicants had "highly specialized" experience or not. In the studies, it was found that

age was a factor in post academy success rate, so the FAA implemented a maximum application age of 30 for eligibility (Cobb, Lay, & Bourdet, 1971; Pavel, 2012).

In 1981, the U.S. Civil Service Air Traffic Aptitude Screening Test was analyzed and updated to the Office of Personnel Management (OPM) three-test battery which consisted of the Multiplex 8 Controller Aptitude Test (MCAT), the Abstract Reasoning Test (ABSR) and the Occupational Knowledge Test (OKT) (Broach & Manning, 1997). With the Professional Air Traffic Controllers (PATCO) strike of 1981, the FAA had the difficult task of filling all those positions which were lost to the strike, and the improvements to the hiring process came to an abrupt halt. In 1981, President Reagan fired 11,345 controllers who went on strike. By October of 1985, 13,533 applicants entered the FAA academy (GAO, 1988). As a checks and balance of their current hiring system, and the success rate of the program, the Government Accounting Office (GAO) commissioned the Flight Safety Foundation to study the air traffic controller workforce. The GAO found that the attrition rate was close to 60 percent at the Air Route Traffic Control Center's (ARTCC) as well as "conditions within the controller workforce in the past five years, and the air traffic control system safety had diminished since the 1981 controllers' strike" (GAO, 1986). Because the FAA didn't meet the Congressionally mandated goal of 10,450 full performance level (FPL) controllers by the end of 1988 the FAA Administrator responded and created the Office of Training (GAO, 1986; GAO, 1988).

On August 5, 1988, the FAA Administrator announced the establishment of the Office of Training to evaluate, upgrade, and modernize the ATC program. The Office of Training was also tasked with establishing a national recruiting program, new

relationships with academia and industry, a new air traffic screening program and an Institute for Human Resources Research to improve selection, training, human performance and human factors research (Jorgenson, 2013). In October of 1988, the FAA Office of Training and Higher Education was created to elevate the status of training within the FAA and improve management of training. (GAO, 1989).

In 1988 two studies were completed reviewing the training of Air Traffic Control Specialists (Means et al., 1988; Northern NEF, Inc., 1988). The studies recommended exploration of "nonfederal, post-secondary institutions (i.e., two- and four-year colleges and universities) to develop and test academic programs for training fundamental skills and knowledges related to air traffic control (ATC)." (Means et al., 1988; Northern NEF, Inc., 1988). These studies began the development and implementation of the collegiate training initiative (CTI).

Prior to the Collegiate Training Initiative – Air Traffic Control Specialist Program there were two programs prior that taught basic knowledge and skills for the FAA Academy training. It was the College Cooperative (Co-op) Education Program and the Airway Science Program. Upon completion of either one of these programs, applicants proceeded to the FAA Academy.

In 1989, the Collegiate Training Initiative – Air Traffic Control Specialist (CTI-ATCS) program was created (Coyne, 2014; Pavel, 2012). However, the initial design of the Collegiate Training Initiative – Air Traffic Control Specialist (CTI-ATCS) program was meant to provide a comprehensive training curriculum to allow the applicant to be hired as a direct-to-facility hire.

As the AT-CTI program developed, the FAA instituted Order 3120.26 which explained the requirements of an FAA approved CTI School. The FAA's selection criteria is stated as:

a) Demonstrated capability to develop an air traffic control curriculum, experienced faculty, and appropriate facilities and equipment;
b) Methodology to prepare students for the air traffic control occupation;
c) Strategy to aggressively recruit minorities and females;
d) Willingness to select and screen students in accordance with the provision of Title IX of the Civil Right Act of 1964;
e) History of producing graduates of relevant programs who have achieved the full performance level of an air traffic controller; and
f) Willingness to allow FAA to evaluate the total program (U.S. Department of Transportation, FAA, 1991).

The first two approved schools were the Minnesota Air Traffic Control Training Center (MnATCTC), Eden Prairie, Minnesota, as administered by the Mid-America Aviation Resource Consortium (MARC) and Hampton University. The MARC school was provided $3.4 million dollars from the FAA to operate an air traffic controller training program. These funds came from Department of Transportation and the Related Agencies Appropriations Act, 1990, Public Law 101-164, H.R. 3015, 103 Stat. 1070 (101st Congress, 1989). Hampton University was provided with a $5 million-dollar grant from the FAA. In January 1991, the FAA solicited additional schools to participate in the AT-CTI Program and three additional schools were selected. By the end of 1991 there were five schools participating in the CTI Program (Morrison, Fotohui, & Broach, 1996).

Table 1. Initial Schools Accepted in 1991

("CTI Overview and FAQ's V1.0 CTI School Version," n.d.)

INITIAL SCHOOLS ACCEPTED IN 1991
Minnesota Air Traffic Control Training Center (MnATCTC), Eden Prairie, MN;
Hampton University (HU), Hampton, VA;
Community College of Beaver County (CCBC), Monaca, PA;
University of North Dakota (UND), Grand Forks, ND; and
University of Alaska, Anchorage (UAA), Anchorage, AK.

After a five-year test period was completed, an evaluation by the Civil Aeromedical Institute was conducted and it was shown that the CTI program was "functioning well" (Morrison, Fotohui, & Broach, 1996). The program was expanded to 13 schools in 1996 to include ("CTI Overview and FAQ's V1.0 CTI School Version," n.d.):

Table 2. Schools Accepted in 1996

("CTI Overview and FAQ's V1.0 CTI School Version," n.d.)

SCHOOLS ACCEPTED IN 1996
Vaughn College of Aeronautics, Flushing, NY
Daniel Webster College, Nashua, NH
Dowling College, Oakdale, NY
Embry-Riddle Aeronautical University, Daytona Beach, FL
Inter-American University of Puerto Rico, Bayamon PR
Miami-Dade College, Homestead, FL
Middle Tennessee State University, Murfreesboro, TN
Mt. San Antonio College, Walnut, CA
Purdue University, West Lafayette, IN

In 1996, the Air Traffic Standardization and Selection Tool (AT-SAT) was implemented to serve as a predictor of a person's aptitude for the air traffic control specialist position (Ramos, Heil, & Manning, 2001). The reason for the updated hiring tool was because the Office of Personnel Management (OPM) three battery test had not been updated in the 15 years it had been in place and was said to be "highly compromised".

Due to the anticipated attrition rate, from the PATCO strike in 1981, the FAA expanded the AT-CTI Program again. Between 2007 and 2009 the number of approved AT-CTI schools went from 13 schools to 36 schools (Coyne, 2014; "CTI Overview and FAQ's V1.0 CTI School Version," n.d.) See Figure 2 for current status of approved AT-CTI schools.

Table 3. Schools Accepted Between 2007 & 2009

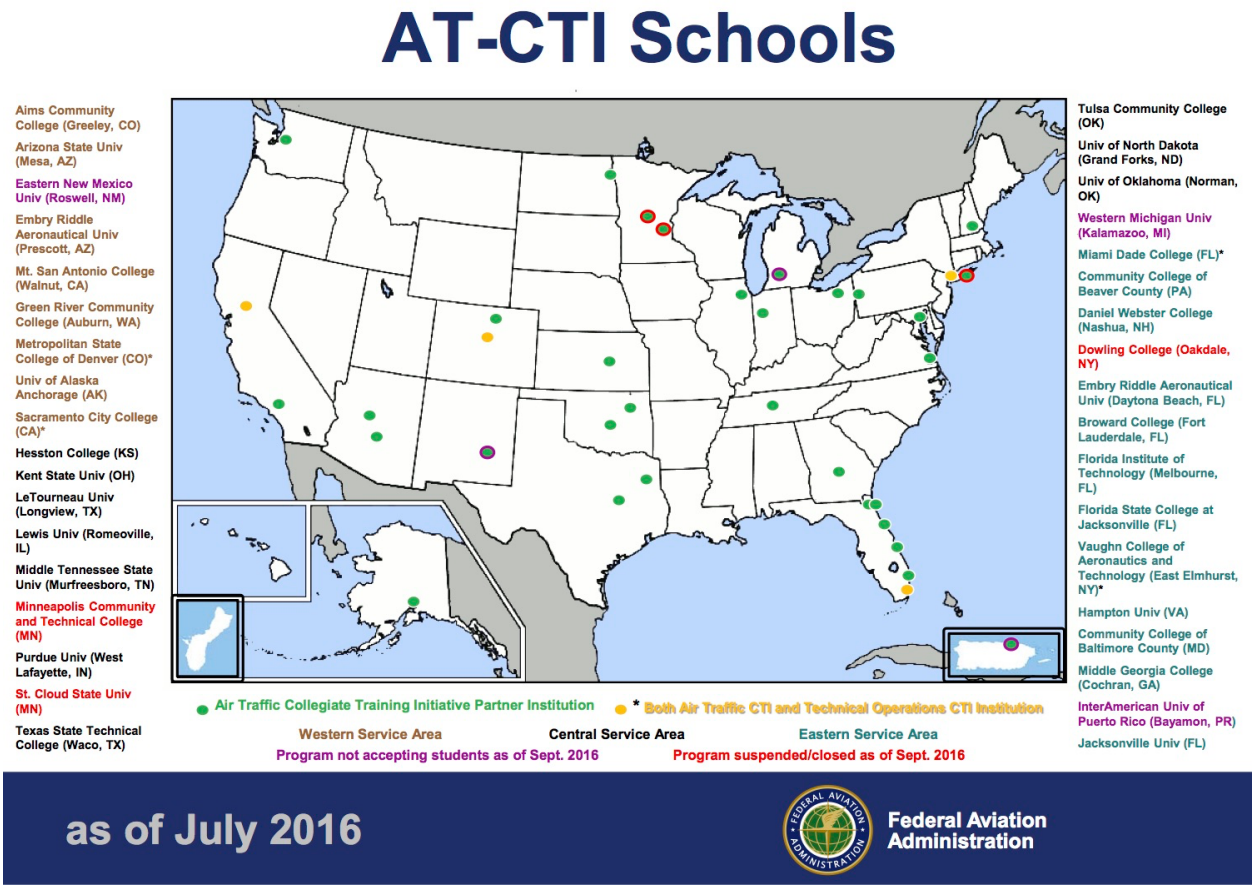
("CTI Overview and FAQ's V1.0 CTI School Version," n.d.)

SCHOOLS ACCEPTED IN 2007
Arizona State University
Florida State College at Jacksonville
Green River Community College
Kent State University
Lewis University
Middle Georgia College
The Community College of Baltimore County
University of Oklahoma
Metropolitan State College of Denver

SCHOOLS ACCEPTED IN 2008
Aims Community College
Broward College
Eastern New Mexico - Roswell
Embry-Riddle Aeronautical University, Prescott
Jacksonville University
Le Tourneau University
St. Cloud State University
Tulsa Community College

SCHOOLS ACCEPTED IN 2009
Florida Institute of Technology
Hesston College
Sacramento City College
Texas State Technical College – Waco
Western Michigan University College of Aviation

Figure 2. AT-CTI School Status as of July 2016



A. Chu (personal communication, November 17, 2016)

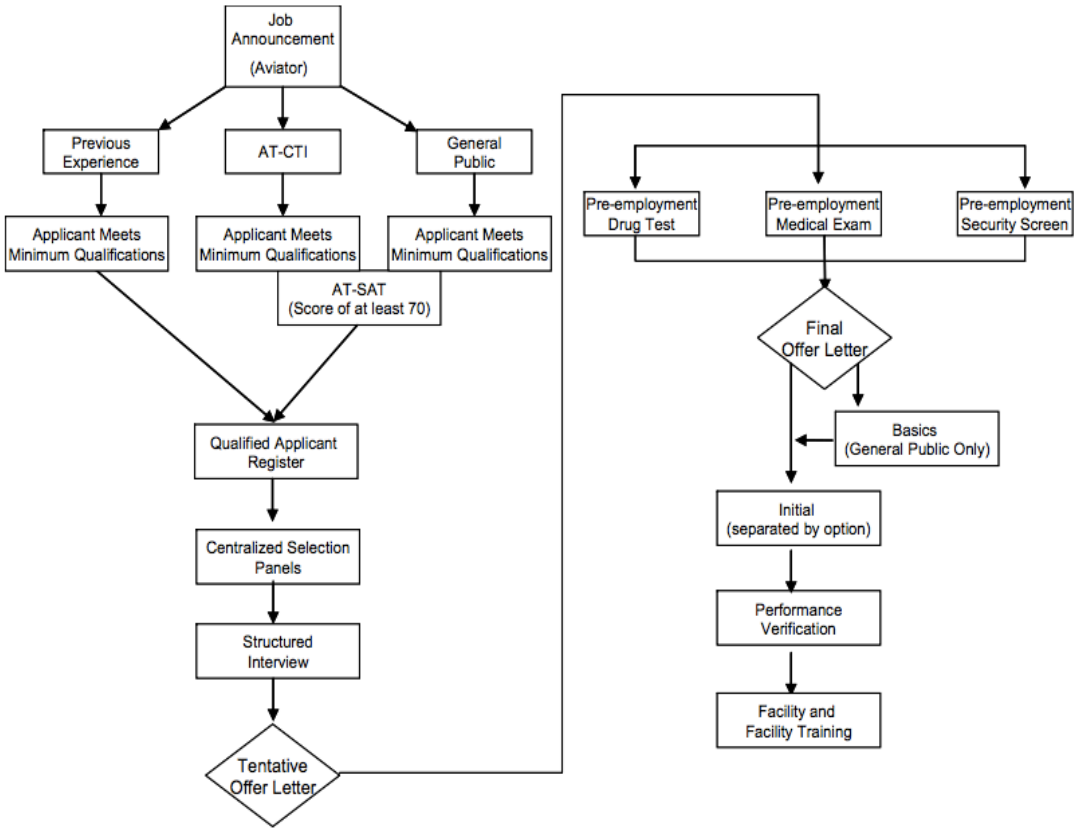
In 2011, an independent review panel consisting of the five authors (Barr, Brady, Koleszar, New, & Pounds, 2011) reviewed the FAA's methods for selecting, hiring, and training air traffic controllers as well as the CTI hiring process. The panel recommended that the FAA implement a tiered type of hiring process and to evaluate each school based on the curriculum provided. The tiers would be based on the level of information taught to applicants at a specific institution. Below is the proposed categorization from the independent review panel (Barr, Brady, Koleszar, New, & Pounds, 2011):

- Level 1: Those institutions that teach only Air Traffic Basics including aircraft identification and performance.
- Level 2: Those institutions that teach Air Traffic Basics and the theory of at least one option with no supporting lab(s).
- Level 3: Those institutions that teach Air Traffic Basics and at least one option with supporting lab(s).
- Level 4: Those institutions that teach Air Traffic Basics and all options (Tower, Terminal Radar, En-Route and Non-Radar) with supporting labs for each option.

Prior to 2014, the hiring process consisted of applying to an online vacancy announcement which consisted of three different avenues to get hired as shown in Figure 3. Those avenues being: previous experience, AT-CTI, and general public. Under the AT-CTI and general public announcements, the applicants were required to take the Air Traffic Standardized Aptitude Test (AT-SAT). Once the applicant was deemed to have met the minimum qualifications, the applicant was forwarded to a central selection panel where a structured interview was given and then a tentative offer letter (TOL). The applicant was then required to complete a drug test, medical exam, and security screen prior to being offered their final offer letter. The final offer letter, informs the applicant of their training date to start in basics (general public announcement only) or initial training at the FAA Academy. At the end of their training, the applicant is given a performance verification and then moves on to facility training. (Pierce, Williams, Broach, & Bleckley, 2013)

Figure 3. ATCS Hiring and Academy Training Timeline

(Pierce et al., 2013)



In 2014, the FAA introduced an interim change in the hiring process of air traffic controllers. The purpose of this change allowed the FAA "to more efficiently compare applicants across previous hiring sources to select those candidates most likely to succeed as air traffic control specialists" (FAA, 2016). Key benefits of the new approach included:

1. A single vacancy announcement;
2. A single set of minimum qualifications/eligibility requirements;
3. A multi-hurdle selection process with increased validity and efficiency; and

4. Eliminated the centralized selection panel process and interview.

The FAA modified the interim change in January 2015 to establish a "two-track announcement process."(FAA, 2016). Under both tracks all applicants were required to take the biographical questionnaire and the ATSA (Air Traffic Control Specialist Skills Assessment Battery) The two tracks are:

1. Applicants who have at least 52 weeks of certified air traffic control experience.
2. Applicants who have no operational air traffic control experience. (FAA, 2016)

ATC Current Hiring Process

In August 2016, the FAA issued Human Resource Policy Manual (HRPM) Policy Bulletin #90 which outlined the hiring for new appointments to the air traffic control specialist job. The policy was written to further define "recruitment, assessment, and selection of entry level and experienced ATCS positions" (Federal Aviation Administration, 2016b). Hiring for the FAA still operates under the two-track method, however a few revisions were made with regards to further defining each category and the testing required.

The first category is air traffic control experience. Under this category, the applicant is "given preferential consideration in accordance with 49 U.S.C. § 44506(f). It is typically used to fill permanent positions assigned directly to an ATC facility." (Federal Aviation Administration, 2016b). When the applicant is placed directly into an FAA facility pre-employment testing is not required.

Table 4. ATC Experience Hiring Category

(Federal Aviation Administration, 2016b)

Hiring Categories	Pool	Primary Eligibility Requirement	Additional Eligibility Requirement	Comments
ATC Experience	Preferential Consideration	Maintaining 52 consecutive weeks of ATC experience after receipt of an air traffic certification or air traffic control facility rating	The requirement must have been met within five years prior to application	Typically used to fill permanent positions assigned directly to an ATC facility

The second hiring category is general experience and/or education. This category has two pools within it. Pool 1 consists of CTI school graduates and certain veterans. The four types of applicants that fall under Pool 1 are: CTI eligible, veteran's recruitment appointment (VRA) eligible, preference eligible veterans, and other eligible veterans. Applicants in Pool 1 are "not required to take any biographical assessment, but must take the ATSA or other pre-employment test or exam."(Federal Aviation Administration, 2016b) Pool 2 is the general public which are those applicants who apply under the vacancy announcement open to all U.S. citizens. Applicants in Pool 2 are required to "take any assessment designated by the FAA, including a biographical assessment" as well as "the ATSA or other current pre-employment test or exam." (Federal Aviation Administration, 2016b)

Table 5. General Experience and/or Education

(Federal Aviation Administration, 2016b)

Hiring Categories	Pool	Primary Eligibility Requirement	Additional Eligibility Requirement	Comments
General Experience and/or Education	CTI Eligible Applicant or Certain Veterans (Pool 1)	CTI graduate with successful completion of air traffic controller training	Recommendation or statement from the CTI school	Typically used to fill positions for entry-level Academy trainees
		Eligible for a Veterans Recruitment Appointment (VRA)	Provide a Certificate of Release or Discharge from Active Duty within 120 days of the vacancy announcement closing date or cut-off date	
		Other eligible veteran	Maintaining aviation experience	
		A veteran, or the spouse, unmarried widow or widower, or parent of a veteran	Eligible for veterans' preference	
	General Public (Pool 2)	Persons who apply to a vacancy announcement recruiting from all U.S. Citizens	Applicant does not meet the criteria for Pool 1	Typically used to fill positions for entry-level Academy trainees

Training at the FAA Academy vs Training in the Field

The journey a new applicant has to take to get from applying to fully certifying is a long and arduous process. This prompts the question as to whether or not going to the FAA academy is as beneficial as it is described. In 1975, the FAA conducted research dedicated to compare recruits initially trained at the FAA Academy versus recruits initially trained at assigned centers. This study examined the attrition reasons and training needs. The study concluded that facility trained subjects were less likely to attrite than academy trained applicants. "In 31 percent of telephone interviews and 36 percent of mail questionnaires, training failure or difficulty (including inadequate

training) was mentioned as the main reason for attrition from FAA ATC work." (Mathews, Cobb, & Collins, 1975). With regards to subjects facility trained, their reason for attrition, which is the third leading reason, was job pressure. Seventy-one percent of the subjects in the study agreed that the FAA Academy Training should precede facility training. The academy trained subjects favored being trained at the academy first by 79 percent. Whereas the facility trained subjects favored being trained at the facility by only 38 percent. (Mathews, Cobb, & Collins, 1975) The data in this study reveals that even though there was a lower attrition rate with the facility trained subjects, the majority would have preferred FAA Academy training first. This study fails to identify is the demographics of the participants. Knowing more of the demographics of each participant would help to assist in further dissection of the data.

The Minnesota Air Traffic Control Training Center (MnATCTC), Eden Prairie, Minnesota, as administered by the Mid-America Aviation Resource Consortium (MARC) was one of the founding CTI schools. Currently their program is closed, but while the program was operational it placed air traffic controllers directly into the workforce, bypassing the FAA Academy in Oklahoma City. A study conducted by the FAA looked at how the MnATCTC graduates were doing in their enroute facility training at their first assigned enroute facilities. The study found that MnATCTC graduates did better on six measures of training performance in different training phases versus FAA Academy graduates with three measures of training performance in different training phases. There was no significant difference in the amount of time it took to certify between the two groups as well as between the attrition rates. "MnATCTC graduates required about 2.82 (SD = 0.59) years to certify, in comparison to 3.18 (SD = 0.53) years for FAA Academy

graduates" (Broach, 1998). The MnATCTC program was a cost benefit to the FAA. It reduced or completely eliminated: screening costs, academy training costs, performance verification costs, and reduced overall time to attain full performance level (FPL). Knowing the cost benefit to the FAA and leveraging the CTI program to produce successful applicants is prudent, yet the FAA didn't see it that way due to the fact that funding was cut from MnATCTC.

Being an air traffic controller is one of very few jobs in the government which is considered entry level, with no higher education requirement. By implementing an educational level requirement, it could increase professionalism and quality of employees. By attending a CTI approved school and pursuing a degree there is the opportunity to become an air traffic controller which could produce more well-rounded applicants.

Pilot Experience as a Selection Factor

Having pilot experience is very beneficial when it comes to being an air traffic controller. The questions is, how much experience is needed when it comes to training success. Or is there no degradation in training success based on pilot experience. Cobb and Nelson, (1974) cited one study completed by the FAA's Civil Aeromedical Institute (CAMI) that indicate "personnel having only pilot experience when they entered ATCS training during either of the two widely separated time periods had un-usually low retention rates, even lower than those groups having no aviation-related experience of any type." The study assessed ATC recruits from 1960-1963 and 1969. In the study's timeframe, there was a higher demand for pilots and the pay was much higher which could have contributed to the higher attrition rate of recruits with pilot experience. With

pilot jobs garnering higher pay, the study found that when considering an applicant's pre-employment qualification, a recruit would meet the aptitude screening requirements and age standards would be considered on the same level as those with pilot experience. Also not showing a preference to pilots, it would increase the FAA's "female and minority candidates who, for various socioeconomic reasons probably did not obtain the types of pre-FAA experience for which credit is currently given in selecting ATC candidates." (Cobb & Nelson, 1974) Although the study concluded that there should not be a preference for having "pre-FAA experience," the primary purpose of air traffic control has remained the same from the beginning which is, "The primary purpose of the ATC system is to prevent a collision between aircraft operating in the system and to provide a safe, orderly and expeditious flow of traffic, and to provide support for National Security and Homeland Defense." (Federal Aviation Administration, 2015).

In 2013, the FAA Civil Aeromedical Institute conducted another study assessing prior experience as a selection factor. The study examined the Office of Personnel Management's (OPM) seven alternate requirements. Those requirements are listed in Table 6.

Table 6. Alternate Requirements for FAA Qualifying ATCS Applicants (Federal Aviation Administration, 2016b)

1.	Hold or have held an appropriate facility rating and have actively controlled air traffic in civilian or military ATC terminals or centers;
2.	Hold or have held an FAA certificate as a dispatcher for an air carrier;
3.	Hold or have held an instrument flight rating;
4.	Hold or have held an FAA certificate as a navigator or have been fully qualified as a navigator/bombardier in the Armed Forces;
5.	Have 350 hours of flight time as a copilot or higher and hold or have held a private certificate or equivalent Armed Forces rating;
6.	Have served as a rated Aerospace Defense Command Intercept Director;
7.	Meet the requirements for GS-5 and pass the written test with an appropriately higher score.

Specifically looking at alternate requirements three and five, both requirements showed greater chance at success. Under alternate requirement three, only 4.4% of 9,334 respondents indicated that they had held or previously held an instrument rating, certificate, or license. Those respondents who had held or previously held an instrument rating, certificate, or license had a 61.7% pass rate at the FAA Academy with 38.3% withdrawing or failing. Compared to those who didn't have an instrument rating, certificate, or license and the study shows 53.1% passing the FAA Academy and 46.9% withdrawing or failing. These findings show the benefit to training and cost effectiveness of having instrument rated pilot's as air traffic controllers. Under alternate requirement five, only 12.2% of 9,340 respondents indicated that they currently have or had a private pilot's license and 3.5% of 9,339 respondents indicated that they currently have or had a commercial pilot's license. In the private pilot portion of the study, it indicates that 59.6% of those who have or had a private pilot's license passed the FAA Academy whereas 52.6% of those without a private pilot's license passed the FAA Academy. In the commercial pilot portion of the study it indicates that 60.9% of those who have or had a commercial pilot's license passed the FAA Academy whereas 53.1% of those without a commercial pilot's license passed the FAA Academy. These statistical findings prove the higher success rate of pilots and the benefit they provide to the FAA.

10 Year Strategy for the Air Traffic Control Workforce

Since December 2004, the FAA Administrator has been required to transmit a report to the Senate Committee on Commerce, Science and Transportation and the House of Representatives Committee on Transportation and Infrastructure that describes the overall air traffic controller workforce plan according to Section (221) of Public Law

(108-176) (updated by Public Law 111-117). (Federal Aviation Administration, 2016a). The 2016 Controller Workforce Plan is the eleventh annual update as of September 19, 2015.

In the last five years, the FAA has hired approximately 4,700 new air traffic controllers and plans on hiring 7,400 new controllers over the next five years to keep up with attrition and growth. With the hiring process going from three tracks (prior to 2014) down to two tracks it reduces the capability to identify those applicants with additional experience and to give them a more direct path to facilities. The two new paths are described in Table 5 and Table 6.

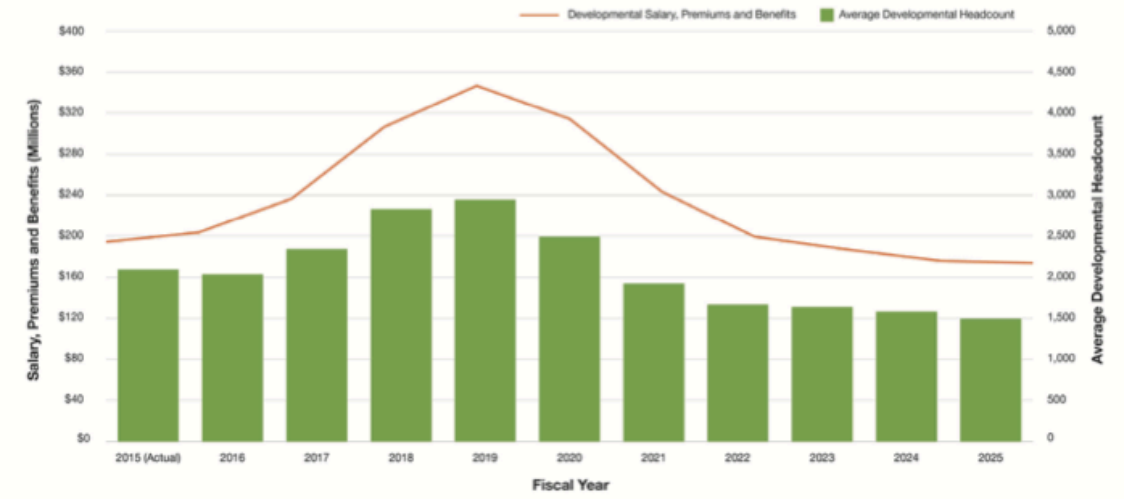
The estimated number of controller losses between FY2016 and FY2025 based on category are listed in Figure 1. FAA Academy attrition and developmental (trainee) attrition is based on both historical rates as well as projections.

Over the next few years there is expected to be a higher than normal promotion rates, due to retirements in those positions. The biggest retirement wave has passed due to the 1981 strike and the increased hiring which occurred shortly after accounted for a large portion of the workforce retiring due to aging out at 56 years old. With the substantial hiring that has taken place over the last 10 years, the FAA may possibly be in the same predicament in 10-15 years. Retirements may not be as severe as they were in 2007, but will still be noticeable throughout that time.

Due to the financial downturn in 2008, many controllers delayed retirement, which may further complicate the hiring process. Another factor which needs examination, is the ability to successfully attain full performance level (FPL) with the lowest cost to the agency, as federal budges constrict this will continue to be of the

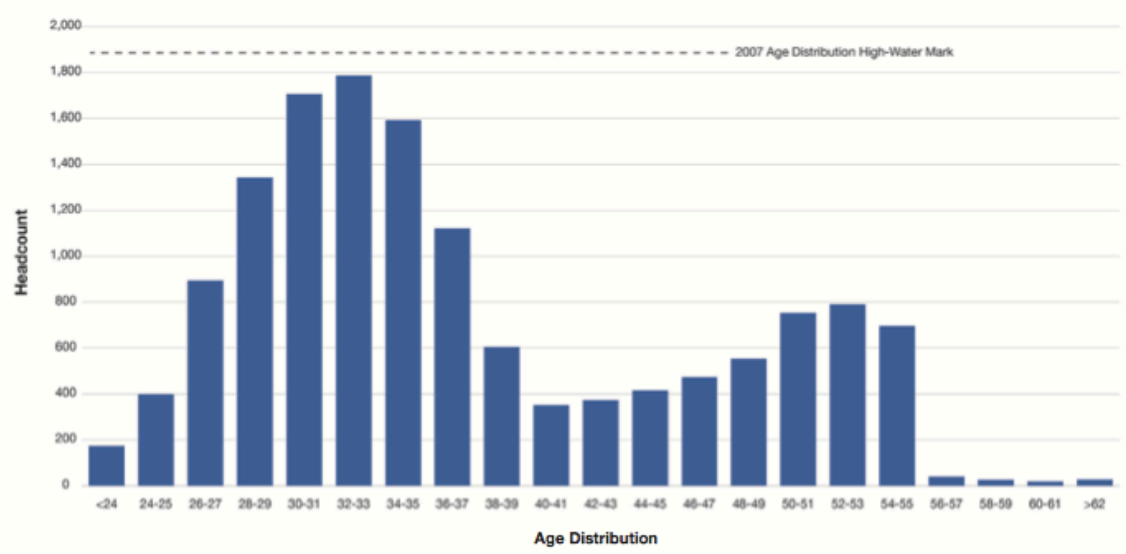
utmost importance. Each developmental trainee incurs more than just training costs to the agency, overall costs include: instructor costs, per diem if applicable and differentials. Figure 4 shows the costs associated with training a developmental before certification which is projected to be $100,155 per trainee in FY2016. (Federal Aviation Administration, 2016a)

Figure 4. Estimated cost of Developmentals Before Certification
(Federal Aviation Administration, 2016a)



With the high amount of training costs incurred per trainee there needs to be stable funding in place and a successful hiring plan that produces top quality controllers who can meet the mission of the FAA. Due to the recovery of all the retirements from the 1981 strike, there is now another age bubble that can be seen in Figure 5 which shows the age distribution of controllers as of September 19, 2015.

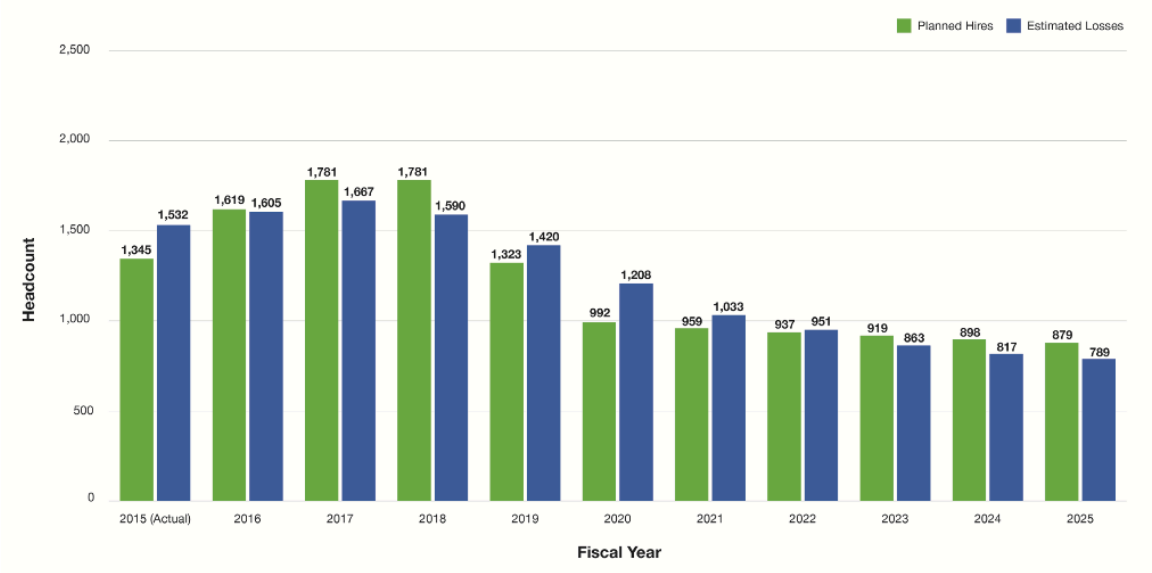
Figure 5. Controller Workforce Age Distribution as of September 19, 2015 (Federal Aviation Administration, 2016a)



The FAA is trying to even out the hiring to reduce the magnitude of retirements in 10-15 years which can be seen in Figure 6. Doing this will provide "better predictability at the Academy and facilities, and to smooth out workload for our medical and security personnel. The number of controllers projected to be hired through FY 2025 is 12,088." (Federal Aviation Administration, 2016a).

Figure 6. Controller Hiring Profile

(Federal Aviation Administration, 2016a)



CHAPTER II

METHODOLOGY

When researching a Collegiate Training Initiative (CTI) school to attend, students have had up to 36 different schools to choose from. Each school has a basic curriculum from which to teach but many differ in how the materials taught. Their training devices and tools used, as well as the requirements to graduate from their school to obtain a CTI recommendation, all differ.

This study examined the different types and requirements of training provided at CTI approved schools and how it may affect the training outcome once employed by the FAA. Additionally, this study examined the correlation of pilot's licenses/ratings to the training outcomes as an air traffic controller with the FAA. This chapter discusses the study population, sample, and research design in detail.

Population

The population examined by this study could have been from any one of the 36 approved CTI schools. The specifics on the exact school were not acquired due to the fact that the study is based on the tools used and requirements needed to be met to obtain a CTI recommendation and how those factors affected the training outcome once employed by the FAA. The study accepted both graduates (and non-graduates who partially attended) CTI schools and were hired via the general public method. Some of the survey questions will not pertain to all graduates, therefore, students were allowed to answer the questions that pertained to them individually. The only surveys that will be eliminated were ones that did not answer any questions.

Sample

The study surveyed AT-CTI graduates from across the nation. Four Collegiate Training Initiative Schools (CTI) were chosen to disseminate the survey based on geographic location, tools used and diversity of students. Additionally, the survey sampled the remainder of the CTI graduates through the use of social media. The University of North Dakota is a public four-year institution; Green River Community College is a two-year institution; Embry-Riddle Aeronautical University (Daytona) is a private four-year institution; and Community College of Beaver County is a two-year institution.

Study Design

The survey was disseminated by sending a link to an electronic survey hosted by Qualtrics Survey Software to air traffic controllers who were assumed to have attended CTI schools. The survey link was forwarded to contacts at the University of North Dakota, Green River Community College, Embry-Riddle Aeronautical University and the Community College of Beaver County. The survey was disseminated to the University of North Dakota alumni through the UND Air Traffic Control Alumni page on Facebook™. All survey responses were anonymous, voluntary and compensation is not provided to participate.

Data Collection

The survey was available to respondents from any internet connected device and was hosted by Qualtrics Survey Software. Numerous methods to collect data was pursued, however the only way to acquire the data came from the developed survey (see

appendix F) distributed to CTI students through their respective colleges, word of mouth, and Facebook™.

The survey was not timed. The first page of the survey consisted of a consent form which outlined a description of the research and an electronic informed consent. The survey was open for 26 days.

The survey consisted of 20 quantitative questions (see Appendix E). When the survey was closed, the data was exported into an SPSS file and the variables were categorized. Appendix F lists the quantitative variables that were analyzed.

Data Analysis

Data analysis was completed using the SPSS Statistics 24 Software. Success in training with the FAA can be defined in many ways. For this study, success at the FAA Academy will be defined as passing all performance verifications and continuing on to the first facility. Success at either the first or second facility will be defined as becoming a Certified Professional Controller (CPC). The research question used for the project are listed below:

Do the success rates at the FAA Academy, First Facility, and Second Facility, differ between participants who:

1. Completed a class on tower, radar or non-radar procedures?
2. Completed a lab for tower, radar, or non-radar?
3. Utilized a Projector Tower Simulation, Table Top (with Model Airplanes), Desktop Computer Simulator, or Strip Boards (non-radar)
4. Earned a pilot certificate
5. Earned an Instrument Rating

Validation and Limitations

The survey was created by the researcher and validated by a panel of ATC experts. The panel of experts, committee members and the researcher's colleagues reviewed the survey to ensure flow, grammar, and comprehension by the subject population.

The research was conducted with several limitations. First, the survey was conducted anonymously and there is no way for the researcher to follow up with further questions. Second, there is no way to know whether or not the survey was taken only once by each participant. Another limitation of the research is that the researcher is a CTI graduate.

Protection of Human Subjects

Participation in this study was voluntary for all subjects. At the time of administering this study, there were no foreseeable risks to the participants of this study. The survey was completely anonymous to keep all data confidential. Approval from the University of North Dakota's Institutional Review Board (IRB) was received on February 22, 2017 (see appendix A). All records and data used during the study will be stored in a safe place and will only be accessible to the researcher and research advisor. After a period of three years, all records and surveys used in this study will be destroyed.

CHAPTER III

RESULTS

The survey was available to the participants from any internet connected device and was hosted by Qualtrics Survey Software. The survey was disseminated through the University of North Dakota's Air Traffic Control Alumni Facebook page (see Appendix D) as well as through Embry-Riddle Aeronautical University, Community College of Beaver County, and Green River Community College through email to their air traffic control alumni (see Appendix C).

One hundred and thirty-six participants started the survey (n=136). One-hundred and fifteen (n=115) completed and submitted the survey in its entirety. Ten (n=10) surveys were partially completed. Eleven (n=11) surveys were incomplete. Table 7 shows the breakdown of participants and the option they were hired under.

Table 7. First Facility Count Demographics

Option	1st Facility
Tower	20
Tower/TRACON	36
TRACON	5
Enroute	58

Dependent Variable Descriptive Statistics

This study has three different dependent variables which are the FAA Academy, First Facility and Second Facility. Table 8 shows the breakdown of pass/certify and fail/washout for each phase in training. The column indicated by other is for those who attended the FAA Academy for TRACON training where their training was pass/pass. Pass/pass means that at the time of the participant's attendance at the FAA Academy they could not fail the academy. Because of the low number of participants who failed to certify at their first facility (n=7), and went on to a second facility, the results will be unstable. When a developmental trainee fails to certify at their first facility, they either separate from the FAA or are retained and placed in a lower level facility.

Table 8. Success Rate Demographics

	Pass/Certify	Fail/Washout	Other (TRACON)
FAA Academy	108	5	12
First Facility	88	12	
Second Facility	6	1	

Independent Variable Descriptive Statistics

Courses Taken

The participants were asked whether or not there was a course on tower, radar, or non-radar that was part of their requirements to graduate, that they completed to obtain a CTI recommendation. Table 9 shows the breakdown of the number of participants that attended each type of course.

Table 9. Courses Taken Demographics

Course	Yes	No
Tower Course	112	12
Radar Course	116	8
Non-Radar Course	100	24

Labs Taken

The participants were asked if there was a lab associated with the courses they attended. Table 10 shows the breakdown of participants by lab types.

Table 10. Labs Taken Demographics

Lab	Yes	No
Tower Lab	106	6
Radar Lab	111	5
Non-Radar Lab	91	9

Training Aids

Training aids are unregulated by the FAA and it is up to each Collegiate Training Initiative (CTI) school to determine what and how to teach the curriculum to their students. This study has condensed the training aids down to four different types: 1) Projector Tower Simulation (270 deg., 360 deg., etc.), 2) Table Top (with model airplanes), 3) Desktop Computer Simulator, and 4) Strip Boards (Non-Radar). Table 11 shows the breakdown of those participants who used each training aid. Participants were able to select more than one training aid used.

Table 11. Training Aid/Tools Demographics

Training Aids/Tools	Used	Not Used
Projector Sim	94	42
Table Top	23	113
Desktop Computer	42	94
Strip Boards	79	57

Pilot Certificate

The fourth research question examines the relationship between success rate and whether or not the participant had a pilot's certificate or not. Table 12 shows the total number of participants who had a pilot's certificate. For the purpose of this study a pilot's certificate was anyone who obtained a Student Pilot, Sport Pilot, Recreational Pilot, Private Pilot, Commercial Pilot, Airline Transport Pilot – ATP, Certified Flight Instructor – CFI, Certified Instrument Instructor - CFII, or a Multi-Engine Instructor – MEI.

Table 12. Pilot Certificate Demographics

Certificate	Yes	No
Pilot Certificate	83	53

Instrument Rating

Research question five studied how the success rate is affected based on holding an instrument rating or not. Table 13 shows the breakdown of participants who have an instrument rating.

Table 13. Instrument Rating Demographics

Rating	Yes	No
Instrument Rating	23	113

Statistical Results

The results of this research are broken down by research question and within each question further broken down by stage of training.

Courses Taken

The first research question asked if the success rates at the FAA Academy, First Facility, and Second Facility, differ between participants who completed a class on tower, radar or non-radar procedures.

A binary logistic regression analysis was conducted to predict the success rate at the FAA Academy based on a tower course, radar course and a non-radar course as predictors. A test of the full model against a constant only model was statistically significant, (chi square = 11.251, $p < .05$ with df = 3). Nagelkerke's R^2 of .312 indicated a relationship between prediction and grouping. Prediction success overall was 96.5% (40% to fail the academy and 99.1% to pass the academy). The Wald criterion demonstrated that only the tower procedures courses made a significant contribution to prediction ($p = .003$). Radar and non-radar procedures courses were not a significant predictor. Results of the logistic regression test indicated that participants who completed a tower procedures course were 54 times more likely to pass the academy than those who did not complete a tower procedure course as shown in Table 14.

Table 14. FAA Academy vs Courses Binary Logistic Regression

Predictors	B	SE	*Wald*	df	Sig.	Exp(B)
Tower Procedures Course	3.989	1.359	8.621	1	0.003**	54.000
Radar Procedures Course	-15.997	10937.369	0.000	1	0.999	0.000
Non-Radar Procedures Course	-20.163	6772.661	0.000	1	0.998	0.000
Constant	35.467	12864.485	0.000	1	0.998	2.529E+15

** Indicates significance at the .01 level

A binary logistic regression analysis was conducted to predict the success rate at the participant's first facility using a tower course, radar course and a non-radar course as predictors. A test of the full model against a constant only model was not statistically significant, (chi square = 4.251, $p > .05$ with df = 3). Nagelkerke's R^2 of .080 indicated a very weak relationship between prediction and grouping. Prediction success overall was 88% (0% to fail/washout the first facility and 100% to certify at the first facility). The Wald criterion demonstrated that none of the courses made a significant contribution to prediction. Results of the logistic regression test indicated that participants who completed a non-radar procedures course were 1.3 times more likely to certify at their first facility than those who did not complete a non-radar procedure course as shown in Table 15.

Table 15. First Facility vs Courses Binary Logistic Regression

Predictors	B	SE	*Wald*	df	Sig.	Exp(B)
Tower Procedures Course	-19.095	12016.574	0.000	1	0.999	0.000
Radar Procedures Course	-18.892	13212.665	0.000	1	0.999	0.000
Non-Radar Procedures Course	0.231	0.846	0.075	1	0.785	1.260
Constant	39.596	17859.801	0.000	1	0.998	1.571E+17

A binary logistic regression analysis was conducted to predict the success rate at the participant's second facility using tower course, radar course and a non-radar course as predictors. However, there was not have enough data to detect a 'statistical significance' from any variable (N=7).

Labs Taken

The second research question asks if the success rates at the FAA Academy, First Facility, and Second Facility, differ between participants who completed a lab on tower, radar or non-radar procedures.

A binary logistic regression analysis was conducted to predict the success rate at the FAA Academy in Oklahoma City using tower lab, radar lab and a non-radar lab as predictors. A test of the full model against a constant only model was statistically significant, (chi square = 4.723, $p < .05$ with df = 3). Nagelkerke's R^2 of .206 indicated a relationship between prediction and grouping. Prediction success overall was 96.4% (0% to fail the academy and 99.1% to pass the academy). The Wald criterion demonstrated that only tower lab made a significant contribution to prediction ($p = .024$). Radar and non-radar labs were not a significant predictor. Results of the logistic regression test indicated that participants who completed a tower lab were 36 times more likely to pass the academy than those who did not complete a tower lab as shown in Table 16.

Table 16. FAA Academy vs Labs Binary Logistic Regression

Predictors	B	SE	*Wald*	df	Sig.	Exp(B)
Tower Lab	3.584	1.586	5.108	1	.024*	36.000
Radar Lab	-3.584	42968.099	0.000	1	1.000	0.028
Non-Radar Lab	-17.619	15191.516	0.000	1	0.999	0.000
Constant	21.203	40192.977	0.000	1	1.000	1615474887

* Indicates significance at the .05 level

A binary logistic regression analysis was conducted to predict the success rate at the participants first facility using tower lab, radar lab and a non-radar lab as predictors. A test of the full model against a constant only model was not statistically significant, (chi square = 6.340, $p > .05$ with df = 3). Nagelkerke's R^2 of .151 indicated a very weak relationship between prediction and grouping. Prediction success overall was 88% (10% to fail/washout the second facility and 100% to certify at the second facility). The Wald criterion demonstrated that none of the labs made a significant contribution to prediction, however with an abnormally large Exp(B) as shown in Table 18 a chi square of independence was also conducted. No significance was found between any of the lab options as noted in Table 17 and 18. Due to the high Exp(B) figure for tower lab, a chi squared test of independence was also run and showed no significance (X^2 (1) = .204, $p>.05$) as shown in Table 18.

Table 17. First Facility vs Labs Binary Logistic Regression

Predictors	B	SE	*Wald*	df	Sig.	Exp(B)
Tower Lab	23.013	40192.962	0.000	1	1.000	9872343689
Radar Lab	-23.013	58836.494	0.000	1	1.000	0.000
Non-Radar Lab	-19.393	15191.521	0.075	1	0.999	0.000
Constant	21.203	40192.991	0.000	1	1.000	1615474689

Table 18. First Facility vs Labs Chi Square

Dependent Variable	Independent Variable	Test Used	Test Statistic	Value of *p*
1st Facility	Tower Lab	Chi Squared	0.204	0.520
1st Facility	Radar Lab	Chi Squared	0.793	1.000
1st Facility	Non-Radar Lab	Chi Squared	1.547	0.597

A logistic regression analysis was conducted to predict the success rate at the participants second facility using tower course, radar course and a non-radar course as predictors. However, there was not have enough data to detect a 'statistical significance' from any variable (N=7).

Training Aids

A multiple regression was calculated to predict the success at the FAA Academy based on projector tower simulation, table top, desktop computer, and strip boards. A significant regression equation was found [F(4,108)=2.771,p=.031] with an R^2 of .093. Participants' predicted that success at the FAA Academy = .872+.155(Projector Tower Sim)+.112(Table Top)+.005(Desktop Computer)-.087(Strip Boards), where all independent variables are coded as 0=no and 1=yes.

Use of the projector tower simulation explained 32.8% of the variance, table top (with model airplanes) explained 20.7% of the variance, desktop computers explained

1.2% of the variance, and strip boards explained -20.7% variance in participant success rate at the FAA Academy. Projector tower simulation, table top (with model airplanes) and strip boards (non-radar) were significant predictors of training at FAA Academy as shown in Table 19.

Table 19. Multiple Regression Predicting Success at FAA Academy

Predictors	B	SE	β	
Projector Tower Simulator	0.155	0.051	0.328	**
Table Top (with model airplanes)	0.112	0.053	0.207	*
Desktop Computer	0.005	0.041	0.012	
Strip Board (non-radar)	-0.087	0.044	-0.207	*
Constant	0.872	0.046		
R^2	0.093			

* Indicates significance at the .05 level
** Indicates significance at the .01 level

A multiple regression was calculated to predict the success at first facility based on projector tower simulation, table top, desktop computer, and strip boards. No significant regression equation was found [F(4,95) = .467,p=.759] with an R^2 of .019. Participants' predicted that success at the FAA Academy = .907-.019 (Projector Tower Sim)+.079 (Table Top)-.043 (Desktop Computer)-.025 (Strip Boards), where all independent variables are coded as 0=no and 1=yes.

Use of the projector tower simulation explained -21.1% of the variance, table top (with model airplanes) explained 87.6% of the variance, desktop computers explained -59.9% of the variance, and strip boards explained -3.8% variance in participant success rate at the FAA Academy. No predictors showed significance as shown in Table 20.

Table 20. Multiple Regression Predicting Success at First Facility

Predictors	B	SE	β
Projector Tower Simulator	-0.019	0.092	-0.211
Table Top (with model airplanes)	0.079	0.091	0.876
Desktop Computer	-0.043	0.072	-0.599
Strip Board (non-radar)	-0.025	0.077	-0.038
Constant	0.907	0.081	
R^2	.019*		

* Indicates significance at the .05 level

A multiple regression was calculated to predict the success at second facility based on projector tower simulation, table top, desktop computer, and strip boards. However, there was not have enough data to detect a 'statistical significance' from any variable.

Pilot Certificate

A chi square test of independence was used to compare FAA Academy success between pilots and non-pilots. Pilot certificates were significantly related to success at the academy ($X^2(1) = 5.04$, $p<.05$). There is an association between having a pilot certificate and success at the academy (see Table 21). The odds of passing the FAA Academy are 8.7 (OR=8.7) times greater for those participants who have a pilot's license versus those who do not.

A chi square test of independence was used to compare first facility success between pilots and non-pilots. Pilot certificates were not significantly related to success at the participants first facility ($X^2(1) = .88$, $p>.05$). There is no association between having a pilot certificate and success at the participants first facility. The odds of

certifying at the first facility are 1.8 (OR=1.8) times greater for those participants who have a pilot's license versus those who do not.

A chi square test of independence was used to compare second facility success between pilots and non-pilots. However, there was not have enough data to detect a 'statistical significance' from any variable (N=7).

Table 21. Pilot Certificate Chi Square

Dependent Variable	Independent Variable	Test Used	Test Statistic	Value of *p*
FAA Academy	Pilot Certificate	Chi Squared	5.04	0.043
1st Facility	Pilot Certificate	Chi Squared	0.884	0.338
2nd Facility	Pilot Certificate	Chi Squared	0.875	1

Instrument Rating

A chi square test of independence was used to compare FAA Academy success between participants with and instrument rating and those without an instrument rating. Instrument ratings were not significantly related to success at the Academy. The odds of passing the FAA Academy are 1.2 (OR=1.2) times greater for those participants who have an instrument rating versus those who do not.

A chi square test of independence was used to compare first facility success between participants with an instrument rating and those without an instrument rating. The odds of certifying at the first facility are 1.3 (OR=1.3) times greater for those participants who have an instrument rating versus those who do not. There is no association between having an instrument rating and success at the participants first facility.

Table 22. Instrument Rating Chi Square

Dependent Variable	Independent Variable	Test Used	Test Statistic	Value of *p*
FAA Academy	Instrument Rating	Chi Squared	1.194	0.582
1st Facility	Instrument Rating	Chi Squared	3.625	0.066
2nd Facility	Instrument Rating	Chi Squared	UNSTABLE	

CHAPTER IV

DISCUSSION

This study explored how the different types and requirements of training provided at Collegiate Training Initiative (CTI) approved schools may differ in the outcome of training at the FAA Academy and in the field. This chapter presents a discussion of the results and analyses that were presented in the previous chapter and will conclude with recommendations and areas for further research.

The Professional Air Traffic Controllers Organization (PATCO) strike in 1981 created an untenable situation in which the FAA had to hire over ten thousand air traffic controllers in a three to four year time period. With the biggest wave of retirements behind them, the FAA is looking for a long term strategy to deal with projected retirements and growth of the national airspace system (NAS). With each new controller training costs estimated at approximately $100,155 (Federal Aviation Administration, 2016a), the FAA should leverage the CTI program to the fullest potential and determine which methods and schools provide the most successful outcome with the lowest cost to the FAA. The number of controllers projected to be hired through FY 2025 is 12,088 (Federal Aviation Administration, 2016a).

Significant Results

All of the statistically significant results came from examining each independent variable against training at the FAA Academy.

Significance came from research question one where a binary logistic test showed that if a participant had taken a tower procedures course at a Collegiate Training Initiative (CTI) school they were 54 times more likely to pass training at the FAA Academy. The study did not break down the type of facility the participants were hired into, and how taking a tower procedures course affects each, however as an overall statistic this is very promising.

The second significant research finding came from research question two where a binary logistic test showed that if a participant had a tower lab they were 36 times more likely to pass the FAA Academy. This statistic further demonstrates the first significant finding that tower training whether it's a course or lab is beneficial to success at the FAA Academy.

The third significant area in this research is with regards to the training tools used by Collegiate Training Initiative (CTI) schools. A multiple regression was utilized and it indicated that projector tower simulation explained 32.8% of the variance, table top (with model airplanes) explained 20.7% of the variance, desktop computers explained 1.2% of the variance, and strip boards explained -20.7% variance in participant success rate at the FAA Academy. These results correspond with the first two significant results described previously. Projector tower simulation shows the highest variance in being successful at the FAA Academy. One statistic that was unexpected was the use of strip boards. If participants attended CTI school and used strip boards, there was a negative variance of 20.7% on the success rate at the FAA academy. This could be due to the modernization of the air traffic control system and the limited area of truly non-radar locations across the national airspace system (NAS). Using strip boards and learning non-radar

procedures while valuable in emergencies, on a day-to-day operation are seldom used these days. Instead controllers typically use a "one in, one out policy" which means once one aircraft is cleared into or out of an airport that airport is shut down until notification is received that the aircraft has landed or is in radar contact.

Although there was no significance noted when examining the tools used versus the first facility the statistical results point out interesting findings. This being that projector tower simulator use is only beneficial at the FAA academy. Upon arrival at their first facility, the variance of success for developmental trainees turns to a negative 21.1% (Table 22) and those who used a table top (with model airplanes) increases the variance to 87.6% at their first facility from 20.7% at the FAA Academy.

The fourth area of significance comes from research question four where a chi square test showed that if developmental trainees had a pilot certificate they were 8.7 times more likely to succeed at the FAA Academy. For the purpose of this study, a pilot's certificate was noted as those participants who obtained a Student Pilot, Sport Pilot, Recreational Pilot, Private Pilot, Commercial Pilot, Airline Transport Pilot – ATP, Certified Flight Instructor – CFI, Certified Instrument Instructor - CFII, or a Multi-Engine Instructor – MEI. This indicates that CTI programs that require flight training in its program would be desirable for FAA applicants.

Non-Significant Results

While the significant results provide a window into which Collegiate Training Initiative (CTI) courses, labs, and training aids provide the most success in the FAA, the lack of significance can also provide interesting clues.

When examining the success rate in training, the multiple regression test shows that those participants who used a desktop computer as a training aid had a decrease in success. The variance of success changed from 1.2% at the FAA Academy to negative 59.9% in their first facility. This statistic shows that desktop computers don't benefit any potential air traffic developmental trainees in their training success.

While having an instrument rating did not lend any statistical significance, the number of participants with an instrument rating (n=23) was rather low and a higher sample would provide a better statistical test.

All of the tests done in this study including future studies would allow the CTI approved schools to tailor their individual programs the way each school sees fit. This would provide the most competitive education with proven success rates at the FAA Academy.

Limitations

There are numerous limitations to this study which include the anonymity, voluntary and internet based survey. Due to the survey being anonymous and voluntary there was no control over whether or not the participant actually went to a Collegiate Training Initiative (CTI) school or whether or not the survey was only taken once by each participant. Also, not all the participants answered each question so the sample size was reduced for each research question. The limitations described above could be negated by using de-identified data already collected by the FAA and/or CAMI. This would allow the study to have a larger sample size and ensure that each participant attended a CTI school.

Future Studies

This was the first study completed specifically looking at the training tools used by CTI schools and how they may affect the success rate at the FAA Academy, first facility, and second facility. More research into this area as a whole is warranted to ensure that CTI program schools know what training methods provide the highest success outcomes for students once employed by the FAA. Also, researching what other air navigation service providers (ANSP) use to train their applicants prior to hiring and how it affects their success in training once employed by the ANSP could further show better training tools/methods. Because other ANSP's around the world use a multitude of training methods, looking at the success rate of their training programs and the tools used could also benefit the FAA's training and CTI school training.

Recommendations for the future would be to do a study which correlate courses attended with the type of facility. Also, increasing the sample size of overall CTI graduates who participated in the research will further validate the findings of significance. Future research on training tools should be done by dividing the participants using the option in which they were hired into, to see if there is a difference in whether or not projector tower simulation helps all options or just one or two, options meaning tower, tower/TRACON, TRACON, or enroute. Because this study grouped all pilot certificates together, a future study should look at each individual certificate to discover which one has the greatest success rate. Increasing the sample size by not limiting this research questions to CTI graduates will help to gather more pilots from within the controller workforce to participate.

The FAA needs to take advantage of the CTI program to increase and enhance their pipeline of prospective applicants which in turn will reduce training cost incurred by the agency. To do this the FAA needs to start tracking CTI students from initial hiring to certification.

Conclusion

Prior to 2014, the FAA hired an applicant using a three-track method which included CTI graduates under their own track. A 2015 change created a two-track method which combined CTI hiring with applicant who have no experience. With new guidance in 2016 from the FAA allowing CTI graduates to skip any biographical questionnaire, this demonstrates the validity the FAA has for applicants who have dedicated the last two or possibly four years to learning air traffic control under a program developed by the FAA. Applicants who financed their own education found there was no benefit to them when they applied for an air traffic control position over those who had no formal training. The CTI program is a valued partner with the FAA to help educate the next generation of air traffic controllers and needs to be leveraged at its full potential of highly specialized applicants which could result in overall training savings for the FAA.

CTI schools range from two year to four year private and public colleges and institutions. The curriculum ranges from text book learning only, to a complete air traffic training curriculum under all options with high definition simulation. Being an air traffic controller is a high stakes occupation and one of the few jobs with the federal government that doesn't require a college degree to apply. The air traffic control position

should likely be re-classified as a professional position that requires educational requirements to which will enhance the level of safety for the flying public.

This research shows the value to the FAA that the CTI schools provide. Moreover, applicants that have had tower courses and tower simulation tend to have more success at the FAA Academy. Those applicants with flight training also had more success with training. The FAA should take this data and gather a larger sample size and make the necessary course corrections in their hiring and training process to provide a higher level of success to air traffic control and cost savings to the taxpayers. Having completed this research, an additional suggestion would be for continued research to be conducted not only for the enhancement of the CTI program but for academy and facility training to ensure that all future certified professional controllers (CPC) have received training with proven tools and methods to be successful in their career. Another examination at implementing a tier based system as previously discussed in the independent review panel of 2011 would be prudent, to help support the continued development and competition amongst CTI schools. This would provide the highest quality air traffic controllers in the workforce.

APPENDICES

Appendix A

IRB Approval

UNIVERSITY OF NORTH DAKOTA

DIVISION OF RESEARCH & ECONOMIC DEVELOPMENT

UND.edu

Institutional Review Board
Twamley Hall, Room 106
264 Centennial Dr Stop 7134
Grand Forks, ND 58202-7134
Phone: 701.777.4279
Fax: 701.777.6708
Email: UND.irb@research.UND.edu

February 22, 2017

Principal Investigator(s):	Stephen Robello
Project Title:	Collegiate Training Initiative: How the Type of Training Methods Provided is a Predictor of Success
IRB Project Number:	IRB-201702-229
Project Review Level:	Exempt 2
Date of IRB Approval:	02/22/2017
Expiration Date of This Approval:	02/21/2020

The application form and all included documentation for the above-referenced project have been reviewed and approved via the procedures of the University of North Dakota Institutional Review Board.

If you need to make changes to your research, you must submit a Protocol Change Request Form to the IRB for approval. No changes to approved research may take place without prior IRB approval.

This project has been approved for 3 years, as permitted by UND IRB policies for exempt research. You have approval for this project through the above-listed expiration date. When this research is completed, please submit a Termination Form to the IRB.

The forms to assist you in filing your project termination, adverse event/unanticipated problem, protocol change, etc. may be accessed on the IRB website: http://und.edu/research/resources/human-subjects/

Sincerely,

Michelle L. Bowles, M.P.A., CIP
IRB Coordinator

MLB/sb

Cc: Terra Jorgenson, M.S.

Appendix B

Acronyms

ABSR	Abstract Reasoning Test
ANSP	Air Navigation Service Provider
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCS	Air Traffic Control Specialist
AT-CTI	Air Traffic – Collegiate Training Initiative
ATSA	Air Traffic Control Specialist Skills Assessment Battery
ATSAT	Air Traffic Standardization Aptitude Test
B	Beta Coefficient
β	"beta" – Type II error or power of the test
CAMI	Civil Aero Medical Institute
CPC	Certified Professional Controller
CTI	Collegiate Training Initiative
df	Degrees of Freedom
FAA	Federal Aviation Administration
FOIA	Freedom of Information Act
FPL	Full Performance Level
FY	Fiscal Year
GAO	Government Accountability Board
HRPM	Human Resource Policy Manual
IRB	Institutional Review Board

MARC	Mid-American Aviation Resource Consortium
MnATCTC	Minnesota Air Traffic Control Training Center
MCAT	Multiplex 8 Controller Aptitude Test
n	Number of members/participants in a sample or population
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
OKC	Oklahoma City
OKT	Occupational Knowledge Test
OPM	Office of Personnel Management
OR	Odds Ratio
PATCO	Professional Air Traffic Controllers Organization
SE	Standard Error
TOL	Temporary Offer Letter
TRACON	Terminal Radar Approach Control Facility
VRA	Veterans Recruitment Appointment

Appendix C

Definitions

Air Traffic Controller - Air traffic controllers coordinate the movement of air traffic to ensure that aircraft stay safe distances apart. Air traffic controllers work in control towers, approach control facilities, or route centers. ("Air Traffic Controllers : Occupational Outlook Handbook: : U.S. Bureau of Labor Statistics," n.d.)

AT-CTI – Air Traffic Collegiate Training Initiative - Air traffic controller training certified schools maintained under title 49 U.S.C. § 44506(c)(1) (Federal Aviation Administration, 2016b)

ATSA – Air Traffic Control Specialist Skills Assessment Battery - Multiple tests that measure cognitive abilities and personal characteristics shown empirically to predict success as an ATCS, including mathematical ability, decision-making ability, spatial information comprehension, working memory, sustained attention object projection, perceptual speed and accuracy, and planning, among others. (Federal Aviation Administration, 2016b)

Biographical Assessment - An assessment used to identify those candidates who have the highest probability of reaching final controller certification by measuring ATCS job applicant characteristics that have been shown empirically to predict success as an ATCS in the FAA. The Biographical Assessment measures an applicant's education, academic achievement, aviation-related experience, and prior air traffic control-related experience and achievement orientation. The assessment was professionally developed and validated based upon years of extensive research of the ATCS occupation in accordance with relevant professional standards and legal guidelines for pre-employment selection testing. (Federal Aviation Administration, 2016b)

Collegiate Training Initiative (CTI) Eligible: One of four types of applicants eligible for Pool 1 defined by 49 USC § 44506(f)(1)(B) that includes individuals who have successfully completed air traffic controller training and graduated from an institution participating in a CTI program maintained under title 49 U.S.C. § 44506(c)(1) and who have received one of the following from the institution (Federal Aviation Administration, 2016b):

- An appropriate recommendation
- A written statement certifying that the individual would have met the requirements in effect as of December 31, 2013, for an appropriate recommendation

Eligible Applicants: Applicants who meet minimum qualifications and all other eligibility requirements (e.g., citizenship, maximum entry age, Selective Service Registration). Such applicants must also meet additional eligibility criteria and, in some cases testing requirements, that pertain to the category and pool for which they are applying. (Federal Aviation Administration, 2016b)

EXP(B): The label that SPSS applies to the odds ratio

Odds Ratio: The ratio of the odds of an event occurring in one group compared to another.

Other Eligible Veterans: One of four types of applicants eligible for Pool 1 defined by 49 USC § 44506(f)(1)(B)(ii)(III) that includes certain veterans as defined in 38 U.S.C. § 4211 who are maintaining aviation experience obtained in the course of the individual's military experience. Specifically, this is a person who falls into one of the following categories (Federal Aviation Administration, 2016b):

- Served on active duty for a period of more than 180 days and was discharged or released therefrom with other than a dishonorable discharge
- Was discharged or released from active duty because of a service-connected disability
- As a member of a reserve component under an order to active duty pursuant to 10 U.S.C. §§ 12301(a), (d), or (g), 12302, or 12304, served on active duty during a period of war or in a campaign or expedition for which a campaign badge is authorized and was discharged or released from such duty with other than a dishonorable discharge
- Was discharged or released from active duty by reason of a sole survivorship discharge (as that term is defined in 10 U.S.C. § 1174(i))

Pools: Groupings of candidates defined by 49 USC § 44506(f)(1)(B). (Federal Aviation Administration, 2016b)

Preference Eligible Veterans: One of four types of applicants eligible for Pool 1 defined by 49 USC § 44506(f)(1)(B) that includes a veteran, or the spouse, unmarried widow or widower, or parent of a veteran, who meets the definition of preference eligible as defined in 5 U.S.C. § 2108. For more information on veterans' preference, see EMP-1.12, Employment of Veterans and Service Members. (Federal Aviation Administration, 2016b)

Preferential Consideration: The process whereby the FAA, based on its annual hiring targets, refers experienced applicants as defined by 49 USC § 44506(f)(1)(A) for appointment, before considering entry-level applicants. (Federal Aviation Administration, 2016b)

Veterans Recruitment Appointment (VRA) Eligible: One of four types of applicants eligible for Pool 1 defined by 49 USC § 44506(f)(1)(B) that includes individuals who are eligible for a veterans recruitment appointment pursuant to 38 U.S.C. § 4214 and who provide a Certificate of Release or Discharge from Active Duty within 120 days of the vacancy announcement closing date or cut-off date. (Federal Aviation Administration, 2016b)

Appendix D

E-mail to Contacts to distribute to CTI Graduates

Dear CTI Graduate:

I am writing to you to request your participation in a brief survey for the completion of my master's degree at the University of North Dakota. The purpose of this survey is to research the training methods used at CTI schools and how it is a predictor to success in training once employed by the FAA.

You will be presented with some survey questions about the type of training you received while at your CTI School. Following that, you will be asked about your training in the Federal Aviation Administration. The data collection process is anonymous and your responses will remain confidential.

I appreciate your willingness to participate and value your feedback. My hope is this survey will help better identify the types of training methods/tools used by CTI schools, that provide the highest percentage of success in air traffic controller training.

This research is being undertaken in compliance with the University of North Dakota's Institutional Review Board.

If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at (701) 777-4279. You may also call that number with problems, complaints, or concerns about the research. Please call this number if you cannot reach research staff, or you wish to talk with someone who is an informed individual who is independent of the research team.

To begin, please click the survey URL below:

Survey URL:
https://und.qualtrics.com/SE/?SID=SV_bkAPy3J2NbzsWuF

Your response and time is greatly appreciated. Thank you!

Sincerely,

Stephen Robello
University of North Dakota Graduate Student
Researcher

Appendix E

Social Media Post

Air Traffic Control Grads!!! Can you help a fellow alumnus out?

This survey is being administered for the completion of a graduate student's master's thesis at the University of North Dakota. It is designed to research the training methods used at CTI schools and how it is a predictor to success in training once employed by the FAA. The information gathered will help to understand what types of training tools and requirements provide the most successful outcome in training.

You will be presented with some survey questions about the type of training you received while at your CTI School. Following that, you will be asked about your training in the Federal Aviation Administration. The data collection process is anonymous and your responses will remain confidential.

Participation in this survey is voluntary.

This research is being undertaken in compliance with the University of North Dakota's Institutional Review Board.

Please feel free to forward this survey link to any other CTI graduates you would like.

Click on the survey link below to begin the survey:

https://und.qualtrics.com/SE/?SID=SV_bkAPy3J2NbzsWuF

Appendix F

CTI Survey

Consent Form

Purpose of the Study: The purpose of this research study is see how the type training provided from CTI schools affects the outcome in training once employed by the Federal Aviation Administration.

Procedures to be followed: You will be presented with some survey questions about the type of training you received while at your CTI School. Following that, you will be asked about your training in the Federal Aviation Administration. The data collection process is anonymous and your responses will remain confidential

Risks: There are no risks in participating in this research beyond those experienced in everyday life.

Benefits: There are no known benefits to your participation other than knowing you have contributed to the advancement of scientific knowledge.

Duration: The duration of this is anticipated to take approximately 5-10 minutes.

Statement of Confidentiality: The survey does not ask for any information that would identify who the responses belong to. Therefore, your responses are recorded anonymously. If this research is published, no information that would identify you will be included since your name is in no way linked to your responses. However, given that the surveys can be completed from any computer (e.g., personal, work, school), we are unable to guarantee the security of the computer on which you choose to enter your responses. As a participant in our study, we want you to be aware that certain "key logging" software programs exist that can be used to track or capture data that you enter and/or websites that you visit.

Right to Ask Questions: The researcher conducting this study is Stephen Robello. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact Stephen Robello at 701-777-6587 during the day or Terra Jorgenson, Advisor at 701-777-6587. If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at (701) 777-4279. You may also call this number with problems, complaints, or concerns about the research. Please call this number if you cannot reach

research staff, or you wish to talk with someone who is an informed individual who is independent of the research team. General information about being a research subject can be found on the Institutional Review Board website "Information for Research Participants" http://und.edu/research/resources/human-subjects/research-participants.cfm

Compensation: You will not receive compensation for your participation

Voluntary Participation: You do not have to participate in this research. You can stop your participation at any time. You may refuse to participate or choose to discontinue participation at any time without losing any benefits to which you are otherwise entitled. You do not have to answer any questions you do not want to answer.

ELECTRONIC CONSENT: Please select your choice below. You may print a copy of this consent form for your records. Clicking on the "Agree" button indicates that:
- You have read the above information
- You voluntarily agree to participate
- You are 18 years of age or older

❍ Agree
❍ Disagree

Survey:
Did you attend a CTI school prior to being hired by the FAA?
❍ Yes
❍ No

Did you graduate prior to attending the FAA Academy?
❍ Yes
❍ No

Was there a class on tower procedures that you completed, as part of your degree requirements?
❍ Yes
❍ No

Was there a class on non-radar procedures that you completed, as part of your degree requirements?
❍ Yes
❍ No

Was there a class on radar procedures that you completed, as part of your degree requirements?

- ❍ Yes
- ❍ No

As part of your tower procedures course was there a lab required?

- ❍ Yes
- ❍ No

As part of your non-radar procedures course was there a lab required?

- ❍ Yes
- ❍ No

As part of your radar procedures course was there a lab required?

- ❍ Yes
- ❍ No

What type of simulation did you use in your labs?

- ❑ Projector Tower Simulation (270 deg., 360 deg., etc.)
- ❑ Table Top (with model airplanes)
- ❑ Desktop Computer Simulator
- ❑ Strip Boards (Non-Radar)
- ❑ Other (Please describe) _____

Were you required to take a flight course at your CTI school to graduate?

- ❍ Yes
- ❍ No

Were you required to obtain a pilots certificate?

- ❍ Yes
- ❍ No
- ❍ No, but I obtained one

What pilot certificates did you obtain?

- ❑ Student Pilot
- ❑ Sport Pilot
- ❑ Recreational Pilot
- ❑ Private Pilot
- ❑ Commercial Pilot
- ❑ Airline Transport Pilot - ATP
- ❑ Certified Flight Instructor - CFI

What pilot ratings did you obtain?

- ❑ Instrument
- ❑ Multi-Engine
- ❑ Seaplane
- ❑ Helicopter
- ❑ Instrument Instructor - CFII
- ❑ Multi-Engine Instructor - MEI

When you were hired which air traffic specialty were you placed into?

- ❍ Tower
- ❍ Tower/TRACON
- ❍ TRACON
- ❍ Enroute

Did you pass Oklahoma City Training?

- ❍ Yes
- ❍ No

What was the level of your first facility?

- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9
- ❍ 10
- ❍ 11
- ❍ 12

Did you successfully attain full certification at your first facility? (i.e. CPC, FPL)

- ❍ Yes
- ❍ No

What type of facility were you relocated to?

- ❍ Tower
- ❍ Tower/TRACON
- ❍ TRACON
- ❍ Enroute
- ❍ Separated from the FAA

What level facility were you relocated to?

- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9
- ❍ 10
- ❍ 11
- ❍ 12

Did you successfully attain full certification at your second facility? (i.e. CPC, FPL)

- ❍ Yes
- ❍ No

Appendix G

Variable List

Variable Name	Variable Description	Values
TOWER_COURSE	Was a tower procedures class a degree requirement	0 - No 1 - Yes
NON_RADAR_COURSE	Was a non-radar procedures class a degree requirement	0 - No 1 - Yes
RADAR_COURSE	Was a radar procedures class a degree requirement	0 - No 1 - Yes
TOWER_LAB	Was a tower lab required as part of tower class	0 - No 1 - Yes
NON_RADAR_LAB	Was a non-radar lab required as part of non-radar class	0 - No 1 - Yes
RADAR_LAB	Was a radar lab required as part of radar class	0 - No 1 - Yes
PROJECTOR_TWR_SIM	Projector Tower Simulator	0 - No 1 - Yes
TABLE_TOP	Table Top (with Model Airplanes)	0 - No 1 - Yes
DESKTOP_COMPUTER	Desktop Computer Simulator	0 - No 1 - Yes
STRIP_BOARDS	Strip Boards (non-radar)	0 - No 1 - Yes
PILOT_CERTIFICATE	Did the participant have a pilot's certificate	0 - No 1 - Yes
INSTRUMENT_RATING	Did the participant have an instrument rating	0 - No 1 - Yes
ACADEMY_SUCCESS	OKC Training Pass/Fail Status	0 - No 1 - Yes
FIRST_FACILITY	Did the participant attain full certification	0 - No 1 - Yes
SECOND_FACILITY	Did the participant attain full certification	0 - No 1 - Yes

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