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Increased Flight Time Requirements of Public Law 111-216: Unnecessary for Collegiate-Trained Aviators?

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INCREASED FLIGHT TIME REQUIREMENTS OF PUBLIC LAW
111-216: UNNECESSARY FOR COLLEGIATE-TRAINED AVIATORS?

by

Eric Hewitt Basile
Bachelor of Science, Southern Illinois University Carbondale, 2001

An Independent Study

Submitted to the Graduate Faculty

of the

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for the degree of

Master of Science

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This independent study, submitted by Eric Basile 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 Advisor under whom the work has been done, and is hereby approved.

(Advisor)

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ABSTRACT

Experience standards for pilot certification are typically established with the objective of ensuring aviation safety. Public Law 111-216 requires all airline pilots in the US to have an Airline Transport Pilot (ATP) certificate by August, 2013. A pending proposal from the FAA would permit graduates of accredited, four-year collegiate aviation programs to obtain a restricted ATP certificate with 1,000 hours of flight time. Concern has been expressed that the 1,000 hour minimum for collegiate program graduates is arbitrary, excessive, and poorly justified, in light of the extensive, structured academic training provided by these institutions. This paper reviews existing literature on pilot performance in the regional airline environment to determine if the 1,000 hour standard is supported by objective evidence. Research suggests there is little objective difference in the technical and non-technical performance of low-time versus high-time pilots in the regional airline environment. Several studies also indicate collegiate aviation program graduates with less than 1,000 hours achieve significantly better outcomes in regional airline pilot training than more experienced trainees. Lastly, analysis of accident data suggests a mandated increase in required flight time for first officers will have little substantive impact in preventing airline accidents. Several changes are recommended to realign the FAA's proposed standard with existing literature and expert recommendations. Avenues for future investigation are also discussed.

CHAPTER I

INTRODUCTION

The amount of flight experience necessary to safely serve as a regional airline first officer in the United States is presently the subject of much debate. The development of smaller, advanced regional airliners has allowed for increased frequency and expansion of service to smaller communities. However, consolidation, changes in consumer travel habits, and economic pressures have altered the business models of the airline industry within the past 10 to 15 years (Air Line Pilots Association, International [ALPA], 2009). This business transformation has also led to a shift in the qualification and experience level of many individuals employed as airline pilots in the United States (ALPA, 2009; Coalition of Airline Pilot Associations [CAPA], 2012). Historical career progression for individuals desiring a commercial airline career once included several years and several thousand hours of experience accumulated through flight instruction, flying cargo in small aircraft, and flying small turboprop feeder aircraft before achieving airline employment (“First Officer Qualifications,” 2010; CAPA, 2012).

In an effort to remain competitive and control ever-rising costs, most major airlines have contracted out a significant portion of their routes, outsourcing flying to regional airlines flying smaller, more fuel-efficient aircraft. Today, over 50% of all airline flights in the US are operated by regional airlines (CAPA, 2012). The competitive nature of regional airline contracts with their major airline partners creates continuous

financial pressure for regional carriers to control expenses. Accordingly, pilot compensation at these airlines is well below that of major airline levels (Scovel, 2010; ALPA, 2009; CAPA, 2012).

Highly experienced pilots are generally unwilling to accept the low pay, schedule, and working conditions typical of the regional airline environment (CAPA, 2012). This has resulted in regional airlines predominantly recruiting lower experienced pilots willing to accept these job conditions. In essence, the regional airline industry has become an entry-level position following initial flight training, and individuals are hired to fly advanced, high performance turbojet aircraft with significantly less flight experience than is generally required for employment at a major airline (ALPA, 2009; CAPA, 2012; "First Officer Qualifications," 2010). At present, airline captains must hold an Airline Transport Pilot, or ATP, certificate, which requires a minimum of 1,500 hours of flight time (Dillingham, 2011). First officers need only hold a Commercial Pilot certificate, which, depending on the training program selected by the pilot, can be obtained with as little as 190-250 hours of flight time (Dillingham, 2011).

In practice, regional airlines generally require newly hired first officers to have additional experience beyond the minimum regulatory flight hours required to obtain a commercial pilot certificate (Dillingham, 2012). The amount of flight time necessary for employment at a regional airline varies with the cyclical dynamics of the airline industry (Fanjoy, Young, & Suckow, 2006), as well as that airline's ability to attract sufficient numbers of applicants for open positions. In times of economic growth with significant demand for additional pilots, regional airlines have been known to hire crewmembers

with significantly less than 1,000 hours of flight time (Fanjoy et al., 2006; Boss, 2012).

Beckman and Barber (2007) noted that, at the time of their research, five of six regional airlines reviewed had minimum pilot hiring standards of only 500 hours total time.

There is dispute whether the recruitment of commercial pilots with lower flight experience has made airline travel less safe. Pilot labor groups such as ALPA and CAPA, both of whom primarily represent pilots at major airlines affected by the shift to regional airline flying, argue that employment of regional airline pilots with fewer flight hours has reduced safety margins (ALPA, 2009; CAPA, 2012). However, regional airlines point to the fact that their flight operations and training are conducted under the same regulatory standards as major airlines. Moreover, pilots hired at regional airlines undergo a rigorous interview process, must complete the airline's academic and simulator training program, and complete a period of Initial Operating Experience (IOE) under the supervision of an experienced check pilot (Regional Airline Association, 2012). During line flight operations, first officers share the flight deck with a more experienced captain, who retains overall responsibility for the flight's conduct. This allows a more experienced pilot to provide guidance, mentoring, and knowledge transfer to the first officer.

However, the February, 2009 crash of Colgan Airlines flight 3407, a regional turboprop airliner approaching Buffalo, NY, has become a catalyst for the debate over minimum first officer experience standards. Investigation of that accident by the National Transportation Safety Board [NTSB] (2010) determined both pilots failed to monitor a reduction in airspeed and improperly responded to an aerodynamic stall. The

NTSB also highlighted the failure of the pilots to adhere to sterile cockpit procedures, as well as the captain's failure to effectively manage the flight. Public release of the cockpit voice recorder transcript and research into the flight crew's background also exposed additional concerning details regarding the captain's history of numerous certification checkride failures both prior to and during his airline employment, as well as the crew's lack of experience in winter flying conditions (NTSB, 2010).

Subsequent to the Colgan accident, passenger advocates, major airline labor groups, and others expressed concern regarding qualifications and flight experience requirements for commercial airline first officers. Specifically, it was argued that the minimum pilot certification for airline employment had become insufficient to meet the operational and environmental challenges of regional airline flying (CAPA, 2012). Advocates also point to a series of other regional airline accidents that, in their view, provide evidence of a breakdown in professionalism and safety culture within the regional airline segment that began well before the Colgan 3407 accident occurred. According to these advocates, these issues could be remedied through requiring an increase in flight time, among other changes. Indeed, during the period from 2003-2009, five of six fatal Part 121 airline accidents in the United States were operated by regional airlines. In several of these cases, poor cockpit discipline and/or lack of adherence to procedures are believed to have played a role in the accident. Table 1 depicts these accidents below.

Table 1. Fatal Part 121 airline accidents in the United States, 2003-2009. Reproduced from Scovel, 2010.

Accident Date	Regional Carrier	Accident Site	Fatalities	Contributing Factors
12-Feb-09	Colgan Air Inc (DBA Continental Connection)	Buffalo, NY	50	Pilot professionalism, training, and pilot fatigue issues.
27-Aug-06	Comair Inc (DBA Delta Connection)	Lexington, KY	49	Pilot performance, non-pertinent conversation during taxi.
19-Dec-05	Flying Boat Inc (DBA Chalks Ocean Airways)	Miami, FL	20	Deficiencies in the company's maintenance program.
19-Oct-04	Corporate Airlines (now Regions Air)	Kirksville, MO	13	Pilots' non-pertinent conversation during the flight and fatigue.
14-Oct-04	Pinnacle Airlines (DBA Northwest Airlink) repositioning flight	Jefferson City, MO	2	Pilots' deviation from standard operating procedures, and poor airmanship.
8-Jan-03	Air Midwest (DBA US Airways Express)	Charlotte, NC	21	Deficiencies in company's oversight of outsourced maintenance.

Within only five months of the Colgan 3407 accident, initial legislation was introduced in Congress to ostensibly address many of the recruitment, training, and experience concerns exposed during the accident's preliminary investigation. The rush to implement legislation was fueled by a swift public outcry at the loss of life, and damaging revelations about the accident crew's perceived lack of experience. United States Representative Jerry Costello of Illinois, then Chairman of the House Aviation Subcommittee, stated "we will not wait for rulemaking" ("The Federal Aviation Administration's Call to Action," 2009, p. 110). The families of the accident victims were also unusually vocal in seeking public support for changes to the regional airline industry, both in Congressional testimony and through the media ("Families of Continental Flight 3407," n.d.; Young, 2010).

It is unclear to what extent Congress considered academic research and expert opinion regarding an appropriate level of experience to function as a first officer in the regional airline environment. Representatives from major airline pilot unions and the Colgan 3407 victims' families forcefully argued that 1,500 hours and an ATP are now necessary for first officers entering the airline profession ("Regional Air Carriers," 2009; "The Federal Aviation Administration's Call to Action," 2009).

In August, 2010, President Obama signed the Airline Safety and Federal Aviation Administration Extension Act of 2010, also known as Public Law 111-216. Section 216 of the legislation required that *all* airline pilots, not just captains, must hold an ATP certificate within three years of the law's passage. Section 217 of the Act further directed the FAA to establish rulemaking to modify the experience requirements to obtain an ATP certificate (Airline Safety and Federal Aviation Administration Extension Act of 2010, 2010).

Notably, Section 217 contains a provision allowing the FAA to grant credit against the 1,500 hour flight time requirement of the ATP certificate for specific academic training courses. This credit is permitted so long as the academic training is judged by the FAA to provide greater additional safety than simply accumulating an equivalent amount of flight hours (Airline Safety and Federal Aviation Administration Extension Act of 2010, 2010). The FAA has since proposed that graduates of accredited, four-year collegiate aviation programs may obtain a restricted ATP certificate with 1,000 hours of flight experience (Federal Aviation Administration, 2012). Details of the proposed regulations are shown in Table 2.

Table 2. Current and Proposed Regulatory Requirements for Airline Transport Pilot Certification. Reproduced from FAA, 2012.

Scenario	Current regulations	Proposed regulations
Receive an ATP certificate with airplane category and multiengine class rating.	Be at least 23 years old, hold a commercial pilot certificate with instrument rating, pass a knowledge test and practical test, and have at least 1,500 hours total time as a pilot.	Meet all of the requirements in the current regulations, successfully complete a new ATP Certification Training Program before taking the ATP knowledge test, and have a minimum of 50 hours in class of airplane.
Receive an ATP certificate with restricted privileges (multiengine class rating only).	None	Be at least 21 years old, hold a commercial pilot certificate with instrument rating, successfully complete a new ATP Certification Training Program, pass ATP knowledge and practical tests, and for military pilots, have a minimum of 750 hours total time as a pilot, or for a graduate of an aviation degree program, have a minimum of 1,000 hours total time as a pilot.
Serve as a second in command (first officer) in part 121 air carrier operations.	Hold a commercial pilot certificate with appropriate category and class ratings and an instrument rating.	Hold an ATP certificate with appropriate aircraft type rating OR Hold an ATP certificate with restricted privileges and an appropriate aircraft type rating.
Serve as pilot in command (captain) in part 121 air carrier operations.	Hold an ATP certificate with appropriate aircraft type rating and have at least 1,500 hours of total time as a pilot.	Meet all of the requirements in the current regulations and have a minimum of 1,000 flight hours in air carrier operations (as an SIC in part 121 operations, a PIC in operations under either § 135.243(a)(1) or § 91.1053(a)(2)(i), or any combination thereof).

Statement of the Problem

Significant concern exists that the 1,000 hour threshold for issuance of a restricted ATP certificate to collegiate aviation graduates is excessive, arbitrary, and poorly justified, in light of the extensive, structured academic training provided by these institutions. The proposed rule would require collegiate program graduates to accumulate as much as four times more flight experience than presently required before becoming eligible for airline employment.

The requirement for greater flight hours places an unnecessary burden on collegiate-trained aviators, dramatically increasing the financial costs and time commitment involved in seeking an airline career. The proposal also does little to improve the quality of flight experience gained by prospective airline pilots. Instead, it forces these individuals to acquire an arbitrary number of flight hours by any means possible. Most opportunities to build flight time afford little transferable skill to airline

flight operations. Finally, the proposal appears to give little consideration to academic research suggesting that collegiate-trained aviators already perform safely and professionally in the airline environment with less than 1,000 hours of flight time.

Purpose of the Study

The purpose of this paper is to review the existing literature on pilot performance in the regional airline environment, as well as accident data, to determine if the 1,000 hour standard for collegiate aviation graduates is supported by objective evidence.

Significance of the Study

Pilot training facilities in the United States have, for decades, been able to adequately supply the airline industry with thousands of safe, well-trained pilots. Aviation training programs administered by universities and colleges represent a significant portion of the US pilot training capacity, and afford students an opportunity to receive comprehensive aviation education while simultaneously completing an associate's or baccalaureate degree.

There are likely to be substantial, wide-ranging consequences of the increased flight time requirement for collegiate aviation graduates. In the short term, currently enrolled students in collegiate aviation programs who may have expected to achieve airline employment relatively soon after graduation will likely face significant unforeseen delay and expense to achieve the increased flight time requirements.

Over the long term, there is serious concern that the high cost of flight training, low entry level pay, and limited opportunities for low-time pilots to build experience to

the 1,000 hour mark will further exacerbate enrollment decreases in collegiate aviation programs. Prospective students may look at the combined costs of the college degree and flight training, the potentially long delay and poor income before achieving airline employment, and elect to pursue a different career. In the recent past, several university-sponsored flight training programs have announced an end to further enrollments and plan to close once their currently enrolled students have graduated. Two-year collegiate aviation programs, as well as four-year programs utilizing a Part 61 curriculum, may also be potentially devastated by the proposed rule, since the rule as presently written does not extend a flight time reduction to graduates of these programs.

Research Questions

1. Does existing research support a requirement for 1,000 flight hours for graduates of four-year collegiate aviation programs?
2. Considering existing research, what changes should be made to the proposed rule with respect to treatment of collegiate-trained aviators?

CHAPTER II

REVIEW OF LITERATURE

The minimum credential presently required for employment as an airline first officer is a Commercial Pilot certificate. According to the FAA (2010), the Colgan 3407 accident "...focused attention on whether a commercially-rated copilot in Part 121 operations receives adequate training...to be able to recognize a potentially dangerous situation and respond in a safe and timely manner" (p. 6165). For many pilots, the majority of flight time acquired prior to airline employment is in single engine, single pilot, piston-powered aircraft. A multiengine Commercial Pilot certificate is typically obtained with an average of 10 hours of multiengine flight time, also in a piston-powered, single-pilot aircraft ("First Officer Qualifications," 2010).

However, the aircraft used in regional airline service are typically multiengine, turbine-powered, multi-pilot aircraft. Modern aircraft used by regional airlines have evolved, and operational demands have increased on pilots in high altitude and complex airline operations. Pilots must manage automation, advanced avionics and systems, information displays, and other new technologies (Dillingham, 2012).

Dillingham (2012) reviewed FAA standards for the Commercial Pilot certificate and suggests these minimum standards are not aligned with airline operations, nor do they emphasize skills that airlines consider important. For instance, the standards do not emphasize training in decision-making. Rather, the test standards for a Commercial

Pilot certificate generally emphasize the development of motor skills to master specific maneuvers and individual tasks to determine competence (Dillingham, 2012). There is no requirement for training in advanced systems such as autopilots and flight management systems typically installed on regional airline aircraft. There is also a lack of emphasis on situational awareness, understanding risk assessment, or providing a complete understanding of managing the automation of the aircraft (Dillingham, 2012).

Accordingly, some groups feel a significant gap exists between the knowledge and flight experience required to proficiently function as a first officer in Part 121 air carrier operations, and the knowledge and flight experience acquired by meeting the minimum regulatory requirements for a Commercial Pilot certificate (“First Officer Qualifications,” 2010). ALPA claims:

Low-experience, minima-time pilots struggle to perform their flight duties proficiently. These deficiencies can impact margins of safety and place an extraordinary amount of pressure on the captain, who may also have limited experience and find it difficult to instruct and mentor the first officer while performing other requisite duties (2009, p. 14).

However, while these minimum regulatory requirements may no longer be sufficient to operate proficiently as an airline first officer in today’s modern aircraft, objective evidence for the amount and type of flight experience necessary beyond the Commercial Pilot certificate has been lacking.

The Relationship Between Flight Hours, Performance, and Safety

Several studies suggest that increased pilot flight hours are associated with reduced errors, improved situational awareness and decision making, and reduction in accident risk. A significant effect has been noted for flight experience when evaluating

pilot's assessment of poor weather conditions (Wiggins & O'Hare, 2003). Other studies, however, have not determined a significant effect for either years as a pilot or the total number of hours flown, when exploring accidents in poor weather conditions (Groff & Price, 2006; O'Hare & Chalmers, 1999). Todd and Thomas (2012) and Smith, Bjerke, NewMyer, Niemczyk, and Hamilton (2010) note a great deal of the literature on pilot flight time and training performance has either focused on non-professional, general aviation pilots or military trainees.

Bazargan and Guzhva (2011) defined air transport pilots with 300-2,000 hours of total time as "newly licensed airline transport pilots," those with 2,000-5,000 hours of total time as "moderately experienced airline transport pilots," and those with 5,000 hours or more as "the most experienced pilots." The authors suggest the ratio of pilot error caused to total accidents steadily declines with pilot experience, with significant differences between experience levels. However, the sample included non-professional pilots with less than 100 total hours as well as those with 100-300 total hours. In fact, it was these groups that had the highest error rate (Bazargan & Guzhva, 2011).

When examining professional pilots and crash risk as a function of age and flight experience, Li, Baker, Grabowski, and Rebok (2001) discovered greater total time showed a significant protective effect with regard to pilot error. Pilots with fewer than 5,000 hours were twice more likely to be involved in a crash than those with greater than 5,000 hours. Crash risk stabilized once 10,000 hours of flight time had been achieved (Li et al., 2001). Furthermore, pilot error in general aviation and commuter accidents decreased as the number of ratings a pilot held increased. However, the study

consisted of data from air taxi and commuter operations, industry segments that have a 10 to 45 times higher fatal crash rate per pilot flight hour than scheduled airline service (Li et al., 2001). Therefore, this data may have overstated the crash risk for low-time airline pilots in scheduled service.

Adams (1993) evaluated characteristics of Expert Decision Making (EDM) and concluded these are enhanced as pilots accumulate flight time. It was also determined that development of EDM can be expedited by study and training, in addition to simply accumulating flight experience.

The Society of Aviation and Flight Educators [SAFE] (2012) argues there is little direct connection between the number of hours logged and a guarantee of safety. The organization cites the example of military pilots, who, with comparatively little total flight time “competently and safely fly extremely complex aircraft in highly demanding operations, including off of and back onto moving aircraft carriers, which is acknowledged as the most challenging of all aircraft operations” (p. 2). In contrast, SAFE suggests there have been numerous instances where high-time professional pilots have forgotten, become confused by, or otherwise ignored basic flight principles (2012).

Do Flight Hours Necessarily Translate to Experience?

There is considerable and vocal debate within the aviation industry as to whether the accumulation of increased flight hours guarantees a concomitant increase in experience. Todd and Thomas (2012) note that there is still a pervasive focus throughout the aviation industry on flight hours, which are frequently used as a “surrogate for competency” (p. 777). The authors contend this focus on hours attained

gives little regard to individual skill development and learning requirements. It is further argued that a misconception exists that flight hours are a perfect correlate to an individual pilot's performance, and there is an implicit suggestion that if an individual has attained the required hours to be issued a pilot certificate, they also possess the requisite skill (Todd & Thomas, 2012).

Brady, in testimony before the House Aviation Subcommittee, argued that calls for increased flight time incorrectly emphasize achievement of an arbitrary quantity of flight time, rather than the accumulation of quality flight time ("Regional Air Carriers," 2009). Brady further contends that the process of simply logging flight hours to acquire experience is inefficient, as the experience acquired occurs randomly, in a non-standard and unstructured format, and does not afford the individual an opportunity for reflection or external feedback on the correctness or incorrectness of their response ("Regional Air Carriers," 2009).

Similarly, staff at Human Capital Management and Performance, LLC (2012) suggest that flight hours are not an accurate measure of the competence of pilots. Rather, it is possible to make more accurate predictions of pilot performance through a review of an individual's education, training, and relevant experience, as well as measuring that individual's knowledge, skills, abilities, and personality traits. Education, training and work history are much better indicators of whether the pilot possesses the basic set of attributes required to be successful and took his or her professional preparation seriously. Furthermore:

Logging...hours does not ensure solid understanding of the principles of flight, the science of aviation, or the complexity of advanced avionics which allow a

pilot to correctly interpret events as they happen and take appropriate action. Hours [do] not guarantee cockpit management skills, the cognitive skills required for vigilant monitoring and situational awareness, or the personality traits that allow a person to remain calm, focused and able to pursue solutions in an emergency. *Experience builds expertise only if the candidate is equipped with the right foundation of knowledge and the right abilities and skills to support the demands of the job* [emphasis added] (Human Capital Management & Performance, LLC, 2012, p. 10).

ALPA also concedes there can be a distinction between the number of hours logged and the concept of “experience”:

A high-time pilot may, for example, be a ‘low-experience’ airline pilot if nearly all of his previous flight time has been accumulated in small, slow, single-engine aircraft. A low-time pilot may not meet the definition of a ‘low-experience’ pilot if, for example, he or she has had sufficient education, training, and flight time in transport category aircraft or simulators, and brings a very professional approach to the flight deck (2009, p. 1).

CAPA (2010) argues to the contrary, suggesting that spatial orientation, physiological factors, and situational awareness are more finely honed with additional flight time. The organization contends that increased time flying improves airmanship skills, while providing exposure to non-normal situations. CAPA further contends that “flying aircraft of any size develops airmanship skills” (2010, p. 1), and that these aeronautical skills, together with the training required for the ATP certificate, allow for a smooth and confident transition to Part 121 operations. Finally, with respect to the argument that requiring more flight time emphasizes quantity of flight time over the quality of flight time, CAPA suggests that “‘quantity’ of flight hours have a ‘quality’ of their own” (2010, p. 1), and that “every pilot has better and broader experience with more, not less flight hour experience” (2012, p. 9).

Academic Training as a Substitute for Flight Experience

There is also longstanding debate on the extent to which academic education and advanced training techniques can provide an effective substitute for actual flight hours and in-cockpit flight experience. CAPA contends while “knowledge is transferable through training, experience is not transferable” (2012, p. 4), and that aeronautical judgment is not developed through good training alone. Captain Jeff Skiles, a CAPA representative, argues the flight hours required to qualify for an ATP certificate allow a pilot the opportunity to develop judgment and critical decision making acts that simply aren't possible in a tightly controlled training environment (“The Federal Aviation Administration’s Call to Action,” 2009). CAPA has repeatedly insisted that substituting academic training for flight hours is invalid: “...no amount of theoretical or classroom-oriented study can serve as a substitute for practical experience” (CAPA, 2010, p. 5).

In contrast, Brady argues that “experience, particularly bad experience, is no substitute for quality training” (“The Federal Aviation Administration’s Call to Action,” 2010, p. 142), and that there is simply no amount of experience that can consistently and completely cover all the required knowledge, skills, and ability that quality training instills in pilots. Brady argues that not only does academic instruction enhance pilot performance, but there are certain circumstances where structured academic training is superior to operational experience. It is suggested that academic training, particularly in the collegiate training environment, can provide exposure to scenarios that are unsafe or difficult to experience in the real world:

Collegiate instructional devices allow pilots to systematically and comprehensively encounter ‘experience’ that is often missed during operational

flying. For example, the Contaminated Airfoil Training Aid developed and used at some colleges/universities allows pilots to experience what it feels like to touch light frost and different types and quantity of ice accretion on airfoils. Many ATP-certified pilots have never actually touched contamination on an airfoil. Similarly, AABI collegiate programs put pilots through high altitude laboratories to experience the effects of loss of cognitive functions due to pressure loss. Virtual flight decks are used in crew environments to simulate emergency diversions, fuel jettisoning, and ATC coordination while reprogramming flight management systems and operating at different levels of automation. Pilots are able to experience departure from controlled flight in simulators that represent high-inertia transport-category aircraft. It is highly, highly doubtful that many ATP-certified pilots have come across such experiences during operational flight (“The Federal Aviation Administration’s Call to Action,” 2009, pp. 142-143).

Furthermore, Brady contends that simulations and training can be efficiently used to meet carefully-orchestrated learning objectives, instead of relying on random events that may or may not be encountered as an individual attempts to accumulate flight hours. It is simply not realistic to expect time-building pilots to experience real aircraft malfunctions, physiological problems, and encounters with poor weather conditions to the degree of control and learning value that can be produced in collegiate flight programs. Moreover, if pilots actually do experience such situations during time-building, they will often use incorrect methods for dealing with the situation because of the unstructured context of the situation (“The Federal Aviation Administration’s Call to Action,” 2009).

This argument is also largely shared by the Regional Airline Association, which contends that while experience in the air provides an important learning benefit, experience can also be acquired through a solid academic education and scenario-based training in modern simulators and flight training devices:

The most serious problem with a heavy training dependence on experience in the air is that experience comes along in its own time and at its own pace

and there are far from guarantees that the conditions required to gain particular required pieces of experience will present themselves and be learned in a regularly reproducible schedule or fashion. It is also very hard in an experience-based training environment to ensure standardization of the lessons being taught and of the learning that results, as well as to ensure training program safety (“First Officer Qualifications,” 2010, p. 72).

Low-time vs. High-time Regional Airline Pilot Performance

Given the relative lack of research comparing low-time professional pilot flight hours to flight performance, and in light of accusations that low-time pilots do not possess the requisite experience to function safely in the regional airline environment, Todd and Thomas (2012) attempted to discern whether there are any systematic performance differences between low-time and high-time pilots in regional airline operations.

The study was conducted at an airline conducting short haul jet operations in Australia and used trained observers in the cockpit to observe pilot performance and flight parameters. 287 flight segments were analyzed. Flights ranged from 30 minutes to 5 hours, including day and night conditions, and were selected to provide a representative sample of the airline’s normal route structure. First officers were grouped into those possessing more than 1,500 hours and those with less than 1,500 hours. The 1,500 hour mark was selected since that number has been proposed as a minimum threshold in the US and Australia (Todd & Thomas, 2012). Captains, meanwhile, were grouped into those with more than 5,000 hours and those with less. Observers were blind to the flight hour experience of the pilots at the beginning of the flight. Both technical and non-technical measures were evaluated during flight operations, with the hypothesis that more experienced pilots would demonstrate better

performance in both areas (Todd & Thomas, 2012). Three measures were recorded: individual pilot adherence to stabilized approach criteria, crew non-technical performance, and individual pilot threat and error management.

Individual pilot technical performance was rated against adherence to stabilized approach criteria during approach and landing. This area was selected as it is one of the few periods in flight when the pilot will manually fly the aircraft, rather than use automated systems. Further, unstabilized approaches are frequent factors in approach-and-landing accidents (Todd & Thomas, 2012). The pilot manipulating the controls was measured against six stabilized approach criteria developed by the Flight Safety Foundation at both the 1,000 ft. AFE [above field elevation] and 500 ft. AFE points on approach.

Non-technical areas of crew performance were evaluated in four areas: communication, situational awareness, task management, and decision making. Each of these criteria were further subdivided into a total of 16 subsections. The crew was rated on a scale from 1 (poor) to 4 (outstanding) on each of the performance criteria during five phases of flight: pre-departure; takeoff; cruise; descent, approach, and landing; and taxi.

Finally, crews were also evaluated using the Threat and Error Management (TEM) model. Crews were measured on items such as the proportion of threats effectively managed; proportion of threats that were inconsequential; number of errors made; proportion of errors effectively managed; and proportion of errors that were inconsequential. During the 287 observed flight segments, 845 threats and 811 errors

were noted. These findings are “in line with typical observations of normal commercial flight operations” (Todd & Thomas, 2012, p. 779). Among the most frequent threats were those involving adverse weather, air traffic control requirements and ground handling events. The most common errors involved aircraft handling, management of aircraft systems and instruments, and management of aircraft automation (Todd & Thomas, 2012).

The study found no statistically significant differences between low-time and high-time pilots on the flight performance measure or the TEM measures. A minor effect of increased first officer experience was noted on two of the 16 non-technical skills measures; crews with low-time first officers and low-time captains rated lower on cooperation, and crews with high-time captains and low-time first officers rated lower on monitoring and cross-check. However, the authors note these were the only two differences in a large array of assessment, as well as the fact that the differences in scores were small (Todd & Thomas, 2012).

First officers with fewer than 1,500 hours were also found to keep the autopilot engaged until a significantly lower altitude than those with greater than 1,500 hours. Several explanations are postulated for this behavior: low-time first officers, not yet having developed “expert” performance, may keep the autopilot engaged longer to free up cognitive capacity for other tasks in the flight deck. Conversely, more experienced first officers may disengage the autopilot sooner, as their greater experience and expertise affords a lower level of cognitive load. Also, more experienced first officers may desire additional hand-flying opportunities to prepare themselves for upgrade to a

captain position. The difference in autopilot disconnect altitude, while interesting, was not felt to have an effect on the safety of flight in either case (Todd & Thomas, 2012).

Overall, Todd and Thomas (2012) conclude there is no evidence that low-time first officers are systematically different or less able in performance when compared to more experienced colleagues, despite public discussion to the contrary. Notably, this study did not isolate the educational or flight training background of the pilots involved. Instead, conclusions drawn were merely on the basis of logged flight time.

Characteristics of Successful Regional Airline Pilots

Research by Fanjoy et al. (2006) also lends credence to the argument that an individual's flight hours, considered in isolation, are not as important as other individual characteristics in the airline environment. While operators want to hire the most experienced aviators, "high flight time and number of FAA ratings are only part of the equation" (Fanjoy et al., 2006, p. 1) The authors performed a survey of regional airline flight operations executives in the United States to identify the qualities felt to be most significantly associated with an individual pilot's success in the airline recruitment and training process. Scores were assigned to traits using a scale of 1 (low) to 5 (high.)

In order, the traits considered to be "highly important" were characterized as: trainability (4.8), being a team player (4.7), good Crew Resource Management [CRM] skills (4.5), and recent flight experience (4.2). A college education is felt to be only "moderately important," (3.9), yet is valued more than total flight time (3.2) (Fanjoy et al., 2006). That total flight time was ranked well below numerous other characteristics suggests regional airlines perceive an individual's personality and attitudinal

characteristics are more directly associated with successful mastery of the knowledge and skill set required for regional airline flying than the number of flight hours logged.

Performance of Collegiate-Trained Pilots

Considerable anecdotal evidence exists that collegiate-trained pilots are better prepared and more proficient than non-collegiate pilots when entering regional airline employment. College-educated candidates are presumed to possess the ability to study, understand, and apply training material during the airlines' rigorous indoctrination program more easily than those without degrees. A majority of regional airline representatives interviewed by Dillingham (2011) stated they strongly prefer, but do not require, first officer candidates trained in collegiate aviation schools because they perform better in training. Conversely, it is felt that the lack of oversight and variability of educational content at non-collegiate flight training providers means these sources are less likely to produce first officers that are immediately prepared to succeed in an airline environment (Dillingham, 2011). ALPA contends "...an accredited university's academic program will very likely be more in-depth on the knowledge requirements currently outlined in the regulations, provide more up-to-date instruction on technology, operations, and the operating environment, and produce a better-rounded individual" (2010, p. 5). The Regional Airline Association agrees, stating, "...a candidate with an aviation degree is better prepared to transition to the structured training environment of an air carrier" (2010, p. 5). Among the questions posed by an Advanced Notice of Proposed Rulemaking (ANPRM) issued by the FAA in 2010 was: "Are aviation/pilot graduates from accredited aviation university degree programs likely to

have more solid academic knowledge base than other pilots hired for air carrier operations?" A review of public responses to this question by Lake (2011) reveals nearly 70% of selected respondents ($n=23$) answered in the affirmative.

Several airlines have also observed better performance and a greater breadth of knowledge from their first officers who graduated from collegiate flight programs. "It has been Cape Air's experience that the pilot candidates from AABI-accredited aviation university programs are better prepared to learn and achieve higher success than their peers from other training sources" (Cape Air, 2010, p. 2). However, this opinion is not universal. Ameristar Air Cargo contends their experience with graduates from university programs "...has not shown any advantages over pilots that have had a solid foundation in either a one or two-pilot crewed aircraft operating under part 135" (Ameristar Air Cargo, 2010, p. 3). In light of the anecdotal nature of these opinions, several studies have sought to provide a more quantitative foundation regarding the training performance of first officers in Part 121 operations.

2008 Pilot Yield Study

Cortés (2008) studied the characteristics of new hire first officers entering a regional airline's training program. The study analyzed training records for pilots ($n=452$) at one airline in the United States from 2006 to 2007. Pilot background information was correlated with subsequent success in initial training at the airline. Training success was defined by measuring the number of extra training events that a pilot required to complete the training program. The pilot background variables evaluated included an

individual's source of flight training, type of college degree completed, possession of a flight instructor (CFI) certificate, and total flight experience (Cortés, 2008).

Pilots were categorized from "best performers," or those who required no additional training, to "worst performers," or those who required more than nine additional training events. It was found that the group with the best overall success at the regional airline consisted of individuals who graduated from an AABI-accredited university flight training program, possessed a CFI certificate, and had fewer than 500 hours of total flight time. The least successful in initial training were those trained at a non-collegiate flight school (Cortés, 2008).

2010 Pilot Source Study

Expanding on the results of Cortés' work, researchers from seven universities analyzed the training performance of new-hire pilots ($n=2156$) at six regional air carriers from 2005-2009 (Smith et al., 2010). The study aimed to examine the characteristics of regional airline pilots hired during that time period, and identify any characteristics that may have a significant predictive ability in forecasting an individual's success in airline pilot training. A wide variety of demographic data were gathered for the subject pilots, including: year hired, college degree, type of degree, whether the institution was an AABI-accredited aviation program, military background, where the pilot received advanced (beyond private pilot) training, whether the pilot had previous experience as a flight instructor, total flight hours at the time of indoctrination, and previous experience as a corporate or airline pilot. Two outcome variables were evaluated: first, whether the pilot completed the full training program at the airline, including IOE; and second,

whether the pilot needed extra training events. The outcome variables that could be considered were limited due to variations in the data captured by individual airlines (Smith et al., 2010).

Among the findings were that merely possessing a college degree (Associate or Bachelor's) did not have a significant effect on whether an individual completed training, nor whether they require extra training periods. However, individuals holding an aviation degree saw significantly fewer extra training events and a greater likelihood of completing training. This effect became even more pronounced when considering pilots who earned a degree through an AABI-accredited aviation program. By comparison, individuals who received flight training in non-college Part 141/142 programs or in non-college Part 61 programs did not perform as well as their collegiate counterparts (Smith et al., 2010).

Pilots who attained flight instructor certification also had fewer extra training events and comparatively fewer non-completions in their initial training. By comparison, previous experience either as a corporate pilot or as an airline pilot did not have a significant effect on the number of extra training events or training completion.

Finally, in analyzing the effect of flight hours logged, the study discovered that pilots with 501-1,000 hours of flight time had the highest likelihood of completing training, and required the fewest number of extra training events. This group was followed by pilots with 178-500 hours of flight time, pilots with 1,001-1,500 hours, and those with greater than 1,500 hours. This result was surprising as it contradicts the hypothesis that increased number of flight hours would result in fewer repeated training

events and a greater likelihood of training completion. The authors could find no objective reasoning within the collected data to explain the comparatively poor training performance of individuals with greater than 1,500 hours (Smith et al., 2010).

2012 Pilot Source Study

The study immediately above was repeated in 2012, utilizing data from seven regional airlines and an entirely different data set from the 2010 study. This data was comprised of pilot records ($n=4,024$) representing pilots hired between 2005 and 2011. Outcome variables measured included completion of initial training, whether additional simulator periods were required, whether the pilot had an unsuccessful first year observation, and whether the pilot had an unsuccessful outcome of first year recurrent training (Smith, Herchko, Bjerke, Niemczyk, Nullmeyer, Paasch, & NewMyer, 2013). To nullify suggestions of self-interest on the part of the principal researchers, the data were analyzed by researchers at an independent university that has no aviation program and no vested interest in the outcome.

The findings from the 2012 analysis remained predominantly consistent with those of the 2010 study. Again, significant positive effects were found for individuals who undertook collegiate flight training and who held a flight instructor certificate. Pilots with an aviation degree had more completions than pilots with other degrees or pilots with no degree, and pilots who graduated from an AABI-accredited flight program had more completions than pilots who did not graduate from an AABI-accredited flight program. Pilots who got their advanced pilot training in non-collegiate, Part 61 training had fewer completions than other pilot groups in the data set (Smith et al., 2013).

Finally, individuals holding a Commercial Pilot certificate were actually *more likely* to successfully complete training than those individuals who already held an ATP certificate. The authors suggest this finding may indicate that an individual's training background has more significance in predicting success in airline training than whether the individual has attained an arbitrary number of flight hours or obtained an ATP certificate (Smith et al., 2013).

One of the notable differences between the 2010 and 2012 studies is that pilots with between 1001-1,500 total flight hours now had more completions than three other groups of 0-500 hours; 501-1,000 hours; and greater than 1,500 hours (Smith et al., 2013). The 2010 study had noted pilots with between 501-1,000 hours had the most completions. One possible rationale for the shift in significance is that economic conditions during the period 2009-2011 were relatively stagnant in the US. Accordingly, regional airlines did little hiring and those that did hire pilots generally hired individuals with substantially more than 1,000 hours total time. The addition of a large number of pilots with more than 1,000 hours may have made it more difficult to demonstrate statistical significance for other groups. (Smith et al., 2013). Overall, the authors summarize the results of both the 2010 and 2012 Pilot Source Studies as indicating "when pilots dedicate four years to a college education in the field of aviation, they perform better in pilot training at a regional airline" (Smith et al., 2013, p. 23). Further, it is argued that solely using total flight hours as a predictor of success is not suitable. Rather, consideration must be given to qualitative measures such as the source of a

pilot's training and the quality of flight hours a pilot obtains after their primary training is complete (Smith et al., 2013).

Accident Data Analysis

The FAA's Office of Accident Investigation and Prevention (2010) conducted a safety analysis of Public Law 111-216 to evaluate the impact of the legislation's provisions on aircraft accidents. Accidents involving aircraft operated under Parts 121, 125, and 135 of the Federal Aviation Regulations ($n=417$) were analyzed for the period of Fiscal Years 2001 through 2010. This time period was selected due to the lack of comprehensive copilot pilot experience data prior to 2001 (Office of Accident Investigation, 2010). The majority of these accidents ($n=354$) were aircraft operated under Part 121.

Each accident was scored qualitatively by a three-person panel to evaluate the relative effectiveness of Public Law 111-216's provisions in preventing the accident from occurring. Categories were established as none; low; moderate; moderate-to-high; high; and very high. These categories were then converted to values of 0%; 15%; 35%; 55%; 75%, and 90%. No score of higher than 0.9 was used, as it was felt there can be no certainty that any intervention will eliminate all risk of an accident's occurrence in a given scenario (Office of Accident Investigation, 2010).

Many accidents are simply unrelated to crew performance (Office of Accident Investigation, 2010). The majority of the Part 121 accidents reviewed involved low-level outcomes that did not affect most aircraft occupants; for example, a turbulence encounter resulting in a single injury. These events, ground and ramp accidents, runway

collisions with wildlife, and other miscellaneous events account for 60 percent of the total Part 121 accident subset. Still other accidents involved maintenance issues and other circumstances not related to flight crew performance. Finally, many of the remaining accidents involved high-time captains with high-time first officers who would not be subject to the provisions of this rulemaking. In the FAA's view, the simple presence of a condition such as a first officer with less than 1,500 hours does not necessarily mean the rulemaking would be effective against a particular accident scenario. Therefore, the total number of accidents that would be encompassed by various provisions of the legislation is rather modest (Office of Accident Investigation, 2010).

Of the 354 Part 121 accidents reviewed, crewmember flight time records indicate the legislation's provisions would have affected the eligibility of only 83 accident crews in the 10 year period. Since the legislation also includes a provision regarding captain qualifications, an issue not discussed in the scope of the present paper, not all of the 83 accident crews consisted of first officers with less than 1,500 hours. Furthermore, crew performance was only determined to be an issue in a small segment of this accident subset (Office of Accident Investigation, 2010). See Table 3 for a depiction of accident scoring.

Table 3. Part 121 Accident Scoring, FY 2001-2010. Reproduced from Office of Aviation Policy and Plans, 2012.

Qualitative Effectiveness Score	Quantified Effectiveness Score	Number of Accidents
None	0	323
Low	0.15	17
Moderate	0.35	6
Moderate-to-High	0.55	5
High	0.75	3
Very High	0.90	0
Total		354

Only 31 of the 354 part 121 accidents would have had some likelihood of being prevented by the proposed rule, and in the majority of cases, the effectiveness of the rule in preventing the accident would only be low or moderate. No accidents were rated as very high. Only seven of the 31 accidents had first officers with less than 1,500 hours, and of the three accidents rated as high, only two involved a first officer with less than 1,500 hours (Office of Accident Investigation, 2010). In other words, only 1.9% of the total 354 accidents cited both crew performance as a factor *and* featured a first officer with less than 1,500 hours flight time.

Since the study was conducted prior to the FAA’s proposal to offer a restricted ATP to collegiate aviation graduates with 1,000 hours, it is unknown whether the accident ratings would change under the different flight time requirements.

Nevertheless, given the extremely low occurrence of accidents that combine crew performance and low first officer flight time, the FAA concluded the rulemaking would

have significant effect against only a small number of Part 121 accidents (Office of Accident Investigation, 2010).

The findings of the FAA above are also generally consistent with broader data examined by other researchers. Boss (2012) evaluated characteristics of major U.S. air carrier accidents between 1991 and 2010 using a case control methodology. Accidents citing pilot performance as a causal or contributing factor were compared to air carrier accidents *not* citing pilot performance as a causal or contributing factor, in order to determine whether any significant differences existed between these groups. Among the major findings were that between 1991 and 2010, 96% of first officers involved in a major U.S. air carrier accident possessed at least 2000 hours of total flight time (Boss, 2012). Of the two first officers (4%) with less than 1,500 hours of total flight time, neither was involved in an accident which cited pilot performance as a causal or contributing factor. Boss (2012) suggests this finding does not support the notion that a 1,500 hour total flight time requirement for first officers would contribute to the safety of air carrier operations. A slightly different result was obtained by the Aircraft Owners and Pilots Association [AOPA], which conducted a review of all fatal part 121 air carrier accidents since 1990 ($n=59$) and determined “...only one accident was attributable to Human Error in which the First Officer had less than the 1,500 hours total flight time” (AOPA, 2010a, p. 3).

First Officer Qualifications Rulemaking Advisory Committee

When considering regional airline pilot qualifications within the United States, perhaps the most pertinent and comprehensive analysis was recently conducted by the

First Officer Qualifications Rulemaking Advisory Committee [FOQ ARC]. In light of the Colgan 3407 accident and subsequent legislative pressure to change airline pilot qualifications, the committee was chartered by the FAA in 2010 to develop recommendations concerning flight experience and training requirements prior to operating as a first officer in Part 121 air carrier operations (“First Officer Qualifications,” 2010).

Among the issues the ARC was tasked with considering were the following:

- What should be the minimum certification level required of a First Officer?
- What should be the minimum flight hour experience requirements of a First Officer?
- Can academic training substitute for hours of experience? If so, what subjects and how much flight experience?

The FOQ ARC was composed of subject matter experts from nine organizations, including pilot labor groups and aviation industry associations. Committee members had significant levels of experience in air carrier operations; development, implementation, and management of pilot training and qualification programs; the establishment of pilot training and qualification standards at the domestic and international level; and public advocacy for aviation safety (“First Officer Qualifications,” 2010).

The ARC extensively evaluated the current regulatory and training framework for commercial pilot certification, as well as the knowledge and skill requirements to function safely as a first officer in Part 121 operations. Among other things, the committee concluded there must be a new, higher level minimum certification requirement for airline first officers, termed the ATP SIC. This is due to the gap between

the knowledge and skill provided in Commercial Pilot certification, and that required to safely function at an airline (“First Officer Qualifications,” 2010).

However, the committee noted that bridging this gap cannot be effectively accomplished by merely accumulating more flight time, as all flight hours do not provide the same level of aeronautical experience. Rather, the ARC concluded that training in specific subject areas, such as turbine-powered aircraft, multi-engine aircraft, multi-pilot operations, air carrier operations and procedures, high altitude flight conditions, and the operation of digital flight systems are also necessary. Ideally, this training would comprise one element of a modern pilot training program that methodically integrates academic training, practical training, and flight experience (“First Officer Qualifications, 2010”).

Notably, a majority of committee members agreed that such a modern flight training program can effectively substitute structured academic training for in-cockpit flight experience. Therefore, the committee recommended that first officers should have 1,500 hours of flight time, or a combination of flight time and structured academic training (“First Officer Qualifications,” 2010). Using the results from the 2010 Pilot Source Study as well as the ARC’s experience in Part 121 operations and training, committee members developed a regulatory construct for first officer qualifications. This construct provides detailed credit for specific academic training courses, as well as certain types of flight experience that are likely to contribute positively towards the knowledge and skills required of an airline first officer (“First Officer Qualifications,” 2010).

A total of 14 distinct academic training alternatives were reviewed and evaluated, with corresponding credit recommendations made for each. Of those 14 alternatives, 12 are civil training experiences and 2 are military training experiences.

Table 4 outlines the credit recommendations for each of these training experiences.

Table 4. Recommended aeronautical experience credit for various educational and flight training experiences. Reproduced from “First Officer Qualifications,” 2010.

Educational Source of Aeronautical Knowledge	Aeronautical Experience Credit Value
4-year Aviation University/College Accredited Flight Training Program	350
4-year Aviation University/College Flight Training Program	200
2-year Aviation College Accredited Flight Program	150
2-year Aviation College Flight Training Program	100
Flight Academy (part 141/142) Flight Training Program	100
Part 141 Training Program	50
Part 61 Flight Training Program	0
Military “Fixed Wing” Flight Training Program	750
Military “Rotary Wing” Flight Training Program	500
Initial certified flight instructor certificate ⁴	100
Each additional certified flight instructor ratings ³	50
Military Instructor Pilot	200
AJT Course <u>not</u> resulting in a type rating	200
AJT Course resulting in a type rating	250

The most civilian credits are assigned to training completed in an accredited flight training program at a four-year aviation university or college. Fewer credits are assigned to training programs that were determined to be less structured, such as non-collegiate Part 141 flight schools. In the lower portion of the table below the gray line, credits are offered for additional training determined to provide value to a pilot seeking a Part 121 first officer position, such as obtaining a flight instructor certificate or attending an advanced jet training simulator course. Pilots would be able to claim only

one of the credit values in the upper part of the table. Multiple credits could be selected from the lower part of the table, but each could be selected only once. For instance, only a single jet type rating could be credited (“First Officer Qualifications,” 2010).

Recognizing that certain flight experiences provide more useful skills and knowledge than others, the committee also chose to recommend bonus flight credits for certain types of flight activity. Flight hours performed as a flight instructor, on-demand operator, corporate pilot, or in multiengine flying demonstrate competencies and experiences readily associated with those expected in Part 121 operations (“First Officer Qualifications,” 2010). Individuals would be able to claim additional credit for flight in single or multi-engine turbine aircraft, multi-crew aircraft, multi-engine piston aircraft, night instrument conditions, or for providing flight instruction. This credit would be granted on a one-for-one-basis for each hour of flight time in these environments. A maximum of 500 hours of credit could be awarded for flight instructor activity, and a maximum of 100 hours of credit for multi-engine piston flying in day VFR conditions (“First Officer Qualifications,” 2010).

For example, an individual graduating from an accredited, four-year collegiate training program might have 300 hours of logged flight time at completion of training, including obtaining CFI and CFII flight instructor certificates and completing an advanced jet training course not resulting in a type rating. This individual would receive 350 hours of credit for the completion of the college degree, 150 hours for the two earned flight instructor certificates, and 200 hours for the jet training course. This individual would then be able to provide 250 hours of flight instruction and meet the 1,500 hour standard

for issuance of an ATP SIC. The individual would only have 550 hours of actual logged flight time, but would have also received 700 hours of credit for training and 250 hours of credit for flight instruction provided. In all cases, the ARC specified that an individual would be required to have at least 500 hours of *actual* flight time logged to qualify for the ATP SIC (“First Officer Qualifications,” 2010). Since the current regulations permit first officers to be hired with as little as 250 hours, the minimum of 500 hours of actual flight time recommended by the ARC represents a doubling of the minimum flight time required to seek airline employment (“First Officer Qualifications,” 2010).

Two ARC members, CAPA and the Air Disaster Alliance, filed dissenting opinions within the ARC’s report. Both groups argue that through mandating an ATP certificate for airline first officers, Congress’ intent in passing Public Law 111-216 was to require that airline first officers acquire 1,500 hours of actual flight experience. They contend that academic training should supplement, not supplant, the 1,500 hours of flight time ordinarily required for the ATP certificate. The remainder of the ARC members respond that Section 217 of the legislation is clear in authorizing the FAA to grant flight time credit for specific academic training courses against the ATP’s requirements (“First Officer Qualifications,” 2010).

CHAPTER III

DISCUSSION

The FAA's February 2012 NPRM proposes to create a new restricted ATP certificate open to two groups of individuals: military pilots and graduates of four-year collegiate aviation programs. Specifically, individuals who hold:

...a Bachelor's degree with an aviation major from an accredited 4-year postsecondary institution, and who have also earned a commercial pilot certificate with an airplane category and instrument rating obtained from an affiliated part 141 pilot school may apply for an airline transport pilot certificate with a minimum of 1,000 hours of total time as a pilot...(FAA, 2012, p. 12402).

Individuals not meeting the specific criteria above would be required to obtain a normal, unrestricted ATP with 1,500 hours of flight time before becoming eligible to seek airline employment. The NPRM also proposes additional requirements, such as the completion of an FAA-approved ATP certification training program designed to address the requirement in Section 217 of Public Law 111-216 that ATP certificate holders must receive training in difficult operating conditions.

The FAA provided relatively little justification or amplification of its reasoning in how the agency selected the 1,000 hour threshold for collegiate program graduates. It is noteworthy that the FAA expressed support for the concept that, in certain circumstances, "the combination of focused academic training and structured flight training can substitute for actual flight experience" (FAA, 2012, p. 12379). With regard to graduates of four-year colleges and universities who also obtained their

flight training through a Part 141 flight program affiliated with that institution, the FAA contends these individuals receive concentrated and focused aviation training:

Students complete a course of academic study in an aviation-related major while concurrently training at the university's affiliated FAA-approved part 141 pilot school. Through their academic coursework, these students receive a solid foundation in various topics that may include aeronautical science and technology, aviation meteorology, air traffic operations, air transportation, aviation law, aircraft systems, and CRM. The coursework is comprehensive, structured, and focused on preparing the student, over the course of 4 years, for a professional career in the aviation industry. The flight training accomplished through the college or university's part 141 pilot school is integrated with in-depth academic ground training. The student is continuously evaluated with academic testing and flight evaluations throughout the courses that lead to pilot certificates and ratings. In addition, these aviation programs are specifically focused on preparing pilots for careers in aviation (FAA, 2012, p. 12385).

Although the FAA adopted the First Officer Qualification advisory committee's recommendation to grant flight hour credit for collegiate aviation training, the FAA's proposal is far more limited in scope than that of the committee. Specifically, the committee would have granted credit for graduates of two year aviation programs, as well as grant credit for earning a flight instructor certificate or building time in other types of complex flight operations.

The FAA's recognition of the value and rigor of collegiate aviation training is laudable. To be sure, it may be somewhat easier for a collegiate aviation graduate, who may have 250 to 300 hours of flight time, to accumulate time to the 1,000 hour mark instead of 1,500 hours. Nevertheless, the FAA's proposal provides a seemingly arbitrary 500 hour credit limited exclusively to graduates of four-year collegiate aviation programs with affiliated Part 141 schools. It appears to disregard the existing literature on the airline training performance of collegiate aviation graduates. Perhaps most

importantly, the proposal does little to enhance the quality of pilot experience, while creating significant unintended consequences for future pilots, the collegiate aviation field, and the US airline industry.

Low-Time Pilots Can Perform Safely and Proficiently

The research conducted by Todd and Thomas (2012) confirms that pilots with fewer than 1,500 hours can perform successfully in the regional airline environment, and that there are no meaningful differences in their performance relative to their peers with more than 1,500 hours. This conclusion was derived from both objective and subjective measurements of pilot performance in the operational environment. While some of the literature cited above has determined that accident risk decreases with increased flight time, there are certain weaknesses in those data sets that make it difficult to determine whether an increase in required flight time for first officers would have a meaningful effect on accident risk. The Todd and Thomas study (2012) appears to be the first to directly approach the question of first officer flight hours as they relate to proficiency in technical and non-technical skills in the airline environment.

Collegiate Aviators Perform Well With Less Than 1,000 Hours Total Time

Results obtained by Cortés (2008) and the two Pilot Source Studies (Smith et al., 2010; Smith et al., 2013) suggest that collegiate-trained pilots perform significantly better in airline flight training than those who obtained their aviation education outside of a university flight program. They have a greater likelihood of completing training, and require fewer extra training periods than non-collegiate trained pilots. Perhaps most significantly, the 2010 study determined collegiate-trained pilots with fewer than 1,000

hours total time actually perform *better* in training than those with more than 1,000 hours. This appears to give little support for the FAA's decision to set the experience threshold at 1,000 hours for a restricted ATP.

In the First Officer Qualifications committee report, CAPA's dissenting opinion argues that the pass-fail training data utilized in the Pilot Source studies is inconclusive, because "statistics on whether training is successful or not only [reveal] how students respond in a training environment and does not validate a pilot's readiness for Part 121 operations and hazardous conditions they may encounter" ("First Officer Qualifications," 2010, p. 35). However, Fanjoy et al. (2006) argue that training outcomes are a valid measure, since the complexity and magnitude of pilot tasks ranging from preflight to postflight make operational performance in the field difficult to identify and measure. By comparison, performance during training can be measured continuously, throughout the training program (Fanjoy et al., 2006). It is also worth noting that Smith et al. (2013) not only looked at the outcome of initial airline training, but also outcomes after the pilot had been employed at the airline for a year and had presumably become proficient in the day-to-day requirements and challenges of Part 121 operations.

Simply examining training outcomes in isolation may be insufficient to conclude that pilots with fewer than 1,000 hours can be safely employed in the regional airline environment. However, when the results of the Todd and Thomas study (2012) and the Pilot Source studies are considered together, they give substantial weight to this argument. The in-flight operational observations performed in the Todd and Thomas study, in conjunction with the training outcomes data of the Pilot Source Studies, give

the viewer a rich perspective on the total performance of first officers in the airline environment – both in the training arena as well as in actual operations.

Increased Flight Hours Do Not Necessarily Translate to Increased Expertise or Safety

There is an implicit assumption within Public Law 111-216's requirement for additional flight hours that an individual possessing more flight hours has *ipso facto* accumulated more experience. Many commenters (Todd & Thomas, 2012; University Aviation Association, 2012; Voss, 2012) discount this; they contend that flight hours, considered in isolation, are simply an inappropriate way to measure an individual's proficiency. While the FAA has been forced by Public Law 111-216 to set the ATP as the minimum standard for airline pilot employment, the agency retains considerable latitude to shape the specific requirements for the certificate. The FAA's 1,000 hour standard appears to reflect an ongoing emphasis on achieving an arbitrary quantity of flight hours, rather than varying standards in accordance with an individual pilot's skill development, or the quality of flight time acquired by that individual. There are significant limits on the quality of experience that can be acquired by low-time pilots attempting to build hours for an airline career. Nor can supporters of the increased flight time requirement point to a specific weakness or deficiency of *experience* that can only be rectified through the acquisition of several hundred hours of flight time in light, general aviation aircraft.

Further, it appears requiring prospective first officers to accumulate more flight hours before employment will have little, if any, meaningful impact on safety. The analysis conducted by the FAA's Office of Accident Prevention (2010) suggests only a

tiny fraction of Part 121 air carrier accidents would have been affected by the imposition of a 1,500 hour minimum for airline first officers. This conclusion is further supported by the fact that the US airline industry has not experienced a fatal accident in the four years subsequent to the Colgan 3407 accident (Mouawad & Drew, 2013). This is in spite of the fact that the ATP requirement has not yet taken effect, and regional airlines in the US continue to operate with first officers who have fewer than 1,500, or even 1,000 hours.

Although it is true that a lack of accidents is not synonymous with the absence of a safety issue, if there were in fact a systemic issue related to first officers not having 1,000 or 1,500 hours of experience, it is probable that a fatal regional airline accident would have occurred in this time period. There is no objective evidence to suggest such a systemic issue exists. Indeed, the Colgan 3407 accident and other regional airline accidents in the recent past were most directly attributable to issues unrelated to first officer flight time, such as unprofessional behavior, deficiencies in training, and lack of adherence to standard operating procedures (see Table 1.)

Considering this, it seems logical that the most direct improvement in safety would arise from addressing the root causes of these accidents; focusing training institutions, airline management, labor groups, and regulatory bodies on cultivating a culture of professionalism and adherence to best operating practices. Simply requiring pilots to accumulate more flight hours before arriving at an airline has little capability to create improvements in social characteristics like professionalism and maturity.

The FAA's Proposal Does Little to Ensure Pilots Obtain Quality Experience

A well-known adage in the aviation industry is that there are pilots who have flown 1,000 hours, and then there are pilots who have flown the same hour 1,000 times. The contention that first officers will benefit from accumulating more experience, measured in flight hours, before seeking airline employment glosses over a critical weakness in the aviation regulatory system. Specifically, low-time pilots with Commercial Pilot certificates are severely limited in the types of flying positions they may seek to accumulate experience. Most of these positions afford little or no transferable skills applicable to Part 121 airline operations.

Part 119 of the Federal Aviation Regulations specifies operations for which an FAA-issued air carrier certificate is required. In essence, this section mandates that carrying of passengers or freight for hire requires obtaining a formal air carrier certificate, and is not an activity permitted for individual pilots. There is a limited list of exceptions to this requirement. In practice, this serves as a list of the few permissible flying activities for which an individual holding a Commercial Pilot certificate can receive compensation. These include: flight instruction, sightseeing flights, ferry or training flights, cropdusting, banner towing, aerial photography or survey, powerline or pipeline patrol, or flying parachutists (14 CFR § 119.1).

The common characteristic shared by all these flying activities is that they are almost universally completed in good weather (VFR) conditions, in single-engine aircraft, and typically at low altitude. Moreover, with the exception of flight instruction, these flying activities are almost always flown with a single pilot on board. There is little to no

opportunity to exercise skills in crew resource management, standard operating procedures, or multi-pilot operations. Accordingly, SAFE (2012) contends that these flying positions generally do not expand a pilot's skill set in the areas required for safe air transport operations. For example, a pilot towing banners will likely do so in good weather conditions, rarely climb higher than 500 feet above ground level, and remain in relatively the same geographic location for the duration of his or her workday. Similarly, a pilot flying skydivers will also do so in clear weather conditions, rarely venturing more than a few miles laterally from the airport or parachute drop zone. Yet, an hour logged flying skydivers or towing banners makes precisely the same contribution to a pilot's total flight time as an hour spent flying a multiengine aircraft in night or instrument conditions. The First Officer Qualifications advisory committee report advocated awarding additional credit for hours spent flying at night, in multiengine aircraft, or performing flight instruction ("First Officer Qualifications," 2010). The committee's reasoning was that these activities provide the highest quality of experience to individuals preparing to operate in the airline environment. However, the FAA declined to incorporate credits for flight experience in its proposal. The FAA claims it was limited by Section 217 of Public Law 111-216 to awarding credit for *academic* training only (FAA, 2012).

As a result, Brady argues that prospective airline pilots will select the most expeditious and affordable means for achieving the experience requirements for ATP certification, regardless of the actual effects of that effort toward increasing their knowledge and judgment in air carrier operations ("Regional Air Carriers," 2009).

Supporters of an increased flight time requirement for first officers might suggest that prospective airline pilots can seek employment in charter or corporate flight operations to accumulate experience. However, restrictive flight hour requirements imposed by aviation insurance carriers, as well as the internal flight experience standards of these operations, generally make corporate or passenger charter positions unavailable to low time pilots (Blair & Freye, 2012).

Analogues to Other Career Fields

The fact that most opportunities for low-time pilots to build experience afford little transferable skill or knowledge to airline operations underscores an important distinction between aviation and other career fields that use hours as a measure of experience. For example, both student teachers and emergency medical technicians wishing to become paramedics must acquire a certain minimum number of hours of observation in order to apply for licensure. This allows the individual to accumulate experience in the field and be exposed to a variety of situations. However, in both of these examples the hours spent are *focused*, in that the hours are spent in precisely the type of professional capacity in which the individual hopes to work.

By contrast, there is no requirement from the FAA that a pilot accumulating experience to meet the 1,000 or 1,500 hour threshold do so in a focused way. Rather, as explained above, a pilot can accumulate many hundreds of hours flying skydivers or towing banners under VFR in a low-performance aircraft. While CAPA (2012) argues that any amount of time spent flying any aircraft makes a positive contribution to a pilot's experience and skill, the requirement for collegiate-trained prospective airline pilots to

accumulate several hundred hours of flight time may actually *diminish* their proficiency in airline flying. Immediately after completing a multi-year course of intensive training, that individual must now fly in a different environment where they apply little or none of the skills they acquired in training for airline operations. They may even develop poor habits related to flight operations in these casual, unsupervised, single-pilot environments.

While other occupational fields use training hours as a means to facilitate skill development in a specific, focused way, the aviation industry stands apart. An unfocused requirement to build to 1,000 or 1,500 hours to obtain an ATP certificate is little more than an arbitrary screening threshold without a guarantee of proficiency.

Time Delays in Achieving the Increased Experience Standards

The FAA's Office of Aviation Policy and Plans estimates prospective airline pilots are able to accumulate approximately 750 flight hours per year. Using that standard, they estimate graduates of collegiate aviation programs qualifying for the restricted ATP with 1,000 hours of flight time would only have their careers delayed by only one-third of a year (FAA, 2012). However, instructors surveyed by Bjerke & Malott (2011) accumulated mean flight time of only 446.2 hours in a 12 month period. Using that standard, a university flight program graduate with 300 flight hours would be required to instruct for over 1.5 years before reaching the 1,000 hour flight time mark.

Even more concerning, in addition to the 1,000 hour total time standard established for a restricted ATP certificate, several other subordinate experience requirements must also be met under the FAA's proposal. These include 325 hours of

cross-country flight time and 100 hours of night time (FAA, 2012). The FAA's proposal of 325 hours of cross-country flight time represents 32.5% of the 1,000 hour total. However, the university flight instructors surveyed by Bjerke & Malott (2011) average only 24.1% of their flight time as cross-country flight time. In other words, they accumulate cross-country time much more slowly and would in fact have to accumulate *far more* than 1,000 hours total flying time before meeting the 325 hour cross-country requirement. Indeed, if an instructor accumulates cross-country time at the 24% average, they would have to accumulate 1,354 hours of total time before reaching the 325 hour cross-country minimum (Roesler, 2012). This means collegiate graduates who attempt to build time as flight instructors may need to instruct significantly longer than the 1.5 years listed above. The FAA's analysis does not account for this discrepancy.

The primary concern with a time delay in obtaining airline employment is that a collegiate graduate is generally required to begin paying back student loans after a six month grace period following graduation. Flight instruction and other positions such as banner towing, or flying skydivers do not typically pay wages that will allow an individual to both satisfy their basic living needs while also making student loan payments. Although it is true that entry-level pay at the regional airlines is also considerably low, the sooner an individual can obtain airline employment, the sooner they will be able to advance in seniority and earn higher pay. There is a strong likelihood that forcing collegiate graduates to earn subsistence wages for two years or more before even entering airline employment will lead to an increase in student loan defaults from individuals unable to repay the high costs of their flight training.

In particular, the relatively slow rate of accumulation of flight time associated with flight instruction may result in prospective airline pilots avoiding flight instruction as a potential path to build experience for an airline career. Other opportunities, such as banner towing, pipeline patrol, or aerial photography would allow pilots to accumulate flight time much more rapidly. Bjerke & Malott (2011) conclude this could also result in serious difficulties for collegiate aviation programs in recruiting and retaining sufficient numbers of qualified instructors.

Consequences of the Proposed Rule for Collegiate Aviation

The FAA's proposal appears to be markedly unfair to a number of colleges and universities that provide aviation training. Further, the requirement for collegiate graduates to accumulate many hundreds of hours of experience following graduation will add a considerable amount to the total financial cost of pursuing an airline career. This has the potential to significantly drive down the number of individuals seeking an airline career – at a time when the airline industry can ill afford a reduction in the supply of available pilots.

Diminishing Enrollments Due to Training Cost and Uncertainty

Perhaps the most profound impact of the FAA's proposal on collegiate aviation programs is the potential for serious declines in enrollment. The cost of pursuing an aviation education at a four-year university with an affiliated flight training program is already significant, before considering the added costs imposed by the FAA's proposal. The University Aviation Association (2012) reviewed the cost of attendance for students at five collegiate aviation institutions, including college tuition and flight training costs.

Total costs over four years range from a low of \$132,695 to as much as \$170,758. These costs are out of the reach of all but the wealthiest families, unless the prospective pilot and/or his or her family take on the burden of many tens of thousands of dollars of loans to finance this education. The average college debt of newly graduated flight instructors surveyed by Bjerke & Malott (2011) is \$73,016. Almost 26 percent of those surveyed had a debt load exceeding \$100,000. By comparison, starting salary at many regional airlines is often under \$25,000 per year (Pasztor, 2012). In the past, collegiate aviation students have been willing to accept this financial situation with the expectation that they would be able to obtain airline employment relatively quickly after graduation, begin to accumulate seniority, and advance to higher pay.

However, prospective students investigating collegiate flight training may feel it is no longer a desirable path, in light of the high cost of training, coupled with the uncertain financial and time burdens of accumulating flight time after graduation. They may seek to complete their flight training outside of the collegiate environment, pursue a different aviation career, or a non-flying career altogether. At the University of North Dakota (UND), one of the largest and most well-known aviation universities in the United States, student interest in airline careers is at the lowest level in four decades. According to Kent Lovelace, chairman of the aviation department, "their confidence in the industry just isn't there" (Pasztor, 2012). In 2011, UND graduated only half as many students majoring in commercial aviation as it did in 2005 (Johnson, 2012). In a survey of flight instructors working full-time in a major collegiate aviation program in the upper Midwest, well over half of those surveyed began their university training with the intent

of pursuing an airline career. Following the passage of Public Law 111-216, only a quarter indicated a desire to continue towards an airline career (Bjerke & Malott, 2011). A follow-up survey of flight instructors from 17 different collegiate aviation programs obtained a largely consistent result; 69% aspired to be airline pilots when they began flight training. Now, only 46% are planning an airline career in the short term, and only 38% indicate airline employment is their long-term career goal (Roesler, 2012).

On the surface, it might seem that a reduction of the ATP requirement from 1,500 hours to 1,000 hours for collegiate pilots should be a boon for university aviation enrollment, as prospective pilots seek to take advantage of the opportunity to achieve airline employment with 500 fewer hours of flight time. However, despite the higher quality of collegiate flight training, many individuals place a priority on the quickest and least expensive route to the cockpit, regardless of the quality of training. Brady argues many pilots would seek to build time more quickly outside of a university environment:

The quantity driven ATP requirement would cause potential students who would normally enter a high quality university program to now seek the shortest route to the first officer's seat. Why would they spend 4 years at a college or a university paying tuition and flight fees, when at graduation they still need to fly for another 2 years to be qualified to enter the air carrier as a first officer trainee? They probably wouldn't. They would seek out local flight training providers, acquire the necessary ratings and spend the next year or two flying cheap, 30-year old single engine airplanes to build their flight time ("The FAA's Call to Action," 2009, p. 139).

The impact of declining enrollments is real and substantial. Even prior to the imposition of the ATP requirement, several notable university flight training programs, including the University of Illinois (Cohen, 2011) and Daniel Webster College (Brindley, 2010) have closed, or are in the final phases of closure. There is also evidence that the

administration at Auburn University intends to close its program (Oravet & Shryock, 2013). Declining enrollments and poor return on investment for graduates are some of the reasons cited as justification for these closures. Decreased enrollment in collegiate aviation programs creates a no-win situation – as the number of students drops, there are fewer individuals to share the fixed costs of operating the program (University Aviation Association, 2012). If tuition and other charges are increased to account for this, student enrollment may continue to drop even further. Should the FAA’s proposal be enacted in its present form, there is a strong likelihood that more institutions will abandon their flight training program. This will result in fewer options for individuals to pursue pilot training, and further reduce the supply of highly trained pilots available to the regional airline industry.

Four-year Institutions with Part 61 Flight Programs

A number of universities offer aviation degree programs, yet have elected to operate their flight program under Part 61 regulations, rather than Part 141. These include such institutions as Metropolitan State College in Denver, Purdue University, and Eastern Kentucky University (Southern Illinois University, 2012). These institutions offer four-year aviation degrees and provide largely the same high quality classroom academic training and integrated flight training. For example, Purdue University’s aviation training program was once approved under Part 141, and its current Part 61 training program still uses the same Part 141 syllabi and training materials that had been previously FAA-approved (M. Gasper, personal communication, 12/12/12). Given the same materials are in use, there is little evidence that the university’s training program

is any less rigorous than when it was operated under Part 141 supervision. The 2010 Pilot Source Study did not note a distinction in performance between graduates of university programs operated under parts 61 or 141 (University Aviation Association, 2012). Nevertheless, the FAA's proposal affords no credit for four-year aviation degrees at institutions with Part 61 training programs.

Two-year Colleges

Aviation programs offered by two-year community and technical colleges also stand to be significantly penalized under the FAA's proposal. These institutions offer aviation degree programs with either affiliated 141 Pilot Schools or FAR 61 pilot training programs. The University Aviation Association (2012) identified 40 such programs throughout the US, with an estimated 2,033 students enrolled. Overall, these institutions provide structured, substantially identical classroom academic training to that afforded in a four-year aviation program. For instance, Southern Illinois University (SIU), an institution offering a 4-year aviation degree program, has articulation agreements with numerous community colleges to accept their flight students directly into a Bachelor's degree program in Aviation Management (Southern Illinois University, 2012). The First Officer Qualifications rulemaking committee recognized the value of these two-year institutions by recommending limited credit towards the ATP. Nevertheless, the FAA's proposal declines to grant any credit to individuals who completed their flight training in a two-year aviation program, even if that institution's flight program was operated under Part 141 with FAA supervision. Even more incredibly, a community college aviation student transferring to an institution like SIU to complete

their remaining two years for a Bachelor's degree would not be able to receive any credit toward the flight hours for an ATP. Meanwhile, that student would be attending classes and working alongside students at SIU who, having attended the university for the first two years of their training, would be entitled to earn an ATP at the reduced 1,000 hour standard. The FAA's proposal essentially discourages pilots from attending a two-year aviation program, regardless of its quality or affiliation with a four-year university.

The FAA's Proposal Places a Significant Constraint on the Pilot Supply

The FAA's most recent aerospace industry forecast predicts overall US airline passenger traffic will grow an average of 2.2% per year over the next 20 years as the country emerges from the most recent economic downturn (FAA, 2013). To keep pace with projected airline fleet growth and pilot retirements, Boeing forecasts a global need for 460,000 pilots over the next 20 years, with 97,350 of those needed for North America (Boeing, 2012).

Several unique circumstances in the US airline industry are aligning to create additional demand for pilots. The so-called Age 65 rule, amended in 2007 to permit Part 121 airline pilots to continue working until 65 years of age, initially slowed the need for airline pilots at major airlines, as many pilots chose to continue working rather than retire (University Aviation Association, 2012; Carey, Nicas, & Pasztor, 2012). The first group of pilots began to reach mandatory retirement in December 2012, and this has opened a floodgate of pilots forced into retirement from major airlines. More than half of the entire pilot group at US airlines is over the age of 50 (Carey, Nicas, & Pasztor,

2012); this means in the span of fifteen years, airlines will need to replace at least half of their entire pilot group. Going forward, it is expected that the Age 65 retirement rule will have an increasing impact on Part 121 air carriers to the point where as many as 2,000 pilots will be forced to retire each year (University Aviation Association, 2012). A forthcoming rule from the FAA to increase the amount of rest for airline pilots will also require airlines to hire additional crewmembers to maintain their current schedules. Airline hiring consultant Kit Darby predicts as many as 8,000 pilots per year will be needed to account for retirements, the new rest rules, and to keep up with the industry's expected growth (Jones, 2013). Major airlines such as Delta and American have announced plans to hire significant numbers of pilots over the next decade to account for these factors (Carey, Nicas, & Pasztor, 2012). It is expected that the vast majority of major airline pilot openings will be recruited from the ranks of regional airlines (Carey, Nicas, & Pasztor, 2012; Polek, 2012).

While major airlines in the US will have little difficulty recruiting sufficient numbers of pilots from regional airlines, these regional carriers are already having a difficult time hiring pilots even before the imposition of the ATP requirement. For instance, the regional airline American Eagle is currently advertising a \$5,000 signing bonus for successful pilot applicants, and expects to replace nearly half of its pilot population in the next few years (Thornton, 2013). A survey of regional airlines by the Regional Airline Association revealed that in 2011, 46% of pilots hired had fewer than 1,500 hours of flight time (Polek, 2012). In other words, the population of pilots with more than 1,500 hours who are willing to work for regional airlines has already been

significantly depleted, and these airlines are forced to recruit pilots with less time just to fill openings. The ATP requirement will undoubtedly exacerbate difficulty in recruiting pilots. John Marshall, an independent safety consultant, expresses concern that regional airlines will have to reduce their standards for employment simply to recruit enough pilots who meet the mandatory ATP minimum, including individuals with weak skills or a history of training problems: "It certainly will result in challenges to maintain quality... regional carriers will be creative and have to take shortcuts" to fill pilot positions (Carey, Nicas, & Pasztor, 2012, p. A1). This outcome seems to be directly contradictory to Congress' and the FAA's expectations that promulgating a requirement for increased flight time will somehow improve airline safety.

In light of the difficulty that regional airlines already have in recruiting high quality, well-trained pilots, it seems counterintuitive to establish a rule that would shut off the supply of pilots until they have accumulated an arbitrary number of flight hours. The critical weakness in forcing collegiate-trained pilots (as well as non-collegiate pilots) into a limited number of pathways to accumulate more flight hours is that it constrains the output of pilots to the number of available job opportunities for time building. There are simply not enough banner towing, skydive pilot, or powerline patrol positions available to produce a sufficient number of pilots to meet the near- or long-term manpower needs of the airline industry. Consultant Kit Darby suggests: "We are about four years from a solution, but we are only about six months away from a problem" (Carey, Nicas, & Pasztor, 2012, p. A1). Pilot labor organizations such as ALPA and CAPA argue the problem is overstated, and that if entry-level salaries at regional airlines were

to rise, a sufficient number of qualified pilots would materialize to apply for these positions (CAPA, 2012). Although this may be true in the short term, the number of pilots undertaking flight training has been on a significant decline for a number of years. FAA data show the number of Private and Commercial Pilot certificates issued are down 41% and 30%, respectively, in the past decade (Carey, Nicas, & Pasztor, 2012). A survey undertaken by AOPA (2010) across the entire flight training industry, not just collegiate flight training, suggests only one third of students express an intent to seek a professional flying career. Even if pilot salaries at regional airlines were to rise dramatically, the insufficient number of pilots currently entering training will result in a deficiency of pilots to the regional airline industry.

Collegiate aviation programs have traditionally been able to deliver a supply of well-trained pilots to regional airlines. However, current enrollment declines and lack of enthusiasm for pursuing an airline piloting career already threaten the long-term future of this supply. If collegiate pilots are forced to give flight instruction or unnecessarily build time in other occupations for years before becoming eligible for airline employment, the regional airline industry will likely face a crisis situation. Regional airlines have indicated that, absent a change in circumstances, they will likely be forced to ground aircraft for lack of crews and/or eliminate service to communities (Carey, Nicas, & Pasztor, 2012; Polek, 2012).

CHAPTER IV

CONCLUSION AND RECOMMENDATIONS

Collegiate aviation training programs are an integral component of a healthy aviation system in the United States. These institutions serve as laboratories for cutting-edge aviation research. This includes new and innovative methods of training pilots, such as the FAA-Industry Training Standards, as well as foundational research into aviation human factors and aviation safety. Furthermore, these programs make a vital contribution to the overall pilot supply in the United States. Thousands of students are enrolled in over 100 programs domestically, allowing graduates to develop critical aeronautical knowledge and experience necessary for professional aviation careers.

Many collegiate aviation training programs have integrated top-of-the-line technology into their curricula, including advanced avionics training and regional aircraft simulator training. Quite often, this training and technology is not accessible to students undertaking flight training outside of the collegiate environment. Finally, many collegiate flight training programs have engaged in a process of accreditation through organizations such as AABI, utilizing external review to ensure adherence to industry best practices and continuous improvement in instructional methods. By comparison, most private flight training schools receive no FAA supervision, and lack the intensive academic components and diversity of faculty experience offered in the collegiate environment.

The first research question considered by this paper was whether the 1,000 hour flight time requirement for collegiate-trained aviators is supported by objective evidence. Overall, the literature cited above suggests it is not. Rather, it appears that collegiate-trained pilots perform successfully with fewer than 1,000 hours of flight time in the regional airline environment, and that the requirement for increased flight time would offer little improvement in safety and individual professionalism. The bulk of the arguments in support of increased flight time for airline first officers are rooted in the visceral and unscientific belief that any pilot who accumulates more flight time, regardless of where or how the flight time is gained, is more experienced, and would therefore constitute a safer airline first officer.

Through the work of the First Officer Qualifications rulemaking committee, there is broad consensus that a Commercial Pilot certificate and 250 hours of flight time is no longer an appropriate minimum level of experience prior to airline employment, given the complexity of airline operations. Where the conflict arises is in determining where to set the experience threshold. Todd and Thomas (2012) note:

...there is a continued need for scientific rigor, rather than political commentary, to inform the debate on commercial pilot training and licensing, in particular the individual differences that make up the competence of a pilot instead of adherence to an arbitrary threshold that might somehow ensure performance, and, therefore, safety (Todd & Thomas, 2012, p.781).

There is no doubt that the tragedy of Colgan Air flight 3407 exposed weaknesses in pilot recruitment, professional behavior, air carrier stall training, and FAA oversight within aspects of the regional airline industry. However, initial legislation appeared only six months after the Colgan 3407 accident – before the NTSB final report was even

completed. Legitimate concern exists as to whether the legislation's mandate for an ATP for first officers is rationally and scientifically linked to issues uncovered in the wake of the accident, or was instead merely a poorly considered and rushed effort intended to give the appearance of strong action.

The ATP requirement has proven to be one of the most divisive issues in the aviation industry in some time. It is exceptionally rare that a piece of legislation stands to have such tremendously wide-ranging impact on many levels of the aviation industry. This legislation and the forthcoming FAA final regulations will affect regional airlines, collegiate flight training programs, private flight schools, pilots currently enrolled in flight training, and even individuals who may consider an airline career in the future.

The requirement for collegiate-trained pilots to accumulate 1,000 hours before becoming eligible for airline employment will cause a significant increase in the student pilot budget, harmful impacts to collegiate training institutions, and a critical dilemma for regional airlines seeking to replace pilots departing for the now-growing major airline segment. Moreover, a prolonged unfocused and unsupervised time-building requirement may result in less professional and less safety-minded pilots entering the regional airline industry.

This is not to say that all of the provisions of Public Law 111-216 are unwarranted. In fact, numerous provisions are long overdue and will likely have a positive benefit for improved pilot training and airline safety. For example, Section 206 of the legislation directs the FAA to help establish mentoring programs for less experienced flight crewmembers. Other provisions mandate improvements to training

in stall and upset recoveries. Public Law 111-216 as a whole is not a bad piece of legislation; rather, the ATP requirement for first officers simply appears to be an unnecessary addition that has more negative consequences than positive ones. Minor changes to the ATP requirement would help make the provision more equitable for collegiate aviation training programs and their students.

Proposed Changes

The FAA's NPRM solicited input as to whether its provisions were appropriate or should be modified. Specifically, the FAA recognized that a final rule could include different levels of credit for academic coursework, and expand credit beyond the military and four-year colleges and universities (FAA, 2012). In light of the concerns outlined above, the following changes are recommended to be incorporated into the FAA's proposal before a final rule is issued:

- The 1,000 hour restricted ATP for collegiate-trained aviators should be reduced to 750 hours, provided the pilot obtains both Commercial Pilot and Flight Instructor certificates. The best performing pilots in the Pilot Source Study (Smith et al., 2010) had accumulated 500-1,000 hours of flight time and held flight instructor ratings. A 750 hour minimum is a reasonable compromise that aligns with the objective findings of the Pilot Source Study, yet still represents a threefold increase over the previous minimum of 250 hours. It would also still require an individual pilot to accumulate a reasonable amount of time on their own beyond graduation from a collegiate training program, affording these pilots

an opportunity to sharpen decision-making skills, experience weather and abnormal conditions outside of the training environment.

- The cross-country flight time requirement for the restricted ATP should be reduced from 325 hours to 200. This would bring the FAA's cross-country time requirement into alignment with ICAO ATP standards, which only require 200 hours of cross-country time (Roesler, 2011). The FAA has already made efforts to harmonize its procedures with ICAO, most recently in the areas of Safety Management Systems and flight planning. The 325 hour requirement is arbitrary and imposes an unreasonable burden on pilots, particularly flight instructors, who have relatively few opportunities to accumulate cross-country flight experience. Yet, 200 hours would still provide sufficient experience at unfamiliar airports and would impart an appropriate level of skill for airline operations.
- Graduates of four-year collegiate aviation training programs with affiliated Part 61 flight schools should be considered for eligibility for a restricted ATP certificate. These programs provide the same caliber of academic and flight training as their counterparts with Part 141 flight training programs.
- Graduates of two-year collegiate aviation training programs should be considered for eligibility for a restricted ATP certificate. Again, many of these programs offer the same caliber of academic and flight training as four-year institutions, as evidenced by the First Officer Rulemaking advisory committee's recommendation to award credit for completion of a two-year collegiate aviation program. The FAA might consider setting a 1,000 hour standard for

graduates of a two-year aviation program with an affiliated Part 141 program.

Further, if a graduate of a two-year program transfers and completes an aviation degree at an affiliated four-year university, they should be entitled to seek a restricted ATP at 750 hours.

- Efforts should continue to promote the mentoring of less experienced airline pilots, as well as build strong corporate cultures of professional behavior. The common threads linking the most recent regional airline accidents are immature or unprofessional behavior, lack of adherence to sterile cockpit procedures, or lack of adherence to standard operating procedures. Although neither the FAA nor airline management can legislate professionalism, mentoring from senior pilots and check airmen can encourage junior pilots to act professionally. This will have a far greater impact on reducing the risk of accidents and incidents than simply mandating new airline pilots to have more flight hours before employment.

Recommendations for Further Study

With respect to the questions raised in this paper, the research by Todd and Thomas (2012) was significant in concluding there is no systematic difference in performance between low-time and high-time pilots in flight performance or non-technical skills. However, the results were derived from a naturalistic study that only evaluated normal flight operations. Accordingly, it was not possible to observe the performance of first officers in reacting to abnormal or emergency situations. Furthermore, the authors note the possibility of compensatory behavior due to the

presence of the cockpit observer. Future research could include the retrieval and analysis of Flight Operations Quality Assurance data from aircraft recorders, to provide a more unfiltered view of pilot flight performance. Additionally, flight simulator studies would be valuable to evaluate crews in abnormal or emergency situations that cannot be safely performed in the actual aircraft. Evaluating the reactions of low-time and higher-time first officers under these unusual situations would provide a more robust foundation to assess whether there are performance differences between experience levels.

Continued investigation of the factors contributing to regional airline pilot training success is also warranted. Both the Pilot Yield Study (Cortés, 2008) and the Pilot Source studies (Smith et al., 2010; Smith et al., 2013) reflect superior training outcomes for collegiate-trained aviators. However, the FAA's proposal to require an ATP Certification Training Program prior to airline employment means that both collegiate- and non-collegiate trained pilots will undergo specific, focused training prior to even entering an airline's training program. This is a significant change from the past training regime and could potentially have a positive effect on the training success of non-collegiate trained aviators. Furthermore, due to the reduced flight time permitted by the restricted ATP for collegiate pilots, there will now be a flight experience divergence between collegiate and non-collegiate aviators as they enter airline employment. Future research should be performed to evaluate any differences in training outcomes as a consequence of this change.

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