International supply and demand for U. S. trained commercial airline pilots

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Abstract

The admirable safety record amassed by United States (U.S.) air carriers has created a global demand for commercial pilots trained to Federal Aviation Administration (FAA) Practical Test Standards (PTS). This demand, fueled by emerging countries and recovering economies, may well exceed the number of commercial pilots available today and envisioned in the future. This paper explores the changing demographics of the pilot supply pool; the potential impact of recent U.S. regulatory activities on pilot production; the correlation of aircraft deliveries to pilot requirements; and the training maze and extended lead times required to train commercial pilots. Several possible solutions to meeting the envisioned demand for pilots are presented along with potential limiting factors.

Keywords: pilot training, pilot demand, commercial airline, FAA, pilot career path

Introduction

Until the 1990s, roughly 90 percent of the pilots hired by major U.S. carriers came from the U.S. military with only ten percent being drawn from civilian aviation. Today however, hiring percentages have nearly reversed due to military active duty training commitments rising from six to almost twelve years. "Stop-loss" programs preventing military pilots from leaving the service and incentive programs to retain experienced pilots have also contributed to this trend. Although the United States still has an adequate supply of trained civilian pilots to meet its current needs for now, this pool is dwindling quickly. To further exacerbate the pressure on the remaining U.S. pilot pool, the past four years have seen a rise in the global demand for pilots certificated and qualified to fill pilot-in-command (PIC) or second-in-command (SIC) positions. The need for pilots is particularly strong in China, India, and the Middle East.

In the U.S., most major carriers have now recalled pilots laid-off after September 11, 2001. Although recent economic events such as the merger of Delta and Northwest and proposed industry inventory reduction programs may again lead to a round of pilot furloughs at both regional and major U.S. airlines, the projected future demand for pilots remains strong. Globally, the need for pilots is growing steadily as recovering economies drive aircraft purchases to support airline fleet expansions. These expansion activities have pilot training experts concerned about how to ensure an adequate supply of commercially trained and qualified pilots to meet future industry needs.

The concern over commercial pilot availability stems largely from a review of past U.S. airline industry hiring practices and their ultimate adverse affect on pilot production. In the past, major airlines, both domestic and international, routinely target senior regional pilots to meet their flight deck needs. This practice resulted in some regional airlines having annual cockpit turnover rates in excess of 50 percent. In turn, regional airlines targeted Certified Flight Instructors (CFIs) from Federal Air Regulations (FAR) Part 61 and 141 training organizations (especially those qualified to conduct both instrument and multi-engine training) to meet their flight deck needs. The unintended consequence of this "trickle-down" pattern of pilot hiring is the adverse affect it has on the aviation industry's ability to meet future pilot requirements. By hiring CFIs away from "Ab Initio" (Latin for "from the beginning") training providers, pilot production capabilities are significantly reduced throughout the United States. Additionally, the demand for pilots by major carriers has forced regional carriers to reduce their hiring minimums to all time lows; in some cases, from 1000 total flight hours with 500 being in multi-engine aircraft, down to 350 total flight hours with less than 40 hours in multi-engine aircraft. These economically driven flight hour hiring reductions have industry experts concerned about the adequacy of existing Ab Initio training programs as well as the possible safety issues associated with very low-time pilots operating larger commercial jet aircraft.

Several recent aircraft accidents involving regional airlines have forced Congress to introduce H.R. 3371 (2009), "Airline Safety and Pilot Training Improvement Act of 2009." If this bill is adopted and becomes law in its present state, it may further complicate the airline industry's ability to crew their flight decks in the future. The bill will redefine the airline responsibilities for flight crew education, professional standards,

and acceptable levels of pilot performance both in training and during the conduct of line operations. It would provide rulemaking in regard to ground and flight training related to:

- Stall avoidance
- Recognition and recovery from a stalled condition
- Avoidance and recognition of aircraft upset and the initiation of proper recovery techniques
- Specialized training for aircraft that utilize "stick pusher systems"
- Conduct of operations during icing conditions, microburst and wind-shear weather events

In addition to training program guidance, airlines would be given greater access to the past training records and proficiency examinations of pilots applying for employment. This bill also contains recommendations on training methods and the number of flight hours needed to master aircraft systems, maneuvers, procedures, takeoffs and landings, and crew coordination. It could have far-reaching impact on the training of new pilots and maintaining pilot proficiency. In terms of impacting revenue line operations, the bill will introduce more restrictive pilot work rules relating to fatigue, commuting, and maximum time on duty. Perhaps the most limiting component being considered in the final version of this bill are large increases in the flight time requirements to perform second-in-command (SIC) duties at FAR Part 121 airlines. This requirement could drastically limit the availability of SICs, commonly referred to as the co-pilots or first officers, to support existing delivery schedules for new aircraft at many airlines.

These concerns are not unique to the United States. The International Civil Aviation Organization (ICAO) (2000) has been actively seeking new global standards for pilot training and licensing to proactively address safety concerns as well as meet the growing global demand for highly trained and qualified aviators.

Although the need for commercial airline pilots has been recognized globally, further study is required to determine the number of pilots required by country, and the duration of this need. To be able to more accurately answer these questions, the following areas must be examined:

Commercial Aircraft and Pilot Demand

The demand for commercial airline pilots is a derived demand that is a function of the size and utilization of the commercial airline fleet.

Aircraft manufactures base their forecasts for new and converted aircraft on a complex set of factors that include projected passenger miles, load factors, freight tonnage, economic growth, the regulatory environment, fuel costs, and fleet replacement needs. Forecasts of the demand for aircraft are provided annually by a number of sources including Boeing (2009), Airbus (2007), Bombardier (2009), and the Federal Aviation Administration (2009).

Table 1 shows the world-wide estimates of what the commercial aircraft passenger and freighter fleets were in 2008 and what they are expected to be in 2028. The FAA (2009) estimates of the U.S. commercial aircraft fleet reported in Table 1 have been extended from 2025 to 2028 using the FAA average growth rate in order to coincide with

the Boeing projections for the 20 year period. Using this methodology, the FAA forecasts show the U.S. commercial aircraft fleet for passenger aircraft increasing 33.9 percent from 6,238 in 2008 to 8,350 by 2028, and the number of cargo jets increasing 83 percent from 949 to 1,737 over the next 20 years. The FAA forecast of U.S. passenger jets has been revised downward substantially from just two years ago because of recent economic conditions.

Boeing (2009) has estimated that the world-wide fleet of passenger aircraft will double in the next 20 years, increasing from 18,800 in 2008 to 35,600 by 2028. The Airbus (2007) forecast is slightly lower than the Boeing Company's forecast with the exception of the size of the Cargo/freighter fleet which Airbus forecasts to be larger than the Boeing forecast for 2028.

Table 1

World-Wide Aircraft Demand 2008-2028

Year	**Size of Aircraft Geographic Area**	**FAA United States**	**Boeing World-Wide**
2008	Large Jet	3,656	15,740
	Regional Jet & Piston	2,582	3,060
	Total	**6,238**	**18,800**
	Total Freighters	**949**	**1,940**
	Africa		660
	Asia-Pacific		3,910
	Russia & Central Asia		1,210
	Europe		4,330
	Latin America		1,070
	Middle East		840
	North America	6,238	6,780
	Total World-Wide		**18,800**
2028	**Size of Aircraft Geographic Area**	**FAA U.S. Only**	**Boeing World-Wide**
	Large Jets	5,225	33,380
	Regional Jet & Piston	3,125	2,220
	Total	**8,350**	**35,600**
	Total Freighters	**1,737**	**3,250**
	Africa		1,140
	Asia-Pacific		11,170
	Russia & Central Asia		1,570
	Europe		7,770
	Latin America		2,390
	Middle East		1,860
	North America	8,350	9,700
	Total World-Wide		**35,600**

Source: FAA (Forecast, 2009), pp. 79-80, 85, with the average growth rates used by classification to estimate 2025-2028 U.S. aircraft; Boeing (2009), 2-3, 7.

The U.S. share of the world-wide fleet of passenger aircraft is expected to decline from 33.2 percent in 2009 *t*o 23.5 percent by 2028. However, the U.S. share of the cargo jets/freighters is expected to increase slightly from 48.9 percent in 2008 to 53.5 percent by 2026 (Boeing 2009, FAA 2009).

In 2008, the Bureau of Transportation Statistics (2009) reported 75,715 pilots and co-pilots and 3,530 trainees and instructors working for U.S. air carriers. This includes 9,099 pilots engaged in air cargo operations separate from the major passenger airlines. Given the number of pilots and co-pilots in 2008, the estimated number of pilots required to fly the expected U.S. fleet in 2028 is 125,411 using the current ratios employed pilots and co-pilots to U.S. carrier jet aircraft (Table 2). The FAA is forecasting a 0.3 percent annual increase in the total number of U.S. Airline Transport Pilots (ATP) from 2008 through 2028, while at the same time forecasting a 2.0 percent annual increase in U.S. carrier jet aircraft. This will lead to an apparent shortfall in qualified ATPs. These estimates for pilots are similar to those of Boeing. As reported by Wallace (2007), Boeing had estimated that Canada and the United States had approximately 64,000 jetliner pilots in 2006 and will need 128,000 by 2025. Worldwide, Boeing (Wallace 2007) is estimating 17,000 new pilots will be needed each year just for the new planes to be delivered annually.

Table 2 reports the FAA forecast of ATP pilots and the number employed by U.S. carriers. The estimated number available for succeeding years is the same percentage of the total as in 2008. Next the number of U.S. carrier jet aircraft is used to estimate the demand by U.S. carriers for ATP pilots. This demand is estimated to reach 125,411 by 2028 while supply is forecast to be only 80,983. This process for estimating U. S. ATP pilot demand indicates that unless there is a major change in training, the industry will be facing increasing shortfalls in trained pilots. The cumulative shortfall by 2028 is estimated to be over 44,000 pilots (35 percent of the total demand) unless training activities increase.

Table 2

Estimated Supply and Demand for U.S. ATP Pilots by U.S. Carriers, 2009-2028

Year	FAA ATP Forecast	Estimated* U.S. Carrier Pilots	FAA U.S. Carrier Jet Aircraft	Estimated** Demand for U.S. ATP Pilots	Shortfall of U.S. ATP Pilots
2009	147,650	76,134	3,365	76,134	0
2010	148,400	76,520	3,587	81,157	4,637
2011	149,100	76,881	3,716	84,075	7,194
2012	149,700	77,191	3,823	86,496	9,305
2013	150,300	77,500	3,870	87,560	10,060
2014	150,850	77,783	3,953	89,438	11,655
2015	151,350	78,042	4,043	91,474	13,432
2016	151,800	78,274	4,131	93,465	15,191
2017	152,250	78,506	4,229	95,682	17,176
2018	152,700	78,738	4,390	99,325	20,587
2019	153,150	78,970	4,501	101,836	22,866
2020	153,600	79,017	4,604	104,167	25,150
2021	154,050	79,434	4,684	105,976	26,542
2022	154,450	79,640	4,815	108,941	29,301
2023	154,850	79,846	4,939	111,746	31,900
2024	155,250	80,000	5,074	114,800	34,800
2025	155,650	80,259	5,223	118,172	37,913
2026	156,117	80,500	5,327	120,525	40,025
2027	156,585	80,741	5,434	122,946	42,205
2028	157,055	80,983	5,543	125,411	44,428

Source: FAA (Forecast 2009), p. 88; *Estimated based on the percentage of ATP pilots employed by U.S. Carriers, Bureau of Transportation Statistics (2009); **Estimated based on ratio of carrier jets in service to ATP pilot employed by carriers.

The estimates in Table 2 are based on FAA data and forecasts. These estimates in terms of the number of U.S. carrier jet aircraft are lower than those of Boeing, and may understate the pilot shortage.

The number of new ATP Certificates issued by the FAA averaged 7,169 per year for the three years ending 2001, and the number issued between 2006 and 2008 averaged 5,290 per year. The average age of the ATP certificate holder increased from 45.4 to 48.5 years of age between 2000 and 2008. Of the total ATP Certificates held, 17.1 percent are held by individuals 60 years of age and older (FAA Aviation Data Statistics, Table 12, 2009). An attrition rate as low as 5 percent per year would amount to over 7,300 pilots leaving the industry leading to a net decline in the number of ATP certified U.S. pilots.

On December 13, 2007, President Bush signed The Fair Treatment for Experienced Pilots Act that now lets pilots fly until they reach age 65. Although welcome news for older pilots, this Act is not expected to have a major long-term impact

on the supply due to in-place seniority systems, salary issues, medical requirements, and alternative job opportunities.

Given the impending severe shortfall of qualified ATP pilots, the question must be asked as to what can be done to avoid major disruptions and major related safety issues over the next ten years?

The Path to Becoming a Pilot for a Major Commercial Air Carrier

The path to becoming a pilot for a major commercial air carrier has historically been a long and costly process for both civilian and military pilots. For military pilots, the cost is measured in the time invested to repay initial active duty training commitments; currently a minimum of 8 to 10 years is required. For civilian pilots, the cost is measured both in money and time; the amount of each depending on the chosen training path pursued. However, in both cases, there is an extended time element in getting pilots through the required formal training programs necessary to become certificated and qualified to conduct commercial operations. Chart 1 shows the expected career path for U.S. military pilots. Since this paper focuses on the availability of jet pilots for the global airline market, the U.S Army is shown only for reference purposes since they do not operate large numbers of fixed wing turbine powered aircraft.

With the exception of Air National Guard pilots who may be able to pursue a civilian pilot career within 3 to 4 years of attending U.S. military flight training, civilian pilots can generally seek employment with a major carrier several years earlier than a military pilot who must fulfill a military obligation. However, this early entry capability comes at a high price. Military pilot training is paid for by the service, but a civilian pilot must obtain college scholarships, take out student loans, or pay the training expenses out of pocket. Acquiring all the certificates and/or ratings required to be an airline pilot takes years and may require incurring a debt comparable to that normally associated with attending medical school. To further compare and contrast the career paths of military and civilian pilots, two charts are offered; chart 1 for military pilots and chart 2 for civilian pilots.

Chart 1

Career path for U.S. Military Pilots

United States Navy & Marine Corps		**United States Air Force**			
Academy or NROTC	OCS	Academy or AFROTC	OTS	Reserves	National Guard
Attend Academy or NROTC ↓ Active Duty Commission ↓ API, Primary, Intermediate, & Advanced Flight Training ↓ Pick your aircraft based on merit ↓ Assignments based on career/Navy needs ↓ Eligible for full retirement after 20 years	4-Year College Degree ↓ Officer Candidate School ↓ Active Duty Commission ↓ API, Primary, Intermediate, & Advanced Flight Training ↓ Pick your aircraft based on merit ↓ Assignments based on career/Navy needs ↓ Eligible for full retirement after 20 years	Attend Academy or AFROTC ↓ Active Duty Commission ↓ Undergraduate Flight Training (UFT) ↓ Pick your aircraft based on merit ↓ Assignments based on career/AF needs ↓ Eligible for full retirement after 20 years	4-Year College Degree ↓ Officer Training School ↓ Active Duty Commission ↓ Undergraduate Flight Training (UFT) ↓ Pick your aircraft based on merit ↓ Assignments based on career/AF needs ↓ Eligible for full retirement after 20 years	4-Year College Degree ↓ Officer Training School ↓ Active Duty Commission ↓ Undergraduate Flight Training (UFT) ↓ Pick your aircraft based on merit ↓ Assignments based on career/AF needs ↓ After completing 20 good years; eligible for retirement benefits at age 60	4-Year College Degree ↓ Selected by ANG Unit ↓ Academy Of Military Science (AMS) ↓ Undergraduate Flight Training (UFT) ↓ You will fly your Unit's aircraft ↓ Permanently based at your Unit's location ↓ After completing 20 good years; eligible for retirement benefits at age 60

Source: Adapted from Training Air Wing 4 (2008).

Chart 2

Career Paths for U.S. Civilian Pilots

Education and/or Training Provider			Certificates & Ratings	Additional Jobs to Build Flight Time & Experience
Part 141 University Program	Part 142 Large Commercial Training Provider	Part 61Small Training Provider		
Attend University/ College Aviation program (2 to 4 years) ↓ Fight Instruct (2 to 3 years) OR ↓ Corporate Flying (2 to 3 years) ↓ Regional Airlines (3 to 4 years) ↓ Major Airline (Generally requires a four year degree)	Attend University/ College (2 to 4 years) ↓ Attend Part 142 school (18 months to 2 years) ↓ Fight Instruct (2 to 3 years) OR ↓ Corporate Flying (2 to 3 years) ↓ Regional Airlines (3 to 4 years) ↓ Major Airline (Generally requires a four year degree)	Attend University/ College (2 to 4 years) ↓ Receive Part 61 training *(18 months to 2 years) ↓ Fight Instruct (2 to 3 years) OR ↓ Corporate Flying (2 to 3 years) ↓ Regional Airlines (3 to 4 years) ↓ Major Airline (Generally requires a four year degree)	Certificates: - Private - Commercial - Instructor (optional) - Airline Transport Pilot (ATP) Ratings: - Instrument - Multi-engine - Instrument Instructor (optional) - Aircraft Type Ratings	- Flight Instructor - Crop Dusting - Power Line Inspection - Traffic watch - Fire watch - Fish spotting - Law Enforcement - Civil Air Patrol - Research grants - Sightseeing - Small business support such as car dealerships

(NOTE: *Time may be reduced if Part 61 training is received while attending college.)

(Representative costs for civilian pilots pursuing the FAA certificates or ratings required to become a pilot for a major carrier will be shown in the following section)

The Military Training Maze

The military has approximately 28,000 fixed wing pilots in the Air Force, Navy, Marines, and Coast Guard. Each year, approximately 3,000 new student pilots are

accepted for military flight training. Each flight training candidate must have a college degree and have completed the officer training specific to their branch of the service. Additionally, they must pass a battery of physical, psychological, and motor skill tests prior to beginning initial flight training. Initial training and flight screening requires approximately 20 to 26 weeks. If successful in this phase, candidates move on to advanced training that lasts 26 to 50 weeks depending on the type of operational aircraft they will eventually fly. The next phase is operational flight training for a specific mission which may require an additional 42 to 74 weeks. After earning their wings, the aviator has a service obligation of six to ten years (Miller 2004).

Upon completion of U.S. military training, an individual who wishes to obtain a FAA commercial/instrument airman's certificate must apply to the Federal Aviation Administration (FAA). If the pilot has flown within the past year, the candidate can take his or her flight records to one of the FAA's Flight Standards District Offices and be issued a civilian certificate. If the pilot has not flown during the past year, he or she must pass flight tests administered by an FAA representative.

The Civilian Training Maze

To obtain the necessary FAA certificates and ratings to enter commercial aviation, a pilot typically has to successfully complete ground and flight training and then pass the following three FAA tests for each certificate or rating acquired:

1. A written exam with a passing grade of 70% or higher.
2. An oral exam that typically lasts between one and two hours.
3. A flight test with an FAA approved examiner.

Additionally, prior to being allowed to exercise the privileges associated with a specific FAA certificate, a pilot must obtain the appropriate class of medical certificate from an FAA authorized aviation medical examiner. This documentation certifies that the pilot meets specific health and fitness criteria. There are three levels of medical certificates: a first-class certificate required to exercise the rights of an Airline Transport Pilot (the pilot-in-command (PIC) of a commercial airliner), a second-class certificate needed by commercial pilots, and a third-class certificate covering private pilots and students. The cost of obtaining a medical certificate can range from $50 to $150 dollars for a second or third-class certificate to several hundred dollars for a first-class certificate.

Step One: Private Pilot's Certificate

The first formal step in becoming an airline pilot is obtaining a private pilot certificate. This is generally accomplished by taking ground and flight training from a FAR Part 142, 141 or 61 approved training provider. This introductory course presents requisite knowledge about aerodynamics, flight characteristics, and general aircraft operating procedures. Other ground school training includes courses in airport operations, communications with other aircraft and air traffic controllers, navigation skills, flight planning, weather, and aviation regulations. This knowledge is practically applied in the

air with an instructor as students take flying lessons of increasing complexity culminating in the ability to fly solo. To successfully complete the private pilot course of instruction, the student must complete the three testing phases mentioned earlier in this section. With a private pilot certificate in hand, the holder can now rent or operate their own aircraft and fly solo or with others under visual flight rules in good weather. The cost of basic flight training ranges from $80 to $120 per hour with the total cost to earn a private pilot's certificate around $6,000 to $8,000.

Step Two: Instrument Rating

An instrument rating allows a pilot to fly during periods of darkness or when visibility or ground reference is obscured by clouds, fog, or other visibility-limiting conditions. To obtain the rating, a pilot attends instrument ground school where they learn to operate and navigate the aircraft purely by reference to cockpit instruments and electronic displays. Ground school is then followed by a specified number of actual flight hours with an instructor under instrument or simulated instrument conditions. As with other FAA certificates or ratings, to successfully complete the course a pilot must pass a FAA written and oral exam, and an instrument check-ride with an FAA examiner. Historically, private pilots generally pursued instrument ratings during or shortly after obtaining their commercial pilot certificate; the cost of the instrument rating being approximately $7,500.

Today, under the new FAA Industry Training Standards (FITS) program, the private pilot and instrument rating courses have been combined. This new approach is designed to produce a more capable pilot, in a shorter time and at a lower cost. The cost of completing the new FITS course should be in the range of $10,000 to $12,000.

Step Three: Commercial Pilot's Certificate

A commercial pilot certificate is required in order to be compensated for performing flying activities. The number of flight hours required to obtain a commercial certificate depends on the FAA approved program of the pilot’s chosen training provider. Although the hour requirements differ slightly between Part 61 and 141 training providers, a pilot can plan on completing at least 250 flight hours to obtain a commercial certificate. Although there is not a great deal of additional training required to move from a private to a commercial certificate , a pilot must clearly demonstrate a higher level of technical proficiency and operating knowledge to pass the FAA flight test and/or be competitive for employment. During this licensing phase, a pilot must demonstrate their ability to operate a “complex” aircraft (one equipped with flaps, retractable landing gear, and a variable pitch propeller). Once acquired, a commercial certificate allows a pilot to be compensated for flying a single-engine aircraft conducting such revenue activities as sight-seeing, banner or glider towing, or traffic watch for a news station. Normally, all of these activities are conducted locally and in good weather. To advance past this initial entry into commercial aviation, a pilot must secure additional FAA ratings and build experience in the form of flight hours conducted in larger and more complex aircraft during periods of darkness and/or actual weather conditions.

Step Four: Multi-Engine Rating

In order to compete for jobs at most commercial airlines, pilots must be qualified to fly aircraft with more than one engine. Multi-engine planes tend to be larger, heavier, and more complex machines than single-engine aircraft. Pilots must learn to operate new and more sophisticated systems in a much faster-paced operating environment to prepare for airline operations. The main focus of multi-engine training is learning the handling characteristics of the aircraft during engine failure events. Engine failures on multi-engine aircraft create unbalanced forces on the plane that must be overcome by the pilot in a timely manner. To complete multi-engine training, a pilot attends ground school, completes a specified number of flight hours in a multi-engine aircraft with an instructor, and completes an FAA-administered oral exam and flight test. There is no FAA written exam associated with a multi-engine rating. Normally, the cost for completing a multi-engine rating ranges from $3,500 to $4,000 depending on the training aircraft.

Step Five: Certified Flight Instructor's Certificate (CFI) (optional)

This certificate is not necessarily required to become an airline pilot, but is an excellent way of building flight hours and developing the experience needed to be competitive for an airline job. To become a CFI, a candidate must demonstrate the ability to fly the maneuvers required for a commercial pilot certificate from the right, or co-pilot seat, of a single engine aircraft while explaining the successful accomplishment of each maneuver to a student occupying the aircraft's left seat. The cost of obtaining an instructor's certificate is approximately $4,500 to $7,000.

Step Six: Certified Flight Instructor's - Instrument Certificate (CFII) (optional)

A CFI certificate can be expanded to include an instrument qualification that allows the instructor to provide training to pilots seeking an instrument rating. Again, the primary advantage of acquiring this enhanced CFI certificate is increased earning potential and the ability to build additional flight hours.

Step Seven: Airline Transport Pilot Certificate (ATP)

The ATP certificate is the pinnacle of an aviation career. The ATP is required to be the pilot-in-command (PIC) for an airline, corporate flight department, or charter operator. Often required for insurance reasons, the ATP certificate signifies the pilot is capable of assuming responsibility for the safety and well being of the passengers or cargo aboard a large turbine powered commercial aircraft. To qualify for an ATP, the FAA requires a pilot to:

1. Be at least 23 years of age.
2. Be able to read, speak, write, and understand the English language.
3. Be of good moral character.
4. Hold at least a commercial pilot certificate and an instrument rating or hold either a foreign ATP or a foreign commercial pilot certificate and an instrument rating,

without limitations, issued by a member nation of the International Civil Aviation Organization (ICAO).

5. Hold at least a current FAA third-class medical certificate (To actually exercise the privileges of an ATP a PIC requires a valid first-class medical certificate).
6. Receive and log ground training from an authorized instructor, or complete a home-study course.
7. Pass a pilot knowledge test with a score of 70% or better.
8. Accumulate 1,500 hours of total flight time which must include:
    a. 250 hours of flight time as PIC of an airplane, or as second-in-command (SIC) performing the duties and functions of a PIC under the supervision of a PIC, or by any combination of the two.
    b. 500 hours of cross-country flight time.
    c. 100 hours of night flying.

    d. 75 hours of actual or simulated instrument flight time.

As shown by the aforementioned requirements to obtain an ATP, an individual is already an experienced, professional aviator when they apply for the certificate. Therefore, the cost of completing an ATP can be as little as $1,500 since all of the training and experience required was accumulated during the qualification for other certificates and ratings. However, after all the time, cost, and effort required to earn the certificates and ratings previously discussed in this paper, a pilot with only the minimum FAA requirements to obtain an ATP is rarely competitive for a job at a major airline. Major airlines look for pilots that not only have an ATP, but extensive flight experience. This experience includes thousands of flight hours, extensive time in several complex and high performance aircraft, extensive time flown in actual adverse weather conditions, time flown in international operations, and time flown in multiple crew positions. Generally, a pilot who has just received their ATP must work their way up the ladder by flying for small cargo carriers, flight training schools, business jet operators, charter services, or regional commuter airlines in order to build the flight time and experience necessary to be hired by a major carrier. It can easily take four or five years to qualify for an interview at a major air carrier.

In addition to FAA certification, each airline also has their own FAA approved training program that a pilot must successfully complete to obtain full employment. However, this does not signify the end of training as each pilot must successfully complete recurrent training every six months (one year for specialized advanced qualification programs) to remain employed. Even if a pilot leaves one airline and goes to another flying the same aircraft model, he will have to complete that airline's training program before conducting flight operations. In order to manage risk as closely as possible, a pilot must have an intimate knowledge of the workings of each aircraft type he flies and the duties of each crew position on that aircraft.

Initial company training courses for either a regional or major airline last about ten weeks. The first couple of weeks cover basic indoctrination, regulations, and procedures specific to airline. The remainder of the training is devoted to ground and

flight training for the pilot's initial aircraft assignment. Ground training is followed by procedures practice in a non-motion cockpit mock-up. This phase is generally followed by flight training in a full motion simulator. Upon successful completion of simulator training, a pilot flies a set number of hours in his assigned aircraft with a Line Check Airman in actual commercial operations. Once this "initial operating experience (IOE)" is complete, the pilot is released to crew scheduling for assignment to normal revenue flight operations. In terms of continuing education and assessment, a pilot serving as SIC (or a flight engineer on a three pilot crew) must return to the simulator each year to demonstrate proficiency in non-normal or emergency skills that are rarely utilized. A pilot serving as PIC must return every six months unless participating in an FAA approved Advanced Qualification Program (AQP). Simulator training and checking is preceded by a brief ground school to refresh crewmembers on systems failures rarely experienced during the normal conduct of flight operations and to emphasize crew resource management techniques. Failure to pass any phase of training at a regional or major airline is grounds for termination.

Conclusions and Recommendations

Despite rising oil prices and industry adjustments, the global demand for highly trained and experienced airline pilots should increase sharply over the next five years and remain strong for at least 15 years. The ability to meet this potential demand will present some interesting challenges considering the cost and time required to train and season a commercially viable pilot. Unlike the militaries of the world that have the resources to produce very high quality pilots in 12 to 14 months, existing civilian training organizations cannot currently match this capability in either quality, quantity or production time. Absent the use of jet aircraft during the Ab Initio portion of civilian flight training, it will be difficult for civilian training providers to produce the quality and quantity of jet pilots necessary to keep pace with global demand. Many training providers have invested heavily in advanced simulation to provide jet training to their students, but despite the truly excellent capabilities of today's level 5/6/6+ Flight Training Devices (FTD), they cannot replace the experience gained by actually flying a jet aircraft. Until recently, the acquisition, operating, and insurance costs of jet aircraft have placed them outside the reach of civilian training providers, Today however, the introduction of very light jets (VLJs) has drastically reduced the economic impact of operating small jet aircraft in training organizations. Although there are several regulatory and insurance issues to be addressed, the introduction of VLJ aircraft into Ab Initio training programs is well underway. By further enhancing existing Ab Initio programs with advanced learning management systems, podcasting delivery methodologies, and advanced crew resource management/risk management programs, civilian training providers will be far better prepared to meet the potential global demand for pilots. Clearly, the application of advanced technologies and new teaching techniques can create Ab Initio pilot training programs capable of producing commercially viable jet pilots in a timely manner. However, the cost of creating this pilot training capability is high.

In the U.S., major airlines have little or no problem attracting pilots from regional carriers. Therefore, they do not see a need to financially support Ab Initio pilot training at this time. Regional carriers have yet to exhaust their supply of pilot candidates so it

would be difficult to convince company CFOs that they should invest additional company assets in Ab Initio pilot training. Globally, many international airlines have traditionally used Ab Initio providers to meet their pilot needs since their countries often lacked regional airlines or a sufficient number of available military pilots. However, the sheer number of pilots required by these carriers to meet existing and anticipated aircraft delivery schedules and industry expansion plans is more than existing Ab Initio providers can supply. It has become readily apparent to international airlines that they will have to bear some of the cost burden for an enhanced Ab Initio pilot training capability. In the U.S., the discussion about direct support to Ab Initio training providers continues with no resolution in sight.

In the end, each airline will have to decide, based on their needs, when an investment in Ab Initio training is warranted. Unfortunately, many industry experts believe that this decision will be reactive rather than proactive. A decision forced by the parking of aircraft or a series of accidents. This perspective aside, the importance of having an adequate supply of properly trained, certificated, and seasoned pilots to meet the global demand cannot be overemphasized.

If the global airline industry is to remain safe and economically viable, the growing shortage of qualified commercial airline pilots must be addressed. The real question is who will pay for the training necessary to create these highly qualified pilots? Ultimately, it may well require major airlines to become directly involved in fostering and sponsoring Ab Initio training programs to ensure their corporate sustainability. The time for the airline industry and academics to discuss this issue is now, before economic forces potentially lead to less than properly prepared pilots being allowed into the global aviation work force.

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