



February 2014

AVIATION WORKFORCE

Current and Future Availability of Airline Pilots

GAO Highlights

Highlights of [GAO-14-232](#), a report to congressional requesters

Why GAO Did This Study

Over 66,000 airline pilot jobs exist for larger mainline and smaller regional airlines that operate over 7,000 commercial aircraft. After a decade of turmoil that curtailed growth in the industry and resulted in fewer pilots employed at airlines since 2000, recent industry forecasts indicate that the global aviation industry is poised for growth. However, stakeholders have voiced concerns that imminent retirements, fewer pilots exiting the military, and new rules increasing the number of flight hours required to become a first officer for an airline, could result in a shortage of qualified airline pilots.

GAO was asked to examine pilot supply and demand issues. This report describes (1) what available data and forecasts reveal about the need for and potential availability of airline pilots and (2) what actions industry and government are taking or could take to attract and retain airline pilots. GAO collected and analyzed data from 2000 through 2012, forecasts from 2013 through 2022, and literature relevant to the labor market for airline pilots and reviewed documents and interviewed agency officials about programs that support training. GAO interviewed and collected data from associations representing airlines or their pilots, and pilot schools that accounted for about half of the students who graduated with professional pilot majors in 2012. GAO selected the airlines and schools based on factors such as size and location. GAO is not making recommendations in this report. The Department of Transportation and others provided technical clarifications on a draft of the report, which GAO incorporated.

View [GAO-14-232](#). For more information, contact Gerald L. Dillingham at (202) 512-2834 or dillinghamg@gao.gov.

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What GAO Found

GAO found mixed evidence regarding the extent of a shortage of airline pilots, although regional airlines have reported difficulties finding sufficient numbers of qualified pilots over the past year. Specifically, looking at broad economic indicators, airline pilots have experienced a low unemployment rate—the most direct measure of a labor shortage; however, both employment and earnings have decreased since 2000, suggesting that demand for these occupations has not outstripped supply. Looking forward, industry forecasts and the Bureau of Labor Statistics' employment projections suggest the need for pilots to be between roughly 1,900 and 4,500 pilots per year, on average, over the next decade, which is consistent with airlines' reported expectations for hiring over this period. Yet studies GAO reviewed examining whether the future supply of pilots will be sufficient to meet this need had varying conclusions. Two studies point to the large number of qualified pilots that exists, but who may be working abroad, in the military, or in another occupation, as evidence that there is adequate supply. However, whether these pilots choose to seek employment with U.S. airlines depends on the extent to which pilot job opportunities arise, and on the wages and benefits airlines offer. Another study concludes that future supply will be insufficient, absent any actions taken, largely resulting from accelerating costs of pilot education and training. Such costs deter individuals from pursuing a pilot career. Pilot schools that GAO interviewed reported fewer students entering their programs resulting from concerns over the high costs of education and low entry-level pay at regional airlines. As airlines have recently started hiring, nearly all of the regional airlines that GAO interviewed reported difficulties finding sufficient numbers of qualified entry-level first officers. However, mainline airlines, because they hire from the ranks of experienced pilots, have not reported similar concerns, although some mainline airlines expressed concerns that entry-level hiring problems could affect their regional airline partners' ability to provide service to some locations.

Airlines are taking several actions to attract and retain qualified commercial airline pilots. For example, airlines that GAO interviewed have increased recruiting efforts, and developed partnerships with schools to provide incentives and clearer career paths for new pilots. Some regional airlines have offered new first officers signing bonuses or tuition reimbursement to attract more pilots. However, some airlines found these actions insufficient to attract more pilots, and some actions, such as raising wages, have associated costs that have implications for the industry. Airline representatives and pilot schools suggested FAA could do more to give credit for various kinds of flight experience in order to meet the higher flight-hour requirement, and could consider developing alternative pathways to becoming an airline pilot. Stakeholders were also concerned that available financial assistance may not be sufficient, given the high costs of pilot training and relatively low entry-level wages.

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Abbreviations

ATP	airline transport pilot certificate
BLS	Bureau of Labor Statistics
CFI	certified flight instructor
CFR	Code of Federal Regulations
CIP	Classification of Instructional Programs
CPS	Current Population Survey
DOD	Department of Defense
DOL	Department of Labor
DOT	Department of Transportation
Education	Department of Education
ETA	Employment and Training Administration
FAA	Federal Aviation Administration
IPEDS	Integrated Postsecondary Education Data System
MPL	multi-crew pilot license
OES	Occupational Employment Statistics
RACCA	Regional Air Cargo Carriers Association
SOC	Standard Occupational Classification
STEM	science, technology, engineering, and math
R-ATP	restricted-privileges airline transport pilot certificate
VA	Department of Veterans Affairs
WIA	Workforce Investment Act of 1998

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February 28, 2014

Congressional Requesters

The airline industry contributes to the U.S. economy by providing global mobility and connectivity in transporting passengers and cargo, as well as significant economic and social benefits to small communities. The U.S. airline industry operated more than 7,000 commercial airplanes in 2012, and there were over 72,000 pilots employed nationwide.¹ Since 2000, the aviation industry has experienced significant turmoil (e.g., the 2001 terrorist attacks, the SARS epidemic, two recessions, and numerous mergers and bankruptcies) that has curtailed its growth. However, recent industry forecasts indicate that the global aviation industry is poised for growth, and airlines around the world, including several domestic airlines that are recalling their remaining furloughed pilots, have announced plans to hire several thousand new pilots in the coming years.

Aviation stakeholders have voiced concerns that an insufficient supply of available and qualified pilots could develop because of imminent retirements, changes to qualification requirements for airline pilots acting as first officers, and perceptions that fewer people are entering pilot schools and fewer pilots exiting the military, among other reasons, thus, challenging airlines' ability to fill the near- and long-term demand for pilots. In light of these stakeholder concerns, you asked us to examine the supply of and demand for airline pilots and potential market and government responses. Specifically, this report describes (1) what the available data and forecasts reveal about the need for and potential availability of airline pilots and (2) the types of industry and government actions that are being taken, or might be taken, to attract and retain airline pilots.²

To address these objectives, we reviewed economic literature that describes how to evaluate labor market conditions, including identifying a

¹Data on pilots employed were retrieved from the Bureau of Transportation Statistics' TranStats Web site.

²GAO recently performed similar work focused on the supply of and demand for aviation professionals—including aerospace engineers, aircraft mechanics, and avionics technicians—see GAO, *Aviation Workforce: Information on Current and Future Availability of Aviation Professionals*, [GAO-14-237](#) (Washington, D.C.: February 2014).

labor shortage.³ Following the literature, we analyzed data from the Department of Labor's (DOL) Bureau of Labor Statistics' (BLS) Current Population Survey (CPS)—a monthly survey of households conducted by the Bureau of Census for BLS—on the unemployment rate, employment, and median weekly earnings (earnings) from 2000 through 2012. We also obtained data from BLS's Occupational Employment Statistics (OES) survey for employment and wage earnings from 2000 through 2012. These data can be used as indicators of whether labor market conditions are consistent with a shortage. We used SAS, a statistical software application, to connect the BLS CPS data for 2000-2010 and 2011-2012 by the Standard Occupational Classification (SOC) for aircraft pilots.⁴ We analyzed how these indicators have changed over time, and whether these indicators suggest a labor shortage. To verify our results, we consulted with Malcolm Cohen, Ph.D., labor economist and author of the original methodology for conducting indicator analysis, and incorporated his comments as appropriate. We determined the data were sufficiently reliable for the purposes of our indicator analysis to provide context on the labor market. We also reviewed studies that projected the supply of, demand for, or employment for airline pilots. Each study was reviewed by one GAO economist to evaluate its methods, assumptions, and limitations, and this review was then verified by a second GAO economist. For one study, we replicated the analysis using data provided by the lead researchers. We determined these studies were sufficiently reliable for reporting purposes, and where relevant in this report, we described the limitations we identified in these studies. We reviewed data from the Department of Education (Education) on completion rates for degree or certificate programs that might prepare individuals to work as airline pilots; the Department of Defense (DOD) on the number of military pilots leaving the services; and FAA on the numbers of and types of pilot certificates and pilot schools. We also attempted to gather data projections for the next 10 years (2014 through 2023). To understand the

³See Malcolm S. Cohen, *Labor Shortages as America Approaches the Twenty-first Century* (Ann Arbor, The University of Michigan Press: 1995); James Bell Associates for Department of Labor, *Labor Shortages Case Studies*, (Arlington, VA: 1993); and Carolyn M. Veneri, "Can Occupational Labor Shortages Be Identified Using Available Data?" *Monthly Labor Review* (March 1999).

⁴We used the SOC detailed occupation 53-2011 for "Airline Pilots, Copilots, and Flight Engineers." This number does not include individuals in the SOC detailed occupation 53-2012 for "Commercial Pilots" who are not employed by airlines. The SOC system is used by federal statistical agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data.

extent that employers have had difficulty attracting or retaining airline pilots and whether steps were being taken to mitigate perceived shortages, we interviewed and collected data from various industry stakeholders, including associations representing airlines and airline pilots, mainline and regional airlines,⁵ pilot training programs, industry organizations, among others. See appendix I for more information about our scope and methodology and a listing of the stakeholders we interviewed.

We conducted this performance audit from March 2013 through February 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The U.S. airline industry is vital to the U.S. economy. Airlines directly generate billions of dollars in revenues each year and contribute to the economic health of the nation. Large and small communities rely on airlines to help connect them to the national transportation system. To operate as an airline carrying passengers or cargo for hire or compensation, a business must have an air carrier (airline) operating certificate issued by the Federal Aviation Administration (FAA), based on federal aviation regulations. Certification is determined by the type of commercial service being provided. Airlines that provide scheduled commercial service operate in accordance with Part 121 of Title 14 of the Code of Federal Regulations (CFR)⁶ and are often grouped into two categories: mainline and regional. Mainline airlines include (1) passenger service providers, such as American and Delta that offer domestic and

⁵Mainline airlines provide domestic and international passenger and cargo service on larger aircraft. Regional airlines provide domestic and limited international passenger service, generally using aircraft with fewer than 90 seats, and cargo service to smaller airports.

⁶14 C.F.R. Part 121 prescribes rules governing the domestic, flag, and supplemental operations to hold an air carrier certificate. Scheduled-service airlines are generally issued a Part 121 certificate by FAA and operate turbojet-powered airplanes or airplanes with more than nine passenger seats or airplanes having a payload capacity of more than 7,500 pounds.

international passenger service on larger airplanes, and (2) cargo service providers, such as United Parcel Service and Federal Express, that offer domestic and international cargo service. Regional airlines include (1) passenger service providers, such as SkyWest and ExpressJet, that offer domestic and limited international passenger service, generally using airplanes with fewer than 90 seats and transporting passengers between large hub airports and smaller airports, and (2) cargo service providers, such as ABX Air and Kalitta Air, that provide domestic and limited international cargo service on a charter or contract basis. Regional airlines generally provide service to smaller communities under capacity purchase agreements⁷ with mainline airlines, operate about half of all domestic flights, and carry about 22 percent of all airline passengers. At the end of fiscal year 2012, according to FAA, the U.S. commercial airline industry consisted of 15 scheduled mainline airlines and 70 regional airlines. According to available data, there were over 72,000 airline pilots employed nationwide in 2012. In addition to mainline and regional airlines, other smaller, commercial air-service providers offer scheduled and unscheduled service, via commuter or on-demand operations, and operate in accordance with Part 135 of Title 14 of the CFR.⁸

It takes many years of training and significant financial resources to meet FAA's certification and aeronautical experience qualifications to become an airline pilot. FAA issues several types of pilot certificates that airline pilots progress through—including student pilot, private, commercial, and airline transport pilot (ATP).⁹ Federal aviation regulations establish the core requirements for each pilot certification, including the eligibility requirements, aeronautical knowledge, aeronautical experience, and flight proficiency standards. Regulations also govern what pilots with each

⁷Under a capacity purchase agreement, mainline airlines contract with regional airlines to provide air service beyond the mainline airline's route network to increase their capacity and revenue. Agreement terms vary, but mainline airlines generally take on all commercial functions, such as brand marketing, flight scheduling, and ticket pricing while the regional airlines are responsible for the aircraft and crews to operate the flights, and provide ground and flight operations.

⁸14 C.F.R. Part 135 prescribes rules governing the commuter or on-demand operations to hold an air carrier certificate. Nonscheduled-service airlines are generally issued a Part 135 certificate by FAA and operate aircraft other than turbojet-powered airplanes having no more than nine passenger seats and a payload capacity of 7,500 pounds or less.

⁹14 C.F.R. Part 61 prescribes the minimum training, knowledge, and experience requirements for acquiring a pilot certificate.

certificate can do. For example, a private pilot certificate allows pilots to fly solo or carry passengers in any aircraft for which they are qualified, but not to fly for compensation; a commercial pilot certificate is necessary for a variety of non-airline pilot jobs. The ATP certificate is the highest level of pilot certification, requires the highest amount of cumulative flight time and is necessary to fly as a captain or first officer for an airline.

Airline pilots are mostly trained through FAA-certified pilot schools at a college or university—typically through 2- and 4-year degree programs—non-collegiate vocational schools, or in the military. Outside of military training, where service members receive compensation while training to become a pilot, costs can vary significantly for individuals wishing to become a pilot depending on the number of certificates and ratings¹⁰ they wish to attain and the school or training program they choose. Generally, costs to attain a private pilot certificate averages about \$9,500, according to the University Aviation Association.¹¹ However, the academic education and flight training from a 4-year aviation degree program to obtain up to a commercial pilot certificate with additional ratings necessary to be hired as a pilot for commercial flying can cost well in excess of \$100,000. Pilot students generally do not come out of collegiate and vocational pilot schools with the necessary requisites to attain an ATP certificate. Individuals will typically graduate from these schools with a commercial pilot certificate, and then they must gain experience by accumulating flight time and pass additional certification testing to obtain an ATP certificate. Similarly, upon separation from the military, military pilots would have to meet the same flight time requirements and pass the certification tests as a civilian pilot would in order to obtain an ATP certificate, although they may be able to use their military flight time to meet those requirements.

Until recently, regional and mainline airlines were permitted to hire first officers who had obtained a commercial pilot certificate which, among

¹⁰A rating defines the conditions or type of aircraft in which a pilot certificate may be used. In addition, endorsements by flight instructors may be given to pilots to further define conditions or specific aircraft not covered by ratings.

¹¹The University Aviation Association is the representative voice of college aviation education to the aviation industry, government agencies, and the general public.

other things, required a minimum of 250 hours of flight time.¹² However, following the 2009 Colgan Air, Inc. crash, in New York, the Airline Safety and Federal Aviation Administration Extension Act of 2010¹³ mandated that FAA further limit the hours of pilot flight and duty time to combat problems related to pilot fatigue and increase training requirements and pilot qualifications for first officers. In January 2012, FAA issued a rule mandating that pilots have certain rest periods between flights and limiting the number of consecutive hours a pilot may fly.¹⁴ This rule became effective as of January 2014. In July 2013, FAA, as required by the law, issued a new pilot qualification rule that increased the requirements for first officers who can fly for U.S. passenger and cargo airlines.¹⁵ The rule requires that first officers now hold an ATP certificate, just as captains must hold, requiring, among other things, a minimum of

¹²In commercial aviation, the pilot-in-command (captain) of an aircraft is the person aboard the aircraft who is ultimately responsible for its operation and safety during all phases of flight, as well as when it is operating or moving on the ground, in accordance with FAA's regulations. The second-in-command (first officer) is the second pilot of an aircraft, and has the authority to assume command of the aircraft in the event of incapacitation of the captain. However, control of the aircraft is normally shared equally between the captain and first officer during flight.

¹³Pub. L. No. 111-216, 124 Stat. 2348 (2010).

¹⁴77 Fed. Reg. 330 (Jan. 4, 2012).

¹⁵78 Fed. Reg. 42324 (July 15, 2013). The Airline Safety and Federal Aviation Administration Extension Act of 2010 also stated that in the event that FAA failed to meet the deadline for conducting the necessary rulemaking to implement a new requirement for all airline pilots to have an ATP certificate, the requirement would begin to automatically apply 3 years after the date of enactment of the law, or approximately August 2, 2013. Pub. L. No. 111-216, § 216 (c), 124 Stat. 2348, 2367 (2010).

1,500 hours of total time as a pilot.¹⁶ The law also gave FAA discretion to allow specific academic training courses to be credited toward the required hours of total time as a pilot.¹⁷ As such, the rule included an allowance for pilots with fewer than 1,500 hours of total time as a pilot to obtain a “restricted-privileges” ATP certificate (R-ATP)—that is, to allow pilots to serve as first officers until they obtain the necessary 1,500 hours of total time as a pilot needed for an ATP certificate—when they meet certain requirements¹⁸ and are:

1. former military pilots with 750 hours of total time as a pilot;

¹⁶As required by law, in order to enhance the academic training and operational experience requirements for airline pilots, FAA created the ATP Certification Training Program (ATP CTP) to be a prerequisite for pilots to take the knowledge test to obtain an ATP certificate—to be effective August 1, 2014. Pub. L. No. 111-216, § 217, 124 Stat. 2348, 2367. The program includes training in aerodynamics, automation, adverse weather conditions, air carrier operations, transport airplane performance, leadership, and professional development. Also, the program requires that pilots receive 10 hours of training in flight simulation training devices: 6 hours in a Level C or higher full-motion flight simulator, and 4 hours in Level 4 or higher flight training simulation device. Further, to serve to as a first officer for an airline, a pilot with an ATP or R-ATP certificate must also obtain an appropriate type rating for the aircraft for which he or she operates for the airline. FAA’s new pilot qualification rule, in response to concerns about the lack of sufficient number of training devices to deliver the ATP CTP, stated there were currently 407 FAA-evaluated Level C or higher full-motion flight simulator devices that replicate aircraft with a maximum takeoff weight at or exceeding 40,000 pounds. These devices represent 98 percent of all Level C and D full-motion flight simulators that have been approved by the FAA. Also, there were 81 Level 4 or higher flight training simulation devices. Based on FAA’s analysis of usage for these devices, FAA determined there was sufficient inventory of these devices available to accommodate the requirements of the ATP CTP training course, even with the moderate usage for training unrelated to the course.

¹⁷Section 217(d).

¹⁸14C.F.R. § 61.160(a), (b), and (c), respectively. An ATP certificate requires that a pilot be 23 years of age (14 CFR 61.153(a)(1)), have 1,500 hours total time as a pilot and 500 hours of cross-country flight time (14 CFR 61.159(a)). To qualify for an R-ATP, a pilot must be 21 years of age (14 CFR 61.153(a)(2)) and have 200 hours of cross-country flight time (14 CFR 61.160(f)). The 200 hours of cross-country experience represents a significant increase over the 50 hours of cross-country flight time required for the commercial pilot certificate—the prior requirement to serve as a first officer in part 121 operations. Pilots who hold an R-ATP certificate will be required to meet the 500 hours of cross-country flight time required in section 61.159 prior to having the limitation removed from their certificate. The rule also included a regulatory provision that allows a pilot who is at least 21 years old, and has 1,500 hours of total time as a pilot and 200 hours of cross-country flight time to be eligible for an R-ATP.

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2. graduates of approved 4-year aviation degree programs with 1,000 hours of total time as a pilot and meet other requirements;¹⁹ or
 3. graduates of approved 2-year aviation degree programs with 1,250 hours of total time as a pilot and meet other requirements.²⁰

As of January 24, 2014, 37 collegiate 2- and 4-year aviation degree programs have been authorized to certify graduates to be eligible to apply for an R-ATP certificate.

Although previously permitted to hire first officers with commercial pilot certificates, mainline airlines have generally required their first officers to possess an ATP certificate. Regional airlines, however, would frequently hire entry-level pilots as first officers who had completed training in collegiate and vocational pilot schools and held a commercial pilot certificate and an instrument rating²¹ after these individuals had gained additional aeronautical experience. Previously these graduates could work as first officers for regional airlines and build the additional flight time necessary to qualify for an ATP certificate, but under the new pilot qualification rule, they must attain this experience in other ways prior to being eligible to fly for a regional airline. As a result, FAA and industry stakeholders estimate it may take an additional 1-2 years for pilots coming out of school (roughly 6 years or more from the beginning of training) to accrue the required number of flight hours to qualify for an

¹⁹In order to qualify for the R-ATP with a minimum of 1,000 hours of total time as a pilot, the graduating pilot must hold a bachelor's degree with an aviation major from an institution of higher education and complete 60 semester credit hours of aviation and aviation-related coursework that has been recognized by the FAA Administrator as coursework designed to improve and enhance the knowledge and skills of a person seeking a career as a professional pilot. 14 CFR 61.160(b).

²⁰In order to qualify for the R-ATP with a minimum of 1,250 hours of total time as a pilot, the graduating pilot must hold a bachelor's or an associate's degree with an aviation major and complete 30 aviation semester credit hours, who also receives a commercial pilot certificate and instrument rating, from an institution of higher education that has been recognized by the FAA Administrator as coursework designed to improve and enhance the knowledge and skills of a person seeking a career as a professional pilot. 14 CFR 61.160(c).

²¹Instrument rating is the qualification that allows a pilot to operate an aircraft under the rules and procedures for flying solely by reference to an aircraft's instruments (Instrument Flight Rules) instead of by visual reference (Visual Flight Rules). While an instrument rating requires additional training and instruction beyond what is required for a private pilot or commercial pilot certificate, it is not issued at a certain pilot certification level and is merely an operating privilege.

ATP certificate.²² Options available to these pilots to build the necessary flight hours include:

- Obtain a certified flight instructor (CFI) certificate which allows pilots to accrue flight hours while instructing new student pilots.²³
- Become employed with Part 135 air service providers (i.e., commuter and on-demand, or non-Part 121 cargo operations) as a first officer, where a commercial pilot certificate (minimum 250 hours) is required, among other requirements.
- Become employed performing Part 91 operations—such as banner towing, crop dusting, and corporate flights.²⁴
- Pay for flight time such as renting aircraft for flying or training in a flight simulation training device.²⁵
- Work abroad for foreign airlines, or join the U.S. military and be trained as a pilot.

Several federal agencies have a role in supporting and developing the pilot workforce. As mentioned, FAA is responsible for the administration of pilot certification (licensing), among other things, and DOD, the Department of Veterans Affairs (VA), DOL and its Employment and Training Administration (ETA), and Education each have a role that may contribute to the availability of airline pilots (see table 1).

²²This estimate assumes a total of 4 years to complete a collegiate aviation degree program, obtaining a commercial pilot certificate and instrument rating, and 1-2 years spent gaining the additional experience and number of flight hours to qualify for an ATP certificate.

²³The holder of a valid flight instructor certificate may provide pilot training and instruction for pilot certification in any aircraft for which they are qualified. 14 C.F.R. § 61.183.

²⁴14 C.F.R. Part 91 outlines the federal aviation regulations for the basic rules governing all flight operations. Pilots with commercial pilot certificates can be hired to operate aircraft under Part 91 for government operations (e.g., law enforcement, agricultural, environmental, and emergency response), banner towing, sightseeing operations, pipeline patrol, and corporate flights.

²⁵Part 61 allows for a maximum of 25 hours of training in a full flight simulator representing a multiengine airplane to be credited toward the flight time requirement for an ATP certificate if the training was accomplished as part of a FAA-approved training course. 14 C.F.R. § 61.159(a)(3). In addition, no more than 100 hours of the total non-airplane time towards the total time requirement for an ATP certificate which may be obtained in a full flight simulator or flight training device provided the device represents an airplane and the aeronautical experience was accomplished as part of a FAA-approved training course. 14 C.F.R. § 61.159(a)(5).

Table 1: Federal Roles and Responsibilities for Pilot Certification and Funding Aviation Training

Agency	Role
FAA	FAA issues pilot certificates and ratings; sets requirements and oversees the training provided by FAA-approved collegiate and non-collegiate vocational pilot schools and testing; sets and enforces regulations for airline operations, including crew requirements.
DOD/VA	U.S. airlines have historically recruited pilots trained in the U.S. military service branches. DOD also provides educational assistance to service members to help them enhance their professional development, which can be used for pilot training. VA also administers education benefit programs that can be used to pay for flight training for veterans who are interested in attending approved aviation programs.
DOL/ETA/BLS	DOL-supported workforce-training services can be used to fund aviation training. BLS collects employment and wage data and develops long-term (10-year) employment projections.
Education	Education provides financial assistance to support training in aviation-related fields.

Source: GAO analysis of government information.

Over the last decade, the civil aviation industry has been volatile because demand for air travel is sensitive to the state of the economy as well as to political, international, and even health-related events. As a result, despite periods of strong growth and earnings, the industry has at times suffered substantial financial distress resulting in the industry's contraction. For example, in response to the 2007-2009 economic recession and resulting decrease in demand for commercial air travel, airlines cut capacity, downsized their fleets, and reduced their workforce. However, as demand for air travel has rebounded and is expected to grow, airlines are now looking to hire a substantial number of pilots. Further, the U.S. airline industry is concerned there will not be a sufficient number of qualified airline pilots to support this growth and a labor shortage will result. While no agreed-upon definition for a labor shortage exists, it is commonly described as a sustained period during which the demand for workers exceeds the supply of workers available and willing to work at a particular wage and in specific working conditions at a particular place.²⁶

²⁶A labor shortage is similar in definition to a "skills gap." GAO recently reported that officials from BLS indicated the following conditions would be associated with a skills gap in a particular occupation: 1) jobs remain unfilled for a longer-than-normal time period, 2) wages are increasing, and 3) unemployment is low. GAO, *Workforce Investment Act: Local Areas Face Challenges Helping Employers Fill Some Types of Skilled Jobs*, [GAO-14-19](#) (Washington, D.C.: December 2013).

Data Are Mixed Regarding the Extent of an Airline Pilot Shortage, but Regional Airlines Are Experiencing Difficulties Hiring Entry-Level Pilots

Historical labor market data from 2000 through 2012 provide mixed evidence as to whether an airline pilot shortage exists. The unemployment rate for the pilot occupation—a key indicator for a shortage—has been much lower than for the economy as a whole, which is consistent with a shortage. On the other hand, wage earnings and employment were not consistent with the existence of a shortage, as data for both indicators showed decreases over the period. In looking forward, to meet the expectation of growth in the industry and to replace expected mandatory age-related pilot retirements, projections indicate the industry will need to hire a few thousand pilots on average each year over the next 10 years. Data indicate that a large pool of qualified pilots exists relative to the projected demand, but whether such pilots are willing or available to work at wages being offered is unknown. Furthermore, the number of pilot certificate holders has not been increasing, and fewer students are entering and completing collegiate pilot training programs. Studies and analyses related to the supply of airline pilots find that a shortage may arise depending on several factors, including the extent of future industry growth, the wages being offered, and escalation in education costs. As airlines have started hiring to address growth demands and attrition, 11 of the 12 regional airlines we interviewed reported difficulties filling entry-level first-officer vacancies. Mainline airlines, since they hire experienced pilots largely from regional airlines, have not reported similar difficulties, although mainline airline representatives expressed concerns that entry-level hiring problems could affect the ability of their regional partners to provide service to some locations.

Some Historical Labor Market Data Are Consistent with the Presence of a Pilot Shortage, and Other Data Are Not

While no single metric can be used to identify whether a labor shortage exists, labor market data can be used as “indicators,” in conjunction with observations from stakeholders.²⁷ According to economic literature, one can look at historical unemployment rates, as well as trends in employment and earnings.²⁸ If a labor shortage were to exist, one would expect (1) a low unemployment rate signaling limited availability of workers in a profession, (2) increases in employment due to increased

²⁷A labor shortage occurs when demand for workers for a particular occupation is greater than the number (“supply”) of workers who are qualified, available, and willing to do the work at a current wage rate.

²⁸All data on the unemployment rate, employment, and earnings come from BLS’s CPS unless otherwise noted.

demand for that occupation, and (3) increases in wages offered to draw more people into the industry.²⁹ Of these three indicators, the unemployment rate provides the most direct measure of a labor shortage because it estimates the number of people who are unemployed and actively looking for work in a specific occupation.³⁰ The BLS household survey-based CPS data used to evaluate these three indicators combined airline and commercial pilots into a single occupational category of pilots; therefore, we cannot isolate the extent to which the indicators apply to only airline pilots, although airline pilots represent about two-thirds of the employment within the occupation.³¹

According to BLS data we analyzed from 2000 through 2012, the unemployment rate of pilots has averaged 2.7 percent—a much lower unemployment rate than for the economy as a whole.³² This level of unemployment would be consistent with a shortage because it suggests few pilots during this time frame reported that they were looking for employment as a pilot and were unable to find it. Furthermore, in relative terms, over the entire period, the pilot occupation had the 53rd lowest unemployment rate out of the 295 occupations for which annual BLS data is available.

²⁹Cohen, *Labor Shortages*. In Cohen's analysis, growth rates are calculated by computing the year over year change or annualizing the data; the resulting year-over-year change is then located on a scale from 1 to 7 developed by Cohen, where 1 corresponds to strong indication of a labor surplus and 7 corresponds to strong indication of a labor shortage. Rather than looking at annualized data, we calculated the change in average annual growth, since calculating the data this way allowed us to calculate the significance of any trends. Although this resulted in larger year-to-year changes, it did not affect our interpretation of any of the results.

³⁰Cohen, *Labor Shortages*.

³¹The SOC for airline pilots includes those who pilot and navigate the flight of fixed-wing, multi-engine aircraft, usually on scheduled airline routes, for the transport of passengers and cargo, and commercial pilots are those involved in other flight activities, such as piloting helicopters, crop dusting, charter flights, and aerial photography. The BLS CPS data for unemployment, wage earnings, and employment combined both occupational categories, but the BLS OES survey subdivides its employment and earnings data for airline pilots and commercial pilots.

³²For the economy overall, since 2000, the average unemployment rate has been 6.3 percent, median earnings have not increased, and employment has stayed about the same.

Data on the other two indicators, wage earnings and employment growth, are not consistent with the existence of a shortage in the occupation. First, our analysis of BLS data from 2000 through 2012 shows that the median weekly earnings in the pilot occupation decreased by 9.5 percent over the period (adjusted for inflation), or by an average of 0.8 percent per year.³³ According to economic literature, a positive growth in wages is required for a shortage to be present. So, by absolute standards, the findings for this indicator do not appear consistent with a shortage for pilots during the time frame.³⁴ We also compared wages in this occupation to all other occupations and found wage growth for pilots has been low compared to other occupations. Specifically, the pilot occupation would be 187th out of the 250 occupations for which annual data are available. However, other factors can account for a decline or lack of growth in earnings even during a labor shortage. Earnings may be slow to adjust to other labor market trends, or certain aspects of an industry may prevent wages from increasing. For example, airlines may have limited flexibility to adjust wages for entry-level positions in response to a potential shortage due to seniority-based airlines' pay systems in place for pilots and because airlines' pilot wages are often negotiated contractually with labor unions.

Second, for the rate of employment growth, our analysis showed employment for pilots has actually decreased by 12 percent from 2000 to 2012, a decrease that is also not consistent with a shortage.³⁵ As previously stated, the airline industry has experienced considerable volatility over the last decade due to recessions, bankruptcies, and merger and acquisition activities that have curtailed growth in the industry. By relative standards, the rate of employment growth for the pilot

³³By changing the base year to 2001, for example, we would have estimated a different percentage change because the period was different. To ensure that these growth rates were not driven by our decision of the baseline year, we also estimated the average year-to-year growth by linear regression, and found similar results for annual growth rates of -0.37 percent per year. However, the decline was not statistically significant.

³⁴As stated previously, a limitation of the CPS data is that both airline and commercial pilots are combined into a single occupational category. For wages, data from an alternate source, the OES survey found that airline pilots median annual wages fell by 23 percent from 2000 to 2012, after correcting for inflation, whereas commercial pilots' median wages increased by 27 percent.

³⁵As stated previously, a limitation of the CPS data is that both airline and commercial pilots are combined into a single occupational category.

occupation ranked about 331st of the 490 occupations for which annual BLS data is available.

Our analysis of labor market data has a number of limitations given the nature of the CPS and OES data from BLS and the scope of our analysis. Occupations in the SOC system are classified using occupational definitions that describe the work performed and may not take into account specific requirements an employer seeks. For example, some airlines may require specific aircraft type ratings.³⁶ We identified the following other limitations of the labor market indicators:

- Data are collected through a household survey and are subject to sampling and response errors. Typically, one individual will identify occupation, employment, and wage data for all household members; individuals may report incorrect or inconsistent information.
- Survey results of unemployment rates are based on the person's last job, rather than the longest job held or occupation in which a person is trained or looking for work; the data therefore can miss individuals who are seeking work in a particular occupation. For example, airline pilots who lost their jobs, worked temporarily in another occupation (perhaps even within aviation), but considered themselves pilots and were seeking employment as pilots when surveyed would not be counted as unemployed pilots in the CPS data; rather, they would be classified according to the occupation they had held temporarily.
- BLS collects data on earnings for pilots in all stages of their careers, so we could not examine whether starting earnings—which would be more likely to indicate if wages were rising to attract entry-level workers—have increased.
- Data are collected at a national level; while not all indicators were consistent with a labor shortage, our analysis would not identify any regional shortages.
- Research by BLS and others suggests job vacancy data as another potential indicator for identifying labor shortages. However, BLS does not collect information on job vacancies at the occupational level. Some job vacancy data are collected by some states and private companies, but the data are limited. We could not obtain complete

³⁶A type rating permits pilots to operate specific kinds of aircraft and can be obtained with the various types of pilot certificates. A type rating involves additional training and testing that is specific to the airplane for which the rating is being sought to enable a pilot to operate.

and sufficiently reliable occupational-level job-vacancy data from these sources.³⁷

Finally, as mentioned above, no single measure can provide definitive evidence as to whether a labor shortage exists. Rather, these data can indicate the extent to which employers may have difficulty attracting people at the current wage rate. Moreover, even if perfect data existed, the term “labor shortage” is sometimes used to describe a variety of situations, some of which are generally not considered to be shortages.³⁸ For example, during periods of economic recession, employers may become accustomed to hiring a high caliber of candidate with specific training or levels of experience at a prescribed wage rate. In these cases, employers can be more selective when hiring from among the candidates for the position. However, during an economic expansion, when companies may be increasing the size of their workforce, it is likely that the number of job applicants will shrink and employers may have difficulty finding the same caliber of candidates that they could find during a downturn. Under these circumstances the employer’s challenge may become one of quality of available people, not necessarily quantity of people willing and able to do the job. Economic literature also suggests that to describe the nature and scope of any potential shortage, these indicators should be considered in conjunction with other information, such as trends in the industry that can affect the demand of and supply for qualified professionals and the hiring experiences of employers, which we discuss in the following sections.

³⁷BLS conducts a Job Openings and Labor Turnover Survey that provides a broad measure of job vacancies, but not by occupation.

³⁸Carolyn M. Veneri, “Can Occupational Labor Shortages be Identified Using Available Data?” *Monthly Labor Review* (March 1999) 15-21.

Projected Employment Growth and Retirements Suggest the Need for an Average of a Few Thousand New Pilots a Year over the Next Decade

The number of pilots that U.S. airlines will need to hire will be driven by increases in passenger traffic (growth) and replacements for retiring and attriting pilots. Several reports have projected the need for pilots in the future. Audries Aircraft Analysis—an aviation industry analysis firm—developed a forecast of pilot needs over the next 10 years based on forecasts of new aircraft orders and expected deliveries from aircraft manufacturers Boeing, Airbus, and Embraer.³⁹ Using industry averages for numbers of pilots needed per plane, the forecast determines how many pilots will be needed to accommodate the projected fleet growth, and couples this number with industry data regarding expected retirements. An academic study conducted by researchers from six universities, led by researchers from the University of North Dakota, forecasts the demand for pilots using similar techniques.⁴⁰ FAA also projects the need for pilots based on forecasts of growth in passenger demand and expected retirements. While these projections are helpful in gaining a sense for potential changes in aviation employment, developing long-term occupational employment projections is inherently uncertain for a variety of reasons. Most importantly, each projection relies on a set of assumptions about the future, some of which may not come to fruition. For example, the projections discussed above relied on assumptions of continued economic growth, but if a recession or other unexpected economic event were to occur, the projections for employment are likely to be overstated.⁴¹ These projections vary in their results and based on those results, we estimated that a range of roughly 1,900 to 4,500 new pilots will be needed to be hired on average annually over the next 10 years, as follows:

- **Audries Aircraft Analysis** developed pilot demand forecasts based on aircraft manufacturers' forecasts of fleet growth. Each

³⁹See Audries Aircraft Analysis, *Pilot Demand Projections/Analysis for the Next 10 Years: Full Model* (2013).

⁴⁰See Lovelace, Higgins, et al, *An Investigation of the United States Airline Pilot Labor Supply* (University of North Dakota, 2013). In 2012, various stakeholders within the aviation industry formed a group to analyze the current state of the pilot labor supply for U.S. airlines. Within this stakeholders group, a subgroup of collegiate aviation researchers formed to provide the scientific research related to this topic, and included researchers from the University of Nebraska Omaha; Embry-Riddle Aeronautical University; Southern Illinois University; LeTourneau University; and Middle Tennessee State University.

⁴¹The BLS projections relied on a basic assumption of an economy with full employment in the projected year.

manufacturer uses a slightly different method to create its forecasts. For example, some projections include certain cargo aircraft, and some do not. Despite the differences in methods, the fleet growth forecasts yielded similar results. Each forecast resulted in the projected need for pilots steadily rising over the next 10 years to accommodate growth and replacement of retiring and attriting pilots. Annually averaged, the Embraer forecast resulted in a projection of about 2,900 new pilots needed per year over the next decade; the Boeing forecast resulted in about 3,300 new pilots, and the Airbus forecast resulted in about 3,900 new pilots. It is important to note that these forecasts encompass the entire North American market and are not specific to the United States. In addition, the Boeing forecast projected demand for 498,000 new airline pilots worldwide over the next 20 years. The effect of this global demand for pilots may also have an effect on the available supply of pilots for U.S. airlines in the future, as foreign airlines also recruit U.S. pilots.

- **Academic study led by the University of North Dakota** estimated demand for pilots for roughly the next 20 years in its study of airline pilot labor supply. This study derived demand based on industry growth, retirements, and attrition for reasons other than retirements. Industry growth was derived from forecasts of new aircraft from the *Airline Monitor*⁴² and estimates of the average number of pilots needed per aircraft. Expected retirements came from industry data, and the study used an estimate of an attrition rate for reasons other than retirement of 1.5 percent. The study estimates that the industry would need to hire over 95,000 new pilots over about the next 20 years, with about 45,000 being needed in the next 10 years, for an annual average of about 4,500 over the next decade.
- **FAA 2013 forecast** projects that passenger demand for U.S. airlines over the next 20 years will grow at an average 2.2 percent per year through 2033, with slow or no growth expected in 2013 and slight growth over the next 5 years assuming the U.S. economy grows at a faster rate.⁴³ To account for this industry growth and to replace retiring pilots, FAA projects that about 70,000 new pilots with an ATP

⁴²The *Airline Monitor* is a commercially available aircraft forecast used by financial companies and other businesses who rely upon forecast information for strategic planning purposes.

⁴³FAA, *FAA Aerospace Forecast Fiscal Years 2013-2033* (2013).

certificate through 2032 will be needed.⁴⁴ This equates to an average need for about 3,400 new pilots annually over the next 10 years.

- **BLS Employment Projections 2012–2022** assumes a 6.6 percent net decrease in employment in the overall number of airline pilot positions through the year 2022—which equated to about 4,400 fewer pilot jobs over the time period. This is in contrast with the average expected occupational growth of 10.8 percent for all occupations for this period. Based on the employment projection, we calculated that an average of 440 pilot jobs will be lost annually through 2022. However, while fewer airline pilot jobs will exist during the 10-year period, BLS also projects, at the same time, 19,200 airline pilot job openings, or an annual average of 1,920 openings, that may be available to be filled due to retirements and attrition. The BLS employment projections assume that growth in supply will be adequate to meet the demand, and so the analysis is not designed to forecast whether a labor shortage might develop in any given occupation.

In addition to the need for airlines to hire new pilots based on industry growth and replacement of retirements, FAA’s new rule on pilot flight and duty time may engender a one-time staffing adjustment for airlines. Current crew schedules can vary by airline, the labor contract involved, and the number of pilots assigned to operate each aircraft, and airlines we interviewed varied in their estimates of how many additional pilots they would be need to meet the new requirements. Airlines’ estimates ranged from no effect on the number of pilots needed to 15 percent increase in the number of pilots needed as of January 2014.

While these projections suggest the need for between roughly 1,900 and 4,500 new pilots on an average annual basis over the next 10 years, we cannot indicate with any level of certainty the actual number of new airline pilots that will be needed or hired in the future. Airlines make a variety of

⁴⁴FAA, *Final Regulatory Evaluation Pilot Certification and Qualification Requirements for Air Carrier Operations Office of Aviation Policy and Plans*, Economic Analysis Division (APO-300) (June 2013). FAA’s projection started with 78,728 pilots being employed by airlines at the end of 2011. FAA then projected that the number of airline pilots is estimated to grow at a forecast rate of 0.6 percent each year. The number of retiring pilots was calculated by multiplying the number of pilots in the previous year by an estimated retirement rate of 3.6 percent. The number of new pilots was calculated as the annual change in the number of pilots plus the change in the number of retiring pilots to account for replacement pilots.

business decisions to meet passenger demand for airlines' operations that could affect the number of pilots that the airlines would need or are able to hire. According to information provided by eight mainline airlines, they expect to hire about 20,800 new pilots from 2014 through 2023. Accordingly, several mainline airlines have announced plans to recall all of their remaining furloughed pilots or begin new hiring efforts. For example, in September 2013, United issued recall notices to its remaining 600 furloughed pilots. According to United representatives, it has also started hiring new pilots with an initial goal of about 60 pilots a month to address the airline's projected future needs. While American and Delta had already recalled all of their furloughed pilots, each announced plans for future hiring. In October 2013, American announced plans to hire 1,500 pilots over 5 years. Delta planned to hire 300 pilots in November 2013 and expects to hire about 50 pilots per month through September 2014. Several regional airlines we spoke to have also been actively hiring new pilots. For example, since March 2013, ExpressJet has hired from 32 to 48 pilots monthly. Also, representatives of American Eagle told us that they expect to hire an average of 250 pilots per year for the next 10 years.

Data and Studies of Pilot Supply Provide Some Evidence of the Potential for a Shortage to Emerge

Pools of Certificate Holders Are Large Relative to Employment, but Are Not Increasing

While there were over 72,000 airline pilots employed in 2012, FAA data show a total of 137,658 active pilots under the age of 65 who held ATP certificates, as of January 6, 2014.⁴⁵ This large pool of ATP certificate holders, however, can include pilots who are not available for work or are

⁴⁵An active pilot is a person with a pilot certificate and a valid medical certificate. Pilots are required to obtain a medical certificate that indicates they have passed a physical exam by a FAA-authorized doctor. 14 CFR 61.23. To remain current for most types of pilot certificates, pilots must undergo a medical examination at various intervals. While airline captains must hold first-class medical certificates—which require the most extensive medical examination—which must be renewed every 12 months for pilots under age 40 and every six months for pilots age 40 and over, first officers are allowed to hold second-class medical certificates which must be renewed every 12 months for all pilots regardless of age. 14 CFR 61.23(d). FAA data show a total of 109,465 currently active pilots under age 65 with a first class medical certificate holding ATP certificates, as of January 30, 2014. We excluded the number of certificates held by pilots age 65 and older because they would not be allowed to work as airline pilots due to mandatory age retirement.

not suitable or competent to act as pilots in airline operations on large jet-powered aircraft. Data were not available to determine or verify how many active ATP certificate holders were otherwise employed. The pilots not employed by airlines may also be serving as pilots in the U.S. military, employed as pilots in non-airline operations, employed by foreign airlines, employed in non-pilot jobs in the aviation industry, or working in non-aviation careers. With respect to pilots holding FAA pilot certificates and potentially working for foreign airlines, in 2012 according to FAA data, about 7,858 pilots with ATP certificates (or about 5 percent of the total number of pilots with ATP certificates) and about 15,994 pilots with commercial certificates (or about 14 percent of the total number of pilots with commercial pilot certificates) are listed with a documented residence outside of the United States.

In addition to ATP certificate holders, a large population of commercial pilot certificate holders with instrument ratings also exists. In 2012, for instance, a total of over 116,000 pilots held commercial pilot certificates and about 105,000 of these pilots also held an instrument rating. While not currently qualified to be airline pilots, future ATP certificate holders typically come from this pool, and the instrument ratings held by some of these individuals suggest that they may be on a pathway to qualifying for an ATP certificate. According to FAA officials, the number of pilots holding an instrument rating is a good indicator for forecasting pilots who are more likely to seek an ATP certificate because an instrument rating is a requirement of ATP certification; an instrument rating is not, however, a requirement to hold a commercial pilot certificate.⁴⁶

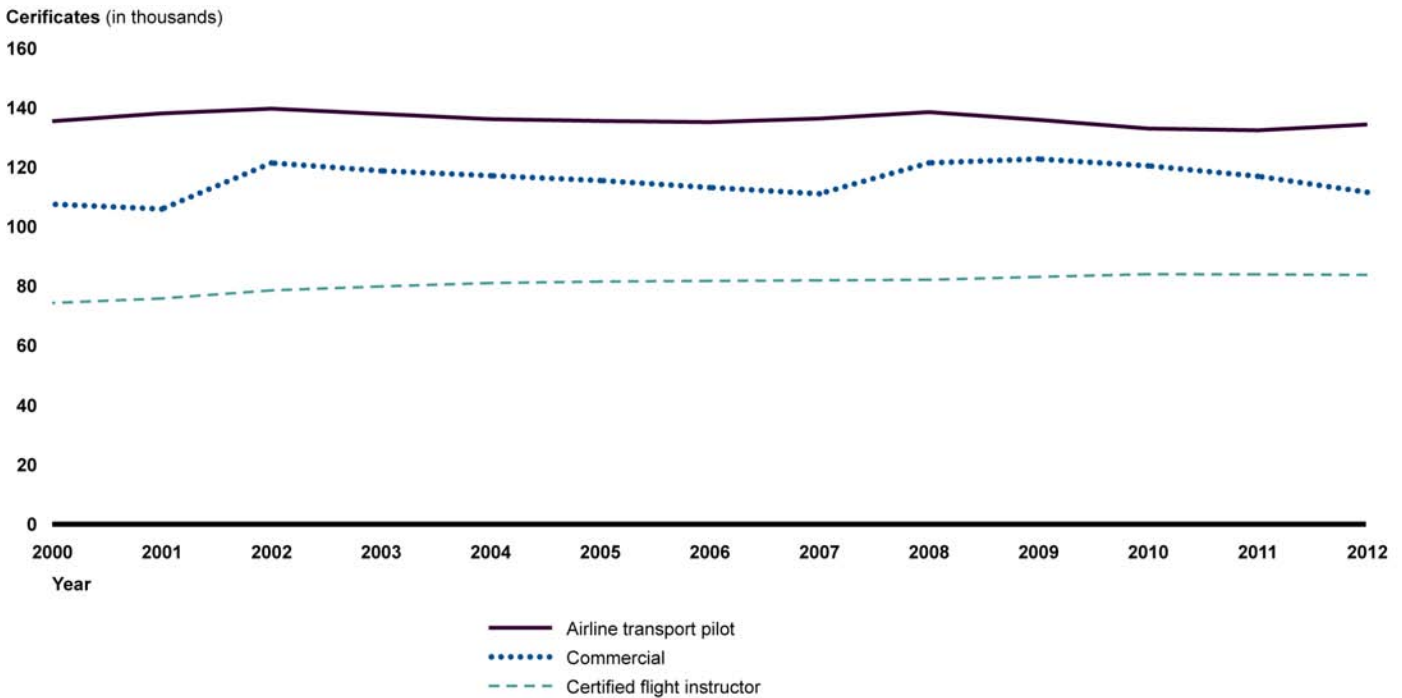
While these pools of existing ATP and commercial pilot certificate holders exist, the pools have remained relatively flat since 2000 (see fig. 1).

- The number of pilots under age 65 holding active ATP certificates decreased about 1 percent from 2000 through 2012, while the number of new certificates issued annually decreased 17 percent during this period (7,715 to 6,396) (see fig. 2). However, new issuance of ATP certificates has increased since 2010, an increase that would be expected given that the new pilot qualification rule took effect in July 2013.

⁴⁶FAA forecasts future ATP certificate holders based on historical trends in pilots with instrument rating and the number of aircraft in the commercial jet fleet.

- Commercial pilot certificate holders under age 65 increased 4 percent from 2000 through 2012. The number of new certificates issued each year averaged about 9,900 over this time period.⁴⁷

Figure 1: Number of U.S. Pilot Certificates Held by Type for Pilots under Age 65 from 2000 through 2012

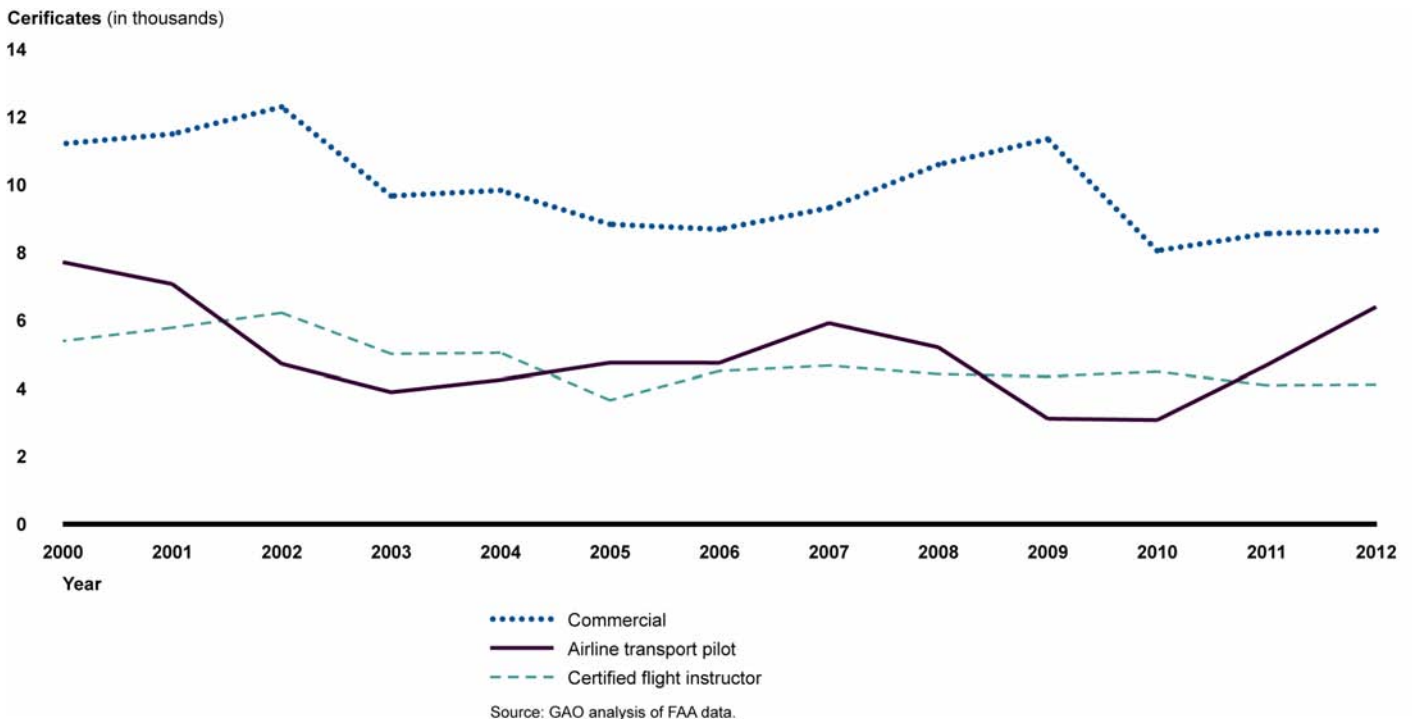


Source: GAO analysis of FAA data.

Note: Our study concerns airline pilots. We excluded all pilots who were 65 years and older because U.S. law requires airline pilots to retire at age 65.

⁴⁷While commercial and ATP certificate pools have remained steady, the number of pilots under age 65 holding private pilot certificates decreased 24 percent from 2000 through 2012, while the number of new certificates issued was 39 percent lower in 2012 than 2000 (16,571 compared to 27,223).

Figure 2: Number of New U.S. Pilot Certificates Issued by Type from 2000 through 2012



We note that these populations of pilots holding active commercial and ATP certificates, while currently relatively large, have been larger in the past. Also, when mainline airlines increase pilot hiring, the rate at which new pilots enter the pipeline would likely increase, as would the rate at which pilots holding commercial pilot certificates upgrade to ATP certificates. To illustrate, from 1990 through 2000, mainline airlines hired about 31,300 pilots.⁴⁸ During that period, the number of ATP certificates held increased by roughly the same number—from 107,732 to 141,596—while the number of commercial pilot certificates held also decreased by roughly the same amount—from 149,666 to 121,858. In contrast, when hiring slowed from 2001 through 2012 and mainline airlines hired about 16,900 pilots, there was a decrease in the total number of airline pilot jobs and the number of ATP certificates held increased only slightly—from

⁴⁸Data from 1990 through 2012 was gathered from Future and Active Pilot Advisors (FAPA.aero), a career and financial advisory service for pilots and aspirants, for the historical hiring of pilots at major airlines.

144,702 to 145,590—while the number of commercial pilot certificates held actually decreased—from 120,502 to 116,400. The average number of new commercial pilot certificates issued each year was also lower in this period (9,780) compared to the 1990’s (11,688).

The number of flight instructors is another predictor of individuals moving through the pipeline to becoming an airline pilot. The number of pilots under age 65 holding active flight instructor certificates increased 13 percent from 2000 through 2012 (see fig. 1), while the number of new flight instructor certificates issued each year averaged about 4,700 over this period and remained relatively flat (see fig. 2). Under the new pilot qualification rule, aspiring pilots must accrue more flight hours than was the case in the past, and stakeholders expect that flight instruction is likely to be one of the primary means of attaining these hours. This means that new pilot graduates who decide to work as flight instructors to gain hours will need to hold such positions for a longer period of time. If this occurs, flight instructor turnover will be slower and new pilot graduates may have more difficulty finding flight instructor positions. On the other hand, representatives of three of the pilot schools we spoke to told us that they are currently facing a shortage of qualified flight instructors.

Enrollments in and Graduations from Pilot Programs Appear to Be Declining

Available evidence suggests that fewer students are entering and completing pilot training since 2001. According to Education’s data, the cumulative number of graduates (completions) of undergraduate professional pilot-degree programs—those most likely to pursue a career as an airline pilot—decreased about 23 percent from academic years 2000-2001 through 2011-2012 (see fig. 3).⁴⁹ Although data on enrollments are not available, representatives from most of the collegiate and vocational pilot schools we interviewed told us their schools have experienced declines in undergraduate enrollments over the last 10 years.⁵⁰ Further, representatives of the 10 collegiate aviation and 2 non-collegiate vocational pilot schools reported waning interest among current and prospective students wanting to pursue professional pilot education.

⁴⁹The Education data contains a small number of non-collegiate vocational schools that do not participate in federal student aid programs. It is possible that a small number of these schools are captured in our analysis if they offer pilot training programs related to the airline pilot occupation for which we collected data.

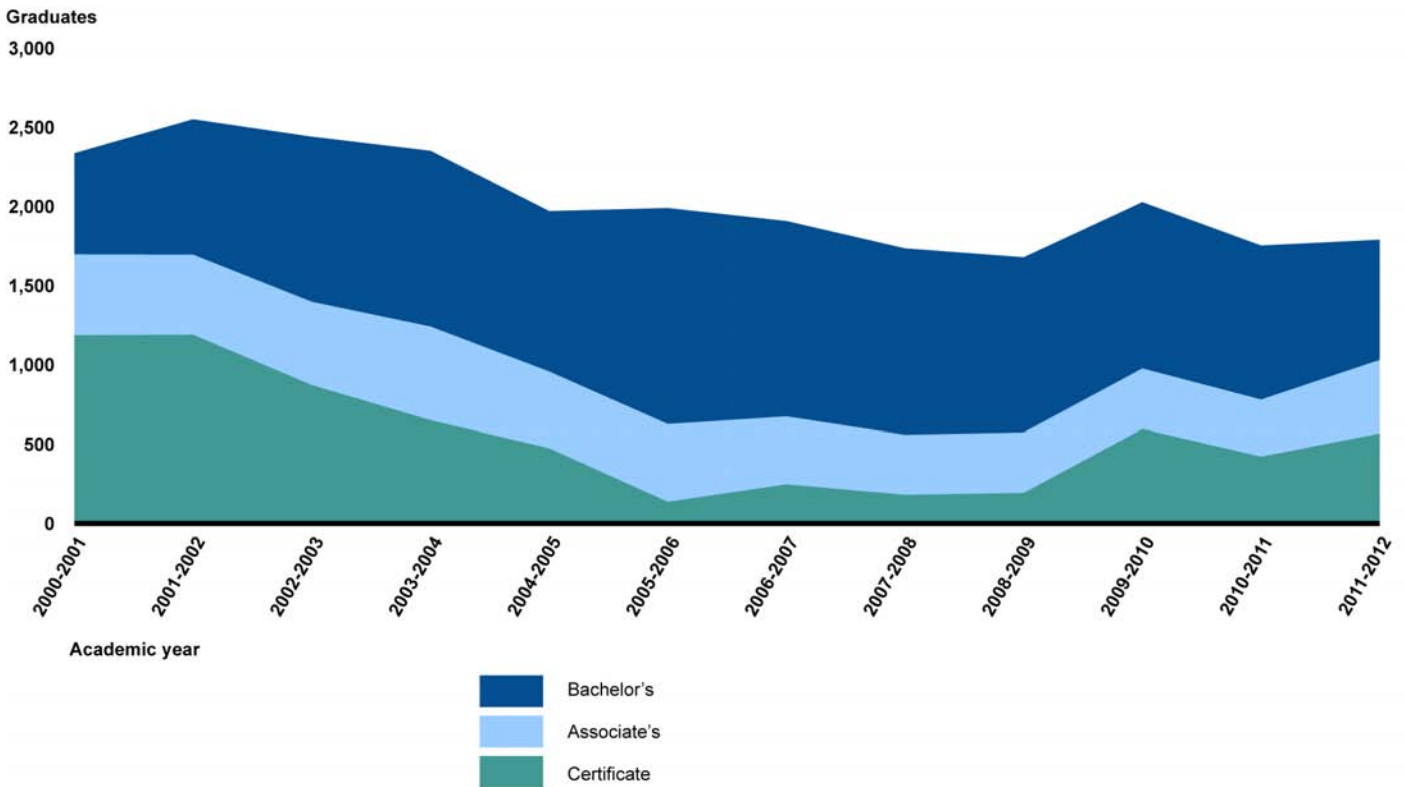
⁵⁰Data on enrollments in pilot education programs nationally are not available.

According to these representatives, the airline pilot career has lost some of its historical appeal for young people over the last 10 years due to a variety of factors, including increases in education costs, limited sources of financial assistance, negative perceptions of working conditions and wages for new pilots, and a perceived lack of stability in the industry. In addition, according to these representatives, the new first officer qualification requirements have also had some impact on student perceptions.

The new requirements mean pilots must spend additional time accruing flight hours (i.e., 1-2 additional years) prior to being qualified to apply to an airline, during the time when new pilots may be receiving relatively low wages (for example, according to the Aircraft Owners and Pilots Association, flight instructors typically make less than \$20,000 per year),⁵¹ and students are facing a longer period of time before they will be financially able to begin repaying their student loan debt. As a result, according to recruiters from four of the schools, students' parents are less encouraging of the career. According to officials at three collegiate aviation schools, due to these and other factors, more students interested in working in the aviation industry are pursuing other piloting careers, such as in unmanned aircraft systems. To illustrate, the officials said that in 2012, they sampled 240 new flight instructor pilots at 17 different collegiate aviation schools and found that while 69 percent (166 instructors) responded that they initially aspired to be airline pilots when they started their pilot training education, only about 38 percent (91 instructors) had aspirations to be airline pilots after graduating from training. Representatives of 5 collegiate aviation and 2 non-collegiate vocational pilot schools also reported financial hardships for many students enrolled in pilot education. Officials representing two collegiate schools told us that based on their discussions with students dropping out of professional pilot education, the lack of financial resources or assistance is often a barrier for students.

⁵¹Flight instructors' pay is generally based on the number of hours that can be billed for providing instruction and whether they are employed part time or full time. According to FAA, full-time flight instructors can, in many instances, make more than a regional airline first officer, depending on demand for pilot instruction in a local area.

Figure 3: Number of Graduates from U.S. Collegiate Professional-Pilot Programs by Degree Type, from Academic Years 2001 through 2012



Source: GAO analysis of Education data.

Note: The year shown is the end of the academic year. For example, 2001 encompasses the 2000-2001 school year.

Former Military Pilots Are No Longer a Significant Supply Source

Although historically, the military has been a significant source of pilots for the airlines, according to some airline industry representatives we interviewed, the number of former military pilots being hired by airlines has been declining. According to these representatives, prior to 2001, some 70 percent of airline pilots hired came from the military, whereas currently they estimated roughly 30 percent come from the military. In addition, all of the airlines we interviewed reported that fewer candidates with military experience are applying for pilot job vacancies than has been their experience in the past. While specific data are not available on the number of pilots separating from the military who sought and gained

Studies and Analyses of Pilot Supply Trends Find that the Extent of any Shortage Depends on Changes in Wages, Industry Growth, and Education Costs

employment at airlines, according to DOD data, from fiscal years 2001 through 2012, an average of 2,400 pilots separated from the military service branches per year.⁵² DOD expects roughly the same trend to continue into the foreseeable future, although future trends may be influenced by several factors, including financial incentives to influence pilots to stay in the military longer, civil job market opportunities, and changing post-war military missions. Once separated from the military, these pilots could choose to seek employment at an airline if FAA pilot certification requirements are met, such as flight hour minimums and other requisites, to be an airline pilot. However, we cannot determine the number of these pilots who may meet these qualifications, who would seek employment with civilian airlines after exiting from the military services, or who have the flight experience that airlines require.

We identified and reviewed three studies that examined pilot supply trends and attempted to determine whether a shortage of pilots may arise given expected retirements, attrition, and increases in demand. Two analyses of pilot supply trends suggested that a prolonged shortage was unlikely to develop,⁵³ although one of these specifically noted that a shortage of entry-level first officers may temporarily emerge, but would likely be addressed within a few years. This same analysis—conducted by the MITRE Corporation—found that, similar to our earlier discussion, a large pool of pilots with lower level pilot certificates exists in the United States who would be available to obtain the higher ATP certification if demand were to increase.⁵⁴ The study also noted that there is a significant pool of trained pilots employed outside the United States or in the military that could be drawn from to fill airline vacancies. However, avoiding a shortage would hinge on the ability to incent lower level pilots to seek a higher certification, and to incent pilots currently working abroad or elsewhere into U.S. airline jobs, should a shortage arise. Both analyses state or imply that airlines may need to provide financial incentives—for example, higher wages, benefits, or bonuses—to bring new pilots into the industry. While such actions would be considered typical market responses to a potential shortage, it does not mean such actions are costless or might not have implications for the industry.

⁵²DOD provided data for the U.S. Air Force, U.S. Army, U.S. Navy, and Marine Corps.

⁵³Brant Harrison from Audries Aircraft Analysis, *Pilot Demand Projections/Analysis for the Next 10 Years Full Model*, 2013; and the MITRE Corporation, *Pilot Supply Outlook* (2013).

⁵⁴MITRE Corporation, *Pilot Supply Outlook* (2013).

The academic study led by the University of North Dakota, which was discussed previously, concluded that U.S. airlines will experience a cumulative shortage of about 35,000 pilots over the next 20 years if no actions are taken by the airline industry or government.⁵⁵ Using regression analysis, the study found that the number of new CFI certifications has a positive association with pilot hiring by mainline airlines—that is, as pilot hiring tends to increase so do new CFI certifications; however, it has a negative association with the cost of pilot school—that is, as educational costs increase, new CFI certifications tend to decrease. Because of the significant finding of a potential shortage, we reviewed the study’s methodology. We also replicated the study’s analysis to better understand how the study’s key assumptions affected its results. We found that the study’s findings of a shortage were based on expectations of hiring needs of mainline airlines of about 95,000 pilots over the next 20 years,⁵⁶ and the supply of new pilots being curtailed by the continued acceleration in the cost of training, relative to the general rate of inflation. To predict future excess cost growth (the increase in the cost of pilot training over and above the general economy-wide level of inflation), the study extrapolated the growth of inflation in the cost of flight training over the past several years to the next 20 years. While using historic trends to predict future changes is part of forecasting, in some cases, it can lead to results that may be unlikely.⁵⁷ In this case, this method resulted in forecasted year-over-year changes in the cost of flight school of almost 8 percent above its historic mean by the year 2030, which is well above historic averages over the past 20 years. However, other changes in the market for pilot training, such as the openings of other pilot schools, for example, could reduce this inflation. Using a different assumption regarding increases in training costs would result in different outcomes with respect to the size of the forecasted shortage. In fact, guidance from the Office of Management and Budget suggests that assumptions regarding price increases (such as the continuation of current trends) should be varied to test the sensitivity of the final results to

⁵⁵Lovelace, Higgins, et al, *An Investigation of the United States Airline Pilot Labor Supply*.

⁵⁶As discussed earlier, this forecast is on the higher end of existing pilot employment projections, such as those from FAA, BLS, and aircraft manufacturers.

⁵⁷This is especially true if the nature of the economic series does not necessarily imply a trend, such as inflation, which measures the change in price and not price itself. For example, over the past 50 years, U.S. inflation has been as high as 14 percent and as low as -0.3 percent, but does not appear to have followed any 20-year trends.

that assumption. For example, we found that reducing the assumed rate of increase of inflation in the cost of flight training to only 1-2 points above its historic mean resulted in about 30,000 more CFI certifications—largely ameliorating the estimated shortage. However, the researchers stated that they felt that extrapolating from current trends would be the most responsible forecast to consider but agreed that if the costs of training do not continue to increase at an escalating rate, relative to inflation, as the study forecasted, then the estimated shortage of pilots could be mitigated.

Regional Airlines Report Difficulties Filling Entry-Level Vacancies

Representatives at 11 of the 12 regional airlines told us they have been unable to meet hiring targets for training classes for new-hire first officers; most reported since early 2013. In anticipation of the August 2013 deadline for the new pilot qualification rule, officials at many of these airlines indicated that 6 to 12 months before this deadline, they began seeking new pilots to hire who already had an ATP certificate or had enough flight hours that additional flying would allow them to reach the minimum to qualify for an ATP certificate by the time FAA finalized the rule. However, representatives of 5 regional airlines indicated they have generally been able to meet about 50 percent of their hiring targets to fill training classes. For example, one regional airline representative told us that his airline had monthly targets of hiring 12 new pilots from August through October 2013 but has been able to hire from 2 to 6 qualified applicants each month. Representatives of most of the regional airlines also reported that their existing banks of qualified pilot applicants have dwindled and that they receive fewer applicants than they have had historically in response to hiring announcements. Representatives of one regional airline estimated that where they may have previously had over 1,000 applicants for hiring announcements, they are now seeing about 100. For the most part, as a result of the new pilot qualification rule, many of the representatives attributed this reduction in the number of applicants to a couple of factors. First, fewer overall number of applicants are available who can meet ATP requirements. Second, according to several of the representatives, pilots completing training from pilot schools must now spend more time accruing required flight time—and forego some potential career earnings—before they can apply for entry-level first-officer jobs at regional airlines, and fewer jobs are available in general aviation and non-airline commercial sectors for pilots to accrue the needed flight hours. Additionally, representatives of 6 regional airlines noted that increasing numbers of applicants were not showing up for scheduled interviews; some of the representatives speculated that this might be due to opportunities at other regional airlines or other jobs.

Representatives at 10 of the 12 regional airlines we interviewed told us they have also observed an overall decline in the quality of flight experience of qualified pilots applying for pilot jobs, while some cited higher drop-out rates among new hire classes or observed that new hire candidates seem to be less prepared for the airline environment, compared to the historic norm. Prior to the new pilot qualification rule, regional airlines would often hire entry-level pilots who had recently graduated from pilot training with a commercial pilot certificate and an instrument rating, and had gained between 500 and 700 hours of flight time in commercial operations or in flight instruction.⁵⁸ The pilot would then be hired at the regional airline, enter training with the airline, and accrue flight time experience towards an ATP certificate in the airline environment. According to representatives from most of the regional airlines, as a result of the new pilot qualification rule, future applicants will have had to accrue an additional 500 to 750 hours of flight time in flight instruction, where they are not always actually flying a plane, or operating in the general aviation (Part 91) environment wherein flight time is accrued in aircraft such as small, single- and multiengine, propeller airplanes that are not as technically advanced as aircraft operated by airlines. According to these representatives, in their experience, applicants with the greater number of flight hours earned outside the airline environment were less proficient and prepared than previous applicants who had recently completed pilot training with between 500 and 700 hours of flight time. While this has been the recent experience of some regional airlines, we do not have data on where aspiring airline pilots are gaining their flight experience, or empirical evidence regarding how this has changed since the new pilot qualification rule went into effect. Furthermore, judgment on what type of flight experience is most suitable for would-be airline pilots is outside the scope of this report.

Representatives at most of the regional airlines also noted that some of the difficulty in finding sufficient numbers of pilots with ATP certificates, being experienced by some regional airlines, could be influenced by

⁵⁸Regional airlines hire first officers with varying numbers of flight hours, depending on the preferred minimum qualifications of the airline, its need, and the available supply of pilots at the point in time the hiring is occurring. Previous to the new rule, the total hours accrued by a new-hire first officer could be higher or lower than the range of 500 to 700 hours mentioned here. Data on the average number of hours of new hires across all regional airlines for the years prior to the new rule are not available. However, a Regional Airline Association's review of its members in 2009 found an average of 1,305 flight hours for new hires across the responding regional airlines.

current perceptions about the potential for career opportunities and progression. Key factors that influence pilots to pursue a job with an airline include the opportunity for upgrading to a captain, type of equipment flown, and work schedule. Pilots' pay rates at airlines are based on seniority with a particular airline, and the rates increase each year and when pilots progress from first officer to captain. According to available data for 14 regional airlines, the average new hire hourly wage for all airplane types is currently about \$24 per hour for the first year of employment.⁵⁹ However, representatives of most of the regional airlines said the hourly wages increase for the second year of employment for first officers—to about \$30, according to the data for the 14 airlines. Regional airlines generally tend to have newer pilots who accumulate flight time in smaller aircraft and use that experience as a stepping stone to the higher wages offered at mainline airlines.

According to FAA, the reason that regional airline first officers are willing to accept a relatively low initial salary is because of the increases in salary that come later in the career, when they advance sequentially to regional airline captain, mainline airline first officer, and, finally, mainline airline captain.⁶⁰ The average number of years to upgrade from first officer to captain is 5 years for regional airlines, but representatives of several regional airlines said they expected upgrades to take longer. In addition, the new pilot qualification rule have extended the period before a pilot can be hired by an airline. Therefore, individuals interested in an airline pilot career would likely expect several more years at the lower end of the pay scale than had been the case in the past. Several industry representatives also noted, however, that the potential career earnings for an airline pilot continue to be significant. Some senior captains at mainline airlines can make \$200,000 or more annually in base salary.

⁵⁹An airline pilot's annual salary is calculated by the hourly rate times the "minimum guarantee" number of hours flown each month that each airline sets in its pilots' contract. The minimum guarantee is generally about 75 hours per month but varies by airline. Pilots may fly less than the guarantee but are still paid for the minimum guarantee hours. If they fly more flight hours than the minimum guarantee, then they will get paid for the additional time flown.

⁶⁰According to a 2010 FAA survey of industry, in terms of the career path of a typical airline pilot, the average number of years for a regional airline first officer to upgrade to a regional airline captain is about 5 years for airlines that use regional jets and/or turboprop airplanes; after 2 years as regional airline captain, the pilot moves to a position as mainline airline first officer; and after an additional 10 years, the pilot upgrades to mainline airline captain.

Pilot pay rates are also based on the type of aircraft that airlines fly because higher pay rates are associated with flying larger, more complex airplanes, and, thus, opportunities to eventually upgrade to flying these airplanes are important in progressing in the career. Representatives of 6 of the 12 regional airlines generally said that young, entry-level pilots have tended to favor the airlines that operate larger regional jet airplanes as opposed to those that operate turboprop-powered airplanes. Therefore, according to one regional airline, it could be difficult at times for some regional airlines to find pilots to hire as first officers willing to fly, for example, small turboprop airplanes when other opportunities are available with other airlines to immediately or eventually fly larger regional jets due to the career opportunities and associated higher pay rates. According to two small regional airlines—those that generally operate small turboprop airplanes—previous to the new pilot qualification rule, they were able to attract sufficient numbers of pilots with an expectation that these pilots would build flight experience over several years and eventually leave for other airline opportunities. However, since the rule went into effect, small regional airlines of this size cannot compete for the available pilots with ATP certificates. Due to issues in finding enough pilots with ATP certificates, one of these small regional airlines has petitioned FAA for approval that would allow it to use some of its smaller 19-seat airplanes under a Part 135 operation—which would not be subject to the new first-officer qualification requirement to have an ATP certificate—on specific routes.⁶¹

According to the representatives of the mainline airlines we spoke with, they are not currently experiencing any difficulty in attracting qualified and desirable candidates. These representatives generally credited higher pay and benefits, better retirement options, and more flexible work schedules than what regional airlines typically offer. For instance, the average hourly wage for first officers at 10 mainline airlines for all airplane types, for which an ATP certificate is required, is currently about \$48 per hour for the first year of employment. The mainline airline representatives did not anticipate any problems as they seek to increase hiring in the future and stated that they could draw from the pool of pilots now employed at regional airlines. However, representatives did express concerns that their regional partners may be experiencing difficulties

⁶¹Operating under Part 135 rules would allow an airline to operate multiengine airplanes with a first officer who has a commercial pilot certificate and an instrument rating.

finding qualified entry-level pilots. Representatives at two mainline airlines were concerned that as they pull pilots from the ranks of their regional partners, the regional partners may have trouble replacing those pilots, a potential chain reaction that might result in regional connecting services' being curtailed. Five regional airlines we interviewed are currently limiting service to some smaller communities because they did not have pilots available to provide that service. Other industry stakeholders expressed similar concerns that service to small communities will continue to suffer going forward.

Industry and Government Are Taking Some Actions to Attract and Train Future Pilots

Economic literature identifies possible actions that employers in a market may take to mitigate a labor shortage. Some of the actions discussed in economic literature are already occurring as part of airline, collegiate pilot school, and government efforts to attract more pilots to the airline industry, including increased recruiting and financial incentives. However, such actions have associated costs and can affect the industry in various ways. Federal agencies have several programs aimed at promoting aviation careers and providing financial assistance for education. However, stakeholders suggested several additional actions that government could take to increase the availability and flexibility of financial assistance available to pilot students and to create additional pathways to becoming an airline pilot.

The Aviation Industry Has Taken Various Steps to Attract, Train, and Retain Airline Pilots

According to economic literature we reviewed, employers—which are the first to identify a shortage when they encounter difficulty filling vacancies at the current wage rate—may take several actions in response to a perceived labor shortage.⁶² The actions vary in desirability for the employer based on resources required and their permanency. For example, increasing recruiting requires fewer resources than raising wages; further recruitment efforts could also be halted if labor market conditions change, whereas wages, once raised, may not be easily lowered. Employers may also choose to take some of these actions for reasons other than filling vacancies—for instance, to improve morale among current employees or to increase profitability. Some of the actions

⁶²Burt S. Barnow, John Trutko, and Jaclyn Piatak, "Conceptual Basis for Identifying and Measuring Occupational Labor Shortages." In *Occupational Labor Shortages: Concepts, Causes, Consequences, and Cures* (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2013) 1-34.

suggested in the literature are not feasible for airlines to take with respect to pilots.⁶³

In response to difficulties filling employment vacancies, employers may:

- *Increase recruiting efforts.* This includes such activities as increasing advertising, using public or private employment agencies, and paying recruiting bonuses to employees who refer new hires.
- *Train workers for the job.* In a difficult labor market, an employer that traditionally relied upon colleges or vocational or trade schools to train its workforce may choose to offer or sponsor training.
- *Improve working conditions.* Equipment or facility upgrades, training, and job recognition efforts may all be effective means to attract and retain personnel.
- *Reduce the minimum qualifications for the job.* Employers may have set minimum qualifications higher than necessary and may choose to reduce those qualifications when hiring becomes difficult. As discussed, regulation sets minimum qualifications for airline pilots. However, most regional and mainline airlines could have hiring requirements in excess of or addition to the regulatory minimums that could be reduced, although airlines with such requirements are often not willing to do so because they view their requirements as important to the safe operation of their airline.
- *Offer bonuses to new employees.* Employers may offer new employees a “signing” bonus such as a cash payment or an agreement to cover the new employee’s moving expenses.
- *Improve wages and fringe benefits.* Increasing wages will help increase the number of personnel willing to work in a particular position or occupation. However, employers are reluctant to do this because they may be forced to raise the wages of current employees as well. Further, unlike some other actions, once wages are raised, it

⁶³Such actions mentioned in the literature include (1) *increasing the use of overtime*, which is not a feasible strategy for airlines, since regulation limits the number of duty hours for pilots; (2) *restructuring the work to use current or new employees in other occupations*, which is not a feasible option for airlines to consider since FAA regulates minimum qualifications for becoming a pilot as well as minimum requirements for operating aircraft; and (3) *substituting machinery and equipment for labor*, which would be analogous to increasing automation in airplanes so fewer pilots would be needed; however, airlines cannot arbitrarily make these determinations, as FAA regulates minimum pilot requirements for operating aircraft and would have to approve the use of any new onboard equipment.

is unlikely that they will be reduced later if hiring becomes less difficult.

- *Contract out the work.* If employers cannot fill vacancies for employees in certain occupations, they may contract out those tasks to another company.
- *Turn down work.* If an employer has exhausted other means to mitigate its hiring challenges and vacancies persist, it may choose to turn down work or curtail services.

Airlines and pilot schools have used a number of these strategies to attract more potential individuals to a career as an airline pilot. Economic literature suggests that increased recruiting is a logical first step to fill vacancies because it requires relatively fewer resources to implement than other potential options for attracting more interest in an occupation experiencing a shortage. Most of the airlines with whom we spoke reported that they have continued involvement with various recruiting activities, such as attending career events, including job fairs, and a couple of airlines reported that they had increased such activity to recruit more potential pilots. For example, representatives of one regional airline told us that after not hiring for several years and furloughing pilots, they have increased their recruiting efforts at some college aviation schools as well as Part 135 air service providers as part of their plan to begin hiring again. In addition, representatives from another airline said that they have almost doubled the size of their recruiting department to facilitate attendance at events and started to advertise new job openings—something they have not previously done.

Some collegiate pilot schools have also expanded recruiting efforts to the next generation of potential future pilots. Officials at some of the collegiate pilot schools we met with had developed outreach programs focused on local elementary and high school students to build interest in aviation, which economic literature suggests could limit any future labor shortages.⁶⁴ For example, Embry-Riddle Aeronautical University works with seven high schools that provide STEM-related courses (science, technology, engineering, and math) intended to immerse and prepare high school students in these academic areas for college as well as jobs in the aviation industry. In another example, the Metropolitan State University of Denver, which has a commercial pilot program, coordinates

⁶⁴Cohen, *Labor Shortages*.

with other groups in Colorado to stimulate interest in careers in STEM fields from the preschool level through the graduate school level.

Airlines were also looking for ways to help new pilots to gain additional flight time and training to eventually qualify for an R-ATP or ATP certificate, and some regional and mainline airlines had begun to restructure “bridge agreements” with collegiate and vocational pilot schools.⁶⁵ Prior to the new pilot qualification rule, regional airlines would develop these arrangements with aviation schools as a way to directly recruit pilot graduates with a commercial pilot certificate and instrument rating as first officers, in which the airlines would typically lower their minimum hiring standards related to flight time and experience for desired pilots from these schools. Some regional and mainline airlines indicated that they had implemented such partnerships with pilot schools to promote greater interest in the field and provide a pathway from pilot school to employment as an airline pilot. For example, ExpressJet, a regional airline that contracts with Delta, has partnered with 11 collegiate aviation schools to offer selected students guaranteed employment at ExpressJet as a first officer and eventually a guaranteed interview at Delta Airlines once the student gains enough experience.

Since implementation of new pilot qualification rule requiring all airlines’ first officers to have an ATP certificate, airlines have begun to change their bridge programs to help potential employees gain the necessary flight time and training to qualify for an ATP certificate. For example, two regional airlines are hiring pilots without an ATP certificate who are currently flight instructors. As airline employees, these pilots receive employee benefits such as medical and dental insurance, but continue instructing for a collegiate or vocational pilot school program to build flight time toward their ATP certification. Once these employees obtain an ATP certificate, they are placed into new hire classes to begin the airline’s training program for first officers. Airlines and other stakeholders told us that they are also considering other options to adjust to the new pilot qualification rules, such as exploring new pathways to becoming an airline pilot and finding ways to improve pilot training, which will be discussed later in this report.

⁶⁵A “bridge agreement” can be a formal agreement through signed documentation or an informal arrangement between a regional airline and an aviation pilot school. Typical conditions of the agreement stipulate a specific grade point average, minimum number of flight hours, and other desirable academic qualifications for the students.

Regional airlines have started offering financial incentives to entice both graduating students and flight instructors. Offering financial incentives to new pilot hires is advantageous for airlines because it is a one-time cost and only affects the new employees hired. According to economic literature, signing bonuses are most frequently used when employers feel they are under intense pressure to fill vacancies in the short run. For example, two regional airlines that have had difficulty filling their new hire classes have started offering new-hire first officers an upfront \$5,000 signing bonus, and one of these airlines also offers up to \$10,000 for tuition reimbursement. However, officials of the industry association that represents these airlines told us that these efforts have essentially attracted pilot applicants away from other airlines, but they have not led to an increase in the applicant pool overall. DOD's Service branches have taken similar actions in direct response to addressing a potential shortage of military pilots by requiring longer service obligations and offering retention bonuses. For example, the U.S. Air Force recently began offering retention bonuses of up to \$225,000 to its fighter jet pilots in exchange for a 9-year commitment.⁶⁶ This is an increase from the Air Force's previous retention offer of a 5-year contract for up to \$25,000 per year, for a maximum of \$125,000, in exchange for the commitment. Similarly, starting in fiscal year 2013, the U.S. Navy began offering retention bonuses to its pilots ranging from \$25,000 to \$125,000 for a 5-year commitment and paid over the term of the contract.

Economic literature also indicates that increasing wages is an obvious approach to increasing the number of workers willing to work in a particular occupation. However, 11 regional airlines with whom we spoke had not increased wages to attract better qualified applicants.⁶⁷ An increase in entry level pay for pilots at regional airlines could influence some pilots employed elsewhere (e.g., in the military, by foreign airlines, or in another industry) to consider seeking employment with these airlines. However, any increases in pay for pilots would be subject to

⁶⁶Eligible pilots have the option to take an upfront lump sum payout of half of the money, minus taxes, with the remainder paid over the nine years of the contract. Also, Air Force pilots earn about \$90,000 in base pay by their 11th year in service.

⁶⁷However, one small regional airline we interviewed recently announced an agreement with the unions that represent their pilots to increase pilot pay, but final approval is subject to ratification by the airline's pilot membership. If ratified by the pilots, the agreement will immediately increase pay and commuting and schedule flexibility, and allow all pilots who remain with the airline for a year to earn a cash retention bonus.

negotiation of collective bargaining agreements between airlines and the pilot unions that represent the employed pilot workforce. As previously mentioned, raising wages is not a costless remedy. Since regional airlines generally provide service under capacity purchase agreements with mainline airlines on a contractual basis, regional airlines' ability to increase wages would likely be limited by their ability to increase revenue (i.e., increasing passenger fares).

Finally, economic literature indicates that contracting out or turning down work are options to cope with a labor shortage. Mainline airlines normally contract with regional airlines to expand available service. As previously mentioned, representatives of five regional airlines we interviewed told us that there have been some instances wherein the contracted capacity (i.e., scheduled flights) for mainline airline partners has had to be turned down by reducing and canceling flights due to a lack of pilot crew availability. According to an official of a small regional airline, for the first time in its history, the airline had to reduce about 20 percent of its scheduled flights in August 2013 because it could not staff all of its airplanes to provide the scheduled flights. Again, such actions are not costless and pose implications for the industry. A continued shortage of pilots for these airlines could mean additional curtailment of services, and thus far, it is smaller communities that are experiencing reduced service, and over a longer term may result in a contraction of the industry.

Federal Agencies Have a Limited Role in Helping to Attract People to Aviation-Related Careers

While no one agency is tasked with developing the pilot workforce, several maintain programs that help promote and train people for aviation-related careers. At the time of its creation in 1958, the FAA was tasked with regulating, promoting, encouraging, and developing civil aeronautics.⁶⁸ In 1996, following criticism of its response to the ValuJet crash in the Florida Everglades and to address concerns about its dual role, FAA's mission was amended to make ensuring the safety of the

⁶⁸Pub. L. No. 85-726, § 103(a) and (b), 305, 72 Stat. 731, 740 and 749 (1958).

national air space system as the agency's top priority.⁶⁹ According to FAA, it has continued to promote careers in aviation, but specific references were deleted from its mandate. Nonetheless, FAA has several initiatives aimed at promoting the aviation industry and encouraging young people to pursue careers in aviation. For example, FAA developed the Aviation Career Education Academies, interactive aviation summer camps geared toward middle- and high-school students interested in aviation and aerospace; the agency also promotes DOT's National Transportation Summer Institute to introduce secondary school students to all modes of transportation careers and encourage them to pursue transportation-related courses of study at the postsecondary education level.⁷⁰ FAA also works with education and industry partners to offer initiatives such as adopt-a-school programs and other activities that expose students and others to aviation and aerospace. FAA works with industry, including the Experimental Aircraft Association, to facilitate the Young Eagle Program, which seeks to expose young people to aviation and give them an opportunity to fly in a general aviation airplane. In addition, FAA's Aviation and Space Education website is intended to appeal to an audience unfamiliar with aviation, such as students and teachers.

Other federal agencies provide financial assistance that is available for students that pursue aviation careers, including pilot training.

- DOD provides Military Tuition Assistance benefits to service members to help them enhance their professional development. The benefits can be used for pilot training or to pay for certification tests, such as an ATP certification.

⁶⁹On May 11, 1996, a ValuJet DC-9 crashed into the Florida Everglades shortly after take-off from Miami International Airport, killing all 110 people aboard. Earlier that year, FAA had initiated a special review of the rapidly-growing low-cost carrier following a series of incidents and non-fatal accidents. In June 1996, FAA announced that the carrier would cease operations pending safety improvements to address serious deficiencies it had found in ValuJet's airworthiness, maintenance, quality oversight, and engineering capabilities. This sparked renewed criticism of DOT and FAA because it appeared to contrast with statements, made following the accident, assuring the public that the airline was safe. The next day, Secretary of Transportation committed to urge Congress to make safety FAA's single primary mission. The change was codified in the Federal Aviation Reauthorization Act of 1996, Pub. L. No. 104-264, § 401, 110 Stat. 3213, 3255 (1996).

⁷⁰FAA collaborated with the Federal Highway Administration to combine the two youth summer programs to increase education outreach from pre-kindergarten to institutions of higher education.

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- Education offers various federal aid benefits, such as low-interest student and parent loans, grants, and work-study funds to help cover educational expenses.⁷¹ Collegiate aviation schools and some vocational pilot schools are generally eligible to receive federal financial aid.
 - VA administers education benefit programs, such as the Montgomery G.I. Bill, that can be used to pay for flight training for veterans who are interested in attending aviation programs approved by FAA, such as collegiate aviation schools and some vocational pilot schools.⁷² The payment amount varies depending on the program and the type of pilot school. In addition, a 2011 law amended the Montgomery G.I. Bill program to provide financial assistance to veterans specifically for flight-training programs.⁷³
 - DOL administers programs under the Workforce Investment Act of 1998 (WIA) in which training services are available to eligible individuals who meet requirements for services—including training to become an airline pilot.⁷⁴ However, according to DOL, due to limited available resources, workforce counselors encourage individuals eligible for WIA training funds to also pursue educational funding from other sources (including VA and Education). Nevertheless, according to DOL data from 2010 through 2012, 124 individuals received WIA funding for pilot training.⁷⁵ In addition, apprenticeships are available

⁷¹The Department of Education's Office of Federal Student Aid manages and administers student financial-assistance programs authorized under Title IV of the Higher Education Act of 1965, as amended, (codified at 20 U.S.C. §§ 1070 – 1099d and 42 U.S.C. §§ 2571 – 2756b), which include student loans, grants, and campus-based work study aid.

⁷²VA benefits can only be used for flight training provided by FAA-approved Part 141 pilot schools, but not by flight-training providers that operate under Part 61— often provided by an individual, for-hire flight instructor who can operate independently as a single-instructor school at a local airport. Also, VA benefits can be used for flight training if the veteran holds a private pilot certificate upon beginning the training and meets the medical requirements.

⁷³The Post-9/11 Veterans Educational Assistance Improvements Act of 2010 authorizes payment of the actual net costs for in-state tuition and fees assessed by the school or \$10,000, whichever is less, per academic year. Pub. L. No. 111-377, § 105(b), 124 Stat. 4106, 4113 (2011).

⁷⁴Pub. L. No. 105-220, 112 Stat. 936 (1998).

⁷⁵The number of individuals who received WIA funding for pilot training represent a small percentage of the total number of WIA funding recipients.

for pilot occupations,⁷⁶ but there were no active apprentices as of November 2013.

- The Internal Revenue Code also provides tax credits—such as the American Opportunity Credit and Lifetime Learning Credit—and various deductions that may be taken to reduce the federal income tax burden for students or those paying the costs of students' post secondary education.⁷⁷

Stakeholders Suggested Various Actions Government Could Take to Mitigate a Potential Shortage of Airline Pilots

Airline and pilot school stakeholders we interviewed suggested several actions that could be pursued by government to respond to potential shortages of airline pilots. These actions generally fell into two categories: (1) increasing the availability and flexibility of financial assistance available to aviation students and (2) creating additional pathways to becoming an airline pilot.

Increase Availability and Flexibility of Financial Assistance to Aviation Students

Several airline and pilot school officials we interviewed stated that the high cost of pilot training is deterring students from entering pilot school and pursuing an airline pilot career. To pay for pilot training, students typically use a mix of personal funds, personal credit (credit cards and personal loans), scholarships, grants, other private educational loans, and federal financial-assistance programs. However, flight school officials said that students enrolled in collegiate aviation schools and vocational pilot schools are finding it more difficult to qualify for financial aid because many private banks have been tightening restrictions on financing available to potential new-pilot students, and others have left the pilot training loan market. We previously found that in 2009, many lenders offering student loans had exited the market due to limited access to

⁷⁶Under the apprenticeship program, individuals earn a salary while receiving work-based training.

⁷⁷Tax credits directly reduce the amount of income tax owed, while deductions reduce the amount of taxable income upon which income taxes are computed. The American Opportunity Credit applies to the first 4 years of post-secondary education up to \$2,500 of the cost of qualified tuition and related expenses paid during the taxable year. The Lifetime Learning Credit has no limit on the number of years the credit can be claimed for each student and applies up to \$2,000 for all levels of post-secondary education coursework. American Recovery and Reinvestment Tax Act, Pub. L. No. 111-5, §1004, 123 Stat. 306, 314.

capital in response to the 2007-2009 financial crisis.⁷⁸ Since that time, according to officials of some pilot schools we interviewed, stricter lending standards continue to make it difficult for some students and parents to qualify for private loans.⁷⁹ In addition, unlike colleges and universities, many vocational pilot schools are not approved or accredited to offer federal financial-aid programs. Some of these schools offer financing options for those students who qualify by working with lenders including banks, credit unions, and private lending institutions. A number of stakeholders suggested that making it easier for all pilot schools to participate in federal student-loan programs could make it easier for schools to train more pilots because many students drop out due to financial difficulties.

Aviation stakeholders we interviewed in previous work agreed that one of most important challenges for maintaining an adequate supply of students for pilot schools is the availability of financial support.⁸⁰ Several airline and pilot school officials said the federal government could consider revising the existing student loan requirements for students in pilot schools seeking to become airline pilots—such as extending the loan repayment period, deferring the start of repaying the loan, and increasing the maximum loan amount—or establishing a student-loan repayment or forgiveness program for airline pilots. Loan forgiveness programs may include criteria for a specified length of employment and a required period of timely payments, upon which all or a portion of the remaining loan balance would be eliminated. Some stakeholders suggested that revising

⁷⁸GAO, *Initial Pilot Training: Better Management Controls Are Needed to Improve FAA Oversight*, [GAO-12-117](#), (Washington, D.C.: November 2011) and GAO, *Higher Education: Factors Lenders Consider in Making Lending Decisions for Private Education Loans*, [GAO-10-86R](#) (Washington, D.C.: November 2009).

⁷⁹Traditionally, most student loans were available through two programs: the William D. Ford Federal Direct Loan Program (Direct Loan), in which the federal government provides loans directly to students through their schools, and the Federal Family Education Loan Program (FFEL), in which private lenders provide loans guaranteed by the federal government. However, the Student Aid and Fiscal Responsibility Act, enacted as part of the Health Care and Education Reconciliation Act of 2010, terminated the authority to make or insure new FFEL loans after June 30, 2010, so that most federal loans are now originated under the Direct Loan Program. Pub. L. No. 111-152, § 2201, 124 Stat. 1029, 1074 (2010). While private lenders no longer provide federally guaranteed student loans, they may continue to provide private loans which are not federally subsidized. As a result, lenders may use other criteria to determine borrower eligibility and loan interest rates.

⁸⁰[GAO-12-117](#).

loan requirements could provide incentives to attract individuals to the pilot profession.

We have also previously found that European airlines have at times funded the training of pilot candidates in response to pilot shortages.⁸¹ In the European countries that we visited for our previous work, many student pilots, following a screening process, were provided training by airline sponsorship with an agreement for future employment with the airline. An example of an airline that follows this practice is Lufthansa, where students are offered the training as part of a partial sponsorship program, wherein candidates are required to pay a small portion of the training costs upfront while Lufthansa provides a student loan to students to cover this cost. Once training is completed, Lufthansa enters into an employment contract with the candidate, and he or she repays the loan by accepting a lower initial salary. Other European airlines have begun to assist their students by forming agreements with banks to reduce the risk of providing student loans to flight school students. British Airways helps students secure the funding required for training through a guaranteed bank loan in the hopes that this will increase the pool of qualified applicants. KLM partially funds an insurance policy to help banks cover their student loan default risks for students who end their pilot training early due to poor performance, failed medical examinations, or other unforeseen circumstances. If the insurance policy is executed, students are contractually obligated to cease their pursuit of an airline pilot career. None of the U.S. airlines we interviewed were currently considering such approaches.

Create Additional Pathways to Becoming an Airline Pilot

Some stakeholders suggested that FAA should consider supplementing the current regulatory framework for training new pilots with additional pathways to achieving an ATP certificate. Stakeholders have made these suggestions because the new pilot qualification rule changed the traditional pathway to becoming an airline pilot, and airlines initial experience under the new rule suggests that the flight hours new pilots are earning to qualify for an ATP certificate may not be directly relevant to an airline setting. Based on an exemption request to FAA from one of the member airlines, the Regional Air Cargo Carriers Association (RACCA) has supported a regulatory change that would allow first officers in Part 135 cargo-only operations to log certain flight hours that they are currently

⁸¹[GAO-12-117](#).

prohibited from logging, except under limited circumstances. According to RACCA officials, these first officers are frequently recent graduates of flight-training programs with commercial pilot certificates, and allowing the hours flown in these operations to count would give these pilots flight experience toward the qualifications for an ATP certificate that is more commensurate with flying for a passenger airline, since they are flying similar planes under similar conditions—unlike the flight hours logged in flight instruction using training airplanes, or through banner towing and similar types of flight experiences.⁸² According to FAA officials, FAA is in the process of developing a proposed rulemaking that could expand the logging of flight time for certain Part 135 operations.

A proposal being developed by a consortium of industry stakeholders would request that FAA consider new regulations allowing the airline industry to take greater advantage of the advancements in computer-based and simulation technology for training pilots. According to the group, U.S. pilot training requirements for certification of airline pilots have not been significantly changed for decades and pilots have had to complete the same certification path based on the same training standards and requirements. While the standards for obtaining pilot certificates have changed little over the years, training technology has advanced through the use of simulation and computers. The group suggested that FAA should allow more credit for training using this type of technology in lieu of actual flying. The group argues that training aids provided by computer software, computer-based simulation, and flight simulation training can help students to achieve as good or better competency in various training components, such as aircraft performance, navigation, and aircraft systems operations. In fact, many of the collegiate aviation schools already provide specialized training in flight-simulation training devices, but FAA allows only a few of these training hours to be credited toward private and commercial pilot certificates. According to industry consortium, the ability to expand the use of these technologies would enable pilot schools to train the next

⁸²RACCA also supports another member airline's petition to FAA for an exemption to reduce the requirement of 1,200 hours of total time to 800 hours for captains in Part 135 cargo-only operations under Instrument Flight Rules, which, if allowed, would only be applicable to all cargo flying in less advanced, non-type-rated airplanes (i.e., below 12,500 lb. maximum takeoff weight and not turbojet-powered). A RACCA official stated this would provide another option to increase experience and qualification in larger airplanes and help the pilot supply pipeline for the U.S. airline industry.

generation of pilots more efficiently and improve the overall competency of entry-level first officers.

Many Asian and European countries have already adopted a similar approach in the form of the multi-crew pilot license (MPL)—an alternative pilot training and certification concept specifically geared toward training airline pilots.⁸³ The training methods for the MPL are focused on enhancing the quality of training geared toward first officer duties. Such competency-based training for pilots is not new and focuses on the training outcome in terms of how well students perform rather than simply meeting specified numbers of training hours.⁸⁴ Thus, training hours are replaced by sets of defined, measureable performance criteria. The MPL training model focuses on the core competencies that pilots need to be able to operate modern jet airplanes during all phases of flight. Many of the airline officials we interviewed suggested that this model for pilot training could serve as an additional career pathway for becoming a U.S. airline pilot.

Concluding Observations

Availability of a sufficient number of qualified pilots is vital to the U.S. airline industry and necessary to support air transportation services for passengers and cargo traveling within the United States or to and from this country. Evidence suggests that the supply pipeline is changing as fewer students enter and complete collegiate pilot-training programs and fewer military pilots are available than in the past. Additional pressure on pilot availability will come from (1) the projected number of mandatory age-related pilot retirements at mainline airlines over the next decade and beyond, (2) the increasing demand for regional airlines to address attrition needs, and (3) the reported lower number of potentially qualified pilots in the applicant pool for filling regional airlines' first-officer jobs. If the predictions for future demand are realized and shortages continue to

⁸³In November 2006, the International Civil Aviation Organization (ICAO) enabled the implementation for the multi-crew pilot license by amending personnel licensing standards to include a new pilot certificate and adopting new standards for this *ab initio* airline pilot training method. ICAO is the international body that, among other things, promulgates international standards and recommended practices in an effort to harmonize global aviation standards.

⁸⁴The international standards for an approved MPL training program specify a minimum of 240 hours of actual and simulated training, but do not specify a descriptive breakdown of hours for the program.

develop, airlines may have to make considerable operational adjustments to compensate for having an insufficient number of pilots.

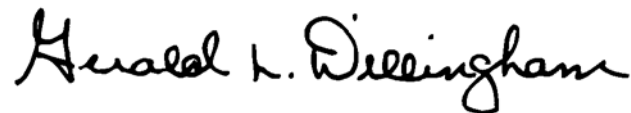
To address such a situation, opportunities exist for the airline industry to take action to attract more pilots. For example, airlines can continue to take actions that will promote aviation as an occupation—such as through employment pathway partnerships with pilot schools and additional career and financial support for pilots as they build flight hours for an R-ATP or ATP certificate. In addition, mainline and regional airlines could work together to shift some of the burden of increasing training costs from students as has been done by some European airlines and adjust contractual agreements between mainline and regional airline partners to help regional airlines increase revenue. Furthermore, with the mandate to increase pilot qualifications for airline pilots having only recently gone into effect, opportunities exist to develop new training methods and pathways for students to gain experience relevant to an airline environment. It is unclear at this point what adjustments could occur within the pilot training system that would help to respond to these stakeholders' concerns about the current regulations, or if government action may be necessary to enable certain changes. Therefore, we encourage FAA to continue its efforts in working with the airline and pilot training industries in considering additional ways for pilots to build quality flight time that contributes directly to working in airline operations. In the absence of efforts discussed in the report to incentivize and attract more people to the career, several airlines and industry stakeholders expressed some concern that service to some small communities may suffer going forward. Given the opportunities available for the industry to address a possible shortage of pilots, as discussed, as well as actions FAA is considering, we are not making recommendations in this report. In the event that Congress decides that actions in the market are not sufficient and it is necessary for government to intervene, this report offers several options for doing so.

Agency and Third-Party Comments

We provided a draft of this report to the departments of Defense, Labor, and Transportation for review and comment. DOD had no comments on the report. DOL and DOT provided technical comments that we incorporated as appropriate. In addition, to verify information, we sent relevant sections of the draft report to Airlines for America, the Regional Airlines Association, Malcolm Cohen, Ph.D., and various stakeholders, which also provided technical comments that we incorporated as appropriate.

We will send copies of this report to interested congressional committees and members; the Secretary of Defense; the Secretary of Labor; the Secretary of Transportation; the Director, Office of Management and Budget; and others. This report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or at dillingham@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix II.



Gerald L. Dillingham, Ph.D.
Director
Physical Infrastructure Issues

List of Requesters

The Honorable John Thune
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Bill Shuster
Chairman
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Frank A. LoBiondo
Chairman
Subcommittee on Aviation
Committee on Transportation and Infrastructure

The Honorable Johnny Isakson
United States Senate

The Honorable John Mica
House of Representatives

The Honorable Thomas Petri
House of Representatives

Appendix I: Objectives, Scope, and Methodology

Our report focuses on the supply of and demand for airline pilots and potential market and government responses. In this report, we described (1) what the available data and forecasts reveal about the need for and potential availability of airline pilots and (2) the types of industry and government actions that are being taken, or might be taken, to attract and retain airline pilots.

To address the two objectives, we reviewed and synthesized a range of published reports from GAO, the Department of Transportation (DOT), and the Federal Aviation Administration (FAA) that included general background information on a variety of related issues, such as the pilot certification process; pilot training schools; typical career paths to become an airline pilot; piloting experience and airline pilot compensation; federal-funding programs for pilot training; and the historical and current health of the airline industry. We also reviewed relevant literature related to factors that affect the supply of and demand for airline pilots, including attrition and retention concerns, factors to consider in the future, and international pilot supply and demand issues based on search results from databases, such as ProQuest®, TRID, and Nexis®, as well as trade publications, industry stakeholder groups, and the Internet. Furthermore, we reviewed the federal aviation regulations related to training and certification for pilots under Parts 61 and 141, Title 14, Code of Federal Regulations (CFR); as well as oversight of air travel operations in accordance with Parts 91, 121, and 135, Title 14, CFR. We also reviewed provisions of the Airline Safety and Federal Aviation Administration Extension Act of 2010 (Pub. L. No. 111-216) related to “Flight Crewmember Screening and Qualifications” and “Airline Transport Pilot Certification.” We reviewed FAA’s regulatory final rules required by the Act related to addressing pilot fatigue (issued in January 2012);¹ increasing qualification requirements for first officers who fly U.S. passenger and cargo planes (issued in July 2013);² and enhancing pilot training requirements for airline pilots (issued in November 2013).³

To determine what the available data and forecasts reveal about the need for and potential availability of airline pilots, we reviewed relevant

¹77 Fed. Reg. 330 (Jan. 4, 2012).

²78 Fed. Reg. 42324 (July 15, 2013).

³78 Fed. Reg. 67800 (Nov. 12, 2013).

economic literature that describe labor market conditions⁴; developed a summary of the general economic principles for evaluating labor market conditions; and identified relevant data sources. Economic literature states that no single definition exists to define a labor shortage; however, one can look at multiple indicators—including unemployment rates, employment numbers, and earnings—which might converge to suggest either the presence or absence of a shortage.⁵ We obtained these data from the Bureau of Labor Statistics (BLS) Current Population Survey (CPS) for years 2000 through 2012.⁶ In 2010, the Standard Occupational Classification (SOC) system's occupation titles were updated and, as a result, some occupations' names were changed. We used SAS, a statistical software application, to connect the BLS CPS data for 2000-2010 and 2011-2012 by the SOC for aircraft pilots; this did not affect our occupation of interest.⁷ We analyzed how these indicators have changed over time, and whether these indicators suggest a labor shortage—that is whether there appears to be an imbalance between the labor supply (i.e., available people) and demand (i.e., available jobs). We analyzed each occupation relative to all other occupations and using a scale with benchmarks developed in previous economic analysis.⁸ For the

⁴Barnow, Trutko, and Piatak, *Conceptual Basis for Identifying and Measuring Occupational Labor Shortages*, and Cohen, *Labor Shortages*.

⁵In the absence of a universally agreed upon definition, we have defined a labor shortage in the same terms that have been used in economic literature, including a BLS publication.

⁶The Current Population Survey, a monthly household survey conducted by the Bureau of the Census for the BLS, provides a comprehensive body of information on the employment and unemployment experience of the nation's population, classified by age, sex, race, and a variety of other characteristics.

⁷Occupation titles were updated in 2010 and some occupations were combined and others were phased out. While this did not affect our occupations, it affected the total number of occupations. We excluded those occupation for which the name changed. We also excluded occupations that had any years where the sample size was too small (i.e., under 50,000 observations) to report unemployment, median weekly earnings, or employment. This affected unemployment and weekly earnings more than employment. As a result, we dropped 288, 490, and 250 occupations from the unemployment rate, employment, and earnings, respectively.

⁸Cohen developed a scale with seven categories to more easily synthesize results from the indicators. Each occupation's indicators were assigned a numerical value from 1 to 7. Categories were developed by looking at the distribution of the results and setting natural groupings (e.g., distinguishing between positive and negative employment growth). A rank of "7" designates the indicator is consistent with a labor shortage and a "1" designates the indicator is consistent with a labor surplus.

unemployment rate we looked at the average unemployment rate for each occupation for 2000 through 2012.⁹ For both employment and earnings we analyzed any change.¹⁰ Due to the limitation that airline pilots and commercial pilots are combined into a single occupational category in the CPS data,¹¹ we also obtained data from the BLS Occupational Employment Statistics (OES) survey for employment and wage earnings and analyzed any change from 2000 through 2012.¹² To verify our results, we consulted with Malcolm Cohen, Ph.D., labor economist and author of the original methodology for conducting indicator analysis.¹³ We incorporated his comments as appropriate. Finally, we summarized limitations with the data with respect to how we used it. We determined the data were sufficiently reliable for the purposes of our indicator analysis to provide context on the labor market.

To identify future demand for, supply of, or employment, we analyzed projections for airline pilots in the United States. To identify relevant studies, we performed a literature review of scholarly material, government reports, and books, among others, to identify any employment projections for airline pilots and limited our results to those projecting employment in the United States (or North America) using

⁹As part of a sensitivity analysis we also compared data since 2003, in addition to developing a regression line for both time periods. Performing multiple analyses with different comparison years allowed us to ensure that a year with unique results would not impact our analysis.

¹⁰Similar to the unemployment rate we also looked at data since 2003 as well. Finally, we adjusted earnings for inflation and only included full-time non-farm workers.

¹¹BLS defines airline pilots as those who work for airline companies that transport passengers and cargo according to fixed schedules, and commercial pilots are those involved in other flight activities, such as crop dusting, charter flights, and aerial photography. BLS's Current Population Survey data for unemployment, wage earnings, and employment combined both occupational categories.

¹²The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations for the nation as a whole, individual States, metropolitan and nonmetropolitan areas, and national occupational estimates for specific industries. BLS subdivides its employment and earnings data for airline pilots and commercial pilots.

¹³Dr. Malcolm S. Cohen, President of Employment Research Corporation, received his Ph.D. in Economics from the Massachusetts Institute of Technology in 1967. Dr. Cohen has directed numerous labor market research and forecasting studies for the U.S. Department of Labor. Dr. Cohen testifies as an expert witness in various court proceedings on economic loss, discrimination, and other employment issues.

databases that included ProQuest®, TRID, and Nexis®. We identified three demand-based forecasts—two conducted by government (FAA Aerospace Forecast Fiscal Years 2013-2033 and BLS Employment Projections 2012-2022), and one conducted by industry (Boeing Current Market Outlook 2013-2032)—and obtained each for analysis. To understand these projections, we reviewed the processes, methodologies, and sources of information used to make the projections. We also discussed the projections with knowledgeable staff involved with each study. We did not verify the data that the companies collected and used. Rather, we summarized the methodology and results for each and discussed any limitations we identified with respect to how the forecast was developed. We also described, based on economic literature, why forecasting generally includes a great deal of uncertainty.

We also identified and reviewed three relevant industry and academic studies that focused on the supply of and demand for airline pilots. The reviewed studies included (1) Lovelace, Higgins, et al, *An Investigation of the United States Airline Pilot Labor Supply*, 2013; (2) Brant Harrison from Audries Aircraft Analysis, *Pilot Demand Projections/Analysis for the Next 10 Years Full Model*, 2013; and (3) the MITRE Corporation, *Pilot Supply Outlook*, 2013. To evaluate these studies, we reviewed their methods, assumptions, and limitations. Each study was reviewed by one GAO economist, whose review was then verified by a second GAO economist. In our review of *An Investigation of the United States Airline Pilot Labor Supply*, we replicated the study's analysis using data provided by the lead researchers, which raised questions about a specific assumption made about future increases in the cost of pilot training. To determine the extent to which the conclusions of the study were based on this specific assumption, we varied the assumption to determine the extent to which that would lead to a different conclusion. We discussed our analysis in detail with the lead researchers, and in general, they acknowledged that our findings were valid, but provided reasons to explain why the original assumption used in the study was warranted.

To identify trends in supply sources for qualified airline pilots, we obtained data from 2000 through 2012 from civilian and military sources for pilots. We analyzed data from the Department of Education (Education) on annual completions by major in professional pilot programs; data from the Department of Defense (DOD) on expectations for the number of new pilots entering military service and separating from the military; and FAA's data on the number of individuals holding and obtaining pilot certificates and instrument ratings by year, specifically:

- *Education:* To describe national trends in completions in professional pilot degree programs, we analyzed data from Education's Integrated Postsecondary Education Data System (IPEDS). We used Education's Classification of Instructional Programs (CIP) and matched degree programs to our SOC codes to identify the relevant degree programs. Specifically, the CIP-SOC relationship indicates that programs classified in the CIP category prepare individuals directly for jobs classified in the SOC category. The categories of schools included in our analysis were degree granting: 4-year research, 4-year master, 4-year baccalaureate, 2-year associate, and vocational schools. Unless otherwise noted, data estimates for graduation rates are within a confidence interval of 5 percentage points.
- *DOD:* To better understand the role of the U.S. military as a source of potential airline pilots, we obtained data on military pilots separating from the Service branches (i.e., the Air Force, Army, Marine Corps, and Navy); the current number of pilots in each Service; and forecasted rates of separation for pilots. We interviewed military officials at the Pentagon to understand how separation trends in the future will compare to past trends.
- *FAA:* To better understand trends in the number of pilot certificates and instrument ratings held and new certificates issued, and age distribution of current airline transport pilot (ATP) certificate holders, we obtained data from FAA on pilot certificates and instrument ratings held and issued from 2000 through 2012. We also obtained data from FAA on the estimated number of active ATP certificates held by age group during this period in order to exclude the number of certificates held by pilots age 65 and older because they would not be allowed to work as airline pilots due to mandatory age retirement. The database in which certificate-holder information is stored maintains records on individuals until FAA is informed of their death.

To assess the reliability of Education, DOD, and FAA data, we reviewed documentation related to all data sources from prior GAO reports, the agencies' websites, and interviewed knowledgeable government officials about the quality of the data. We determined that the data were sufficiently reliable to describe general sources of supply of airline pilots and to support broad conclusions about trends in these sources over recent years.

To develop our list of actions that employers may take to mitigate labor shortages, we reviewed economic literature and interviewed the authors.¹⁴ We also interviewed selected industry associations that represent airlines, the unions that represent pilots, and government officials to get a broader sense of the extent to which employers are taking actions to mitigate labor shortages. To supplement these broader trends, we also reviewed data from and interviewed representatives from passenger and cargo airlines, and selected collegiate aviation and non-collegiate vocational pilot schools. We contacted and gathered information from 10 mainline passenger and cargo airlines, and 12 regional passenger airlines.¹⁵ We selected the mainline and regional airlines based on size in terms of passengers transported in 2012 and stakeholders' recommendations. While these 12 regional airlines are responsible for transporting about 71 percent of regional passengers in 2012, their views and experiences should not be used to make generalizations about all regional airlines. We also interviewed representatives of 10 collegiate aviation and 2 non-collegiate vocational pilot schools, which accounted for about half of the students who graduated with professional pilot majors in 2012. We selected these schools based on geographical diversity, average number of student enrollments in pilot training programs, stakeholders' recommendations, and our previous work related to pilot training. While these schools were among the largest schools in terms of student pilot enrollments, our findings should not be used to make generalizations about the views or experiences of all of the pilot training schools in the United States. We also met with and reviewed documents from various industry stakeholders, including pilot labor unions, airline associations, and industry organizations, among others (see table 2).

¹⁴Barnow, Trutko, and Piatak, *Conceptual Basis for Identifying and Measuring Occupational Labor Shortages*.

¹⁵Mainline airlines provide domestic and international passenger and cargo service on larger aircraft. Regional airlines provide domestic and limited international passenger service, generally using aircraft with fewer than 90 seats, and cargo service to smaller airports.

Table 2: Agencies, Organizations, and Airlines Contacted or Interviewed

U.S. federal agencies

Department of Education

Department of Defense

Department of Labor, Bureau of Labor Statistics

Department of Transportation, Federal Aviation Administration

Industry associations

Air Line Pilots Association

Airlines 4 America

Coalition of Airline Pilots Association

Independent Pilots Association

International Air Transport Association

National Business Aviation Association

Regional Airline Association

Regional Air Cargo Carriers Association

University Aviation Association

Industry organizations

Airline Apps, Inc.

Aviation Workforce Development

Boeing

CareerBuilder

Families of Continental Flight 3407

International Civil Aviation Organization

Venture Management, Inc

Collegiate aviation pilot schools

Embry-Riddle Aeronautical University, Daytona Beach, Florida

Embry-Riddle Aeronautical University, Prescott, Arizona

Kansas State University at Salina

Metropolitan State University

Middle Tennessee State University

Purdue University

Southern Illinois University

Tarrant County College

University of North Dakota

Western Michigan University

Non-collegiate vocational pilot schools

Aerosim Flight Academy

Appendix I: Objectives, Scope, and Methodology

FlightSafety Academy

Mainline airlines

Alaska Airlines

American Airlines

Atlas Air

Delta Airlines

Hawaiian Airlines

JetBlue Airways

Southwest Airlines

United Airlines

United Parcel Service

US Airways

Regional airlines

American Eagle Airlines

ExpressJet

Great Lakes Airlines

Mesa Air

Republic Airways Holdings (Chautauqua Airlines, Republic Airlines, Shuttle America)

Silver Airways

SkyWest Airlines

Trans States Holdings, Inc. (Trans States Airlines, Compass Airlines, GoJet Airlines)

Source: GAO.

We conducted this performance audit from March 2013 through February 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: GAO Contacts and Staff Acknowledgments

GAO Contact

Gerald L. Dillingham, PhD, (202) 512-2834 or Dillinghamg@gao.gov

Staff Acknowledgments

In addition to the contact named above, the following individuals made important contributions to this report: Andrew Von Ah, Assistant Director; Amy Abramowitz; Benjamin Bolitzer; Russell Burnett; Vashun Cole; Dave Hooper; Bonnie Pignatiello Leer; John Mingus; Susan Offutt; Joshua Ormond; and Amy Rosewarne.

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