

Aviation and Pilot Workforce

Aviation Workforce

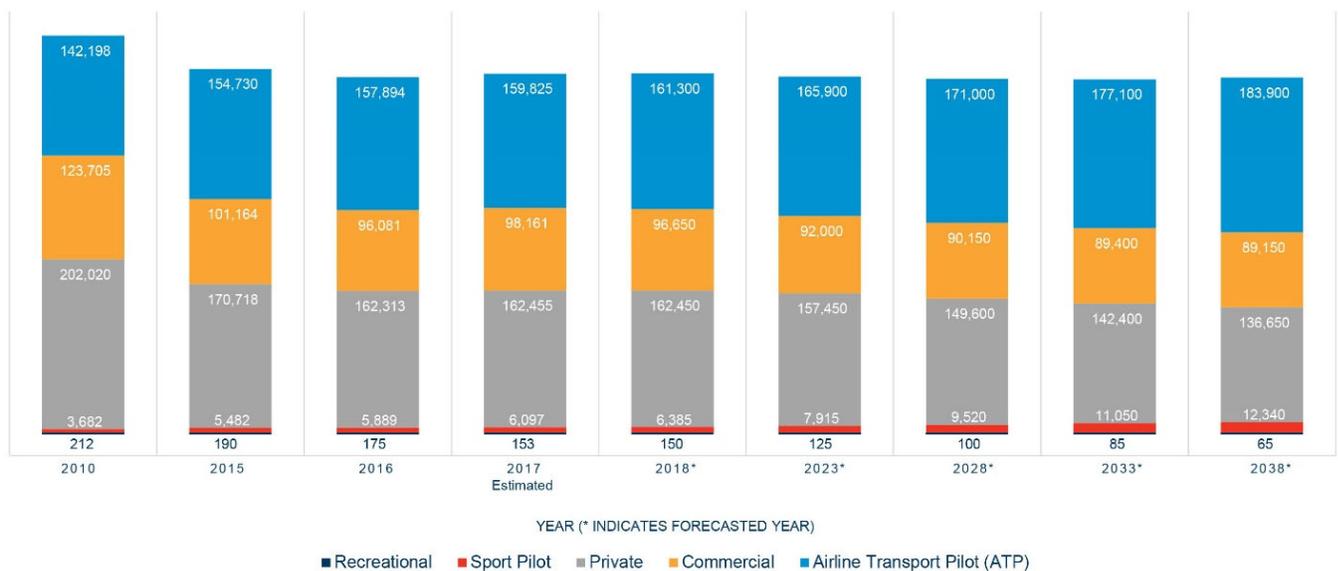
In 2016, aviation accounted for more than five percent of the United States' Gross Domestic Product (GDP), contributed \$1.6 trillion in total economic activity and supported nearly 11 million jobs.¹

The extent of the aviation related activities is far reaching. Aviation careers range from airline operations to aircraft component manufacturing and everything in between. Three specific areas of the aviation work force are discussed in this trend paper including pilots, mechanics and drone operators.

Pilot Workforce Overview

The demand for airline pilots is a global concern. Aircraft manufacturing company Boeing forecasts that the world's airline industry will require 637,000 new pilots by the year 2036.² One third of the required pilots are expected to be needed in the Asia-Pacific Region, which is the highest for any region. Demand for pilots is also felt throughout the United States, and this demand is impacting the aviation industry. Active pilot certificates issued since 2010 excluding rotorcraft and glider certificates are shown in Figure 1.

Figure 1: Active Pilots by Certificate Type



Airline Pilots

The commercial airline industry is currently generating revenue and total passenger miles at an all-time high. Revenue Passenger Miles (RPM), a measure used by airline companies to track the overall profitability of flights, calculates the number of revenue-paying passengers aboard aircraft by the distance traveled for the flight. In 2017, the total RPM for domestic flights by mainline and regional air carriers was 683.3 billion, an increase of 3.0 percent from the previous year, as depicted in Figure 2.³ Another statistic

¹ FAA Economic Impact of Civil Aviation on the U.S. Economy 2016

² Boeing Pilot and Technician Outlook 2017-2036

³ Federal Aviation Administration (FAA) Forecast Fiscal Years (FY) 2018-2038

that works as a general barometer for the well-being of the airline industry is total enplanements, which tracks the total amount of passengers carried by U.S. airlines on domestic and international flights, shown in Figure 3. In 2017, the total amount of air carrier enplanements grew 2.4 percent to 743.5 million. The Federal Aviation Administration (FAA) predicts that both of these statistics will increase steadily through the year 2035.

Figure 2: Revenue Passenger Miles in Billions

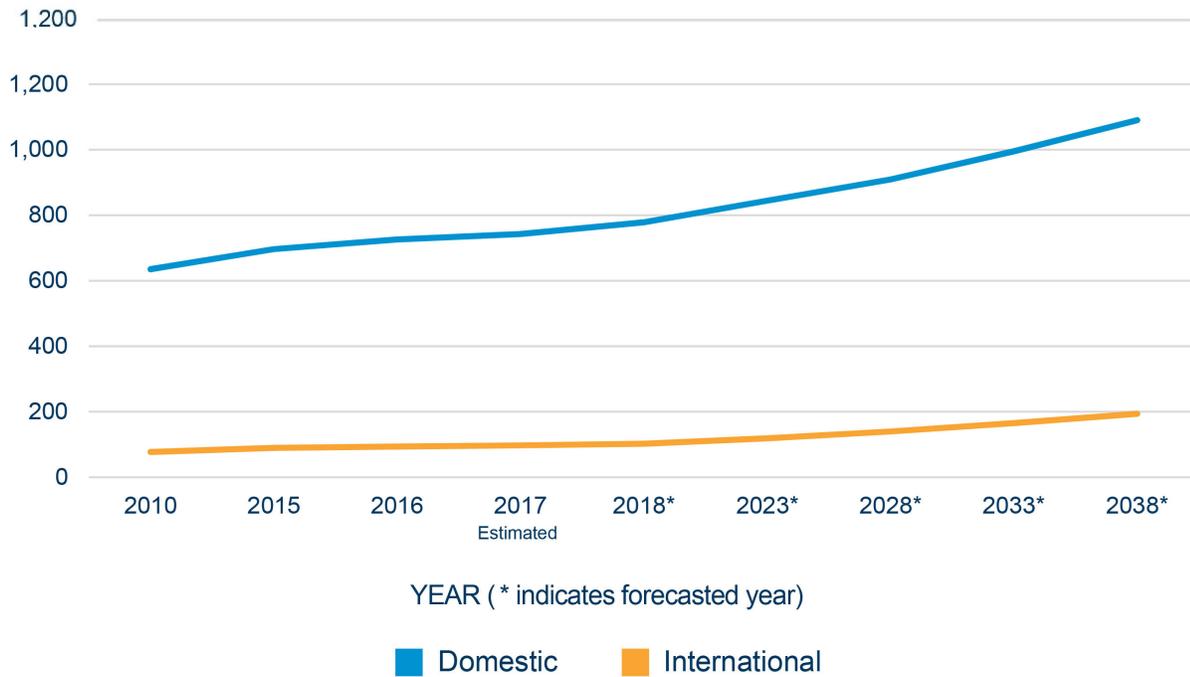


Figure 3: Revenue Passenger Enplanements in Millions

Airlines that transport passengers and cargo require their pilots receive an Airline Transport Pilot (ATP) certificate. ATP certificated pilots have been impacted by regulatory changes since 2010 when pilots were required to have more experience in the form of flight hours than previously required.

Regional Airlines: Regional airlines are contracted to fly the shorter and less profitable routes by a major airline partner. There are regional airlines that fly out of MSP that contract with Delta, United, and American Airlines to the smaller regional airports on direct flights out of MSP.

The increased demand for qualified pilots is a trend on both national and international scale. The demands for able-bodied pilots are increasingly being felt on regional airlines. Not only are these regionals having a difficult time attracting pilots through the door, but they are also losing senior pilots.

Regional airlines have had difficulty hiring and retaining pilots because of low wages; especially when compared to the wages earned by a pilot at a major airline. In 2014, *ALPA International* reported that the average regional airline starting salary for a first officer, the pilot who assists the captain, was only \$22,400⁴.

The Airline Safety and Federal Aviation Administration Extension Act of 2010, which raised the minimum hour requirement from 250 hours to 1,500 hours, have affected regional carriers and their pilot pool. This regulatory change was partly in response to the Colgan Air crash in 2009, in which a regional airplane piloted by an experienced captain and a less experienced first officer

⁴ Fact Sheet – Federal Aviation Administration (FAA) Forecast Fiscal Years (FY) 2018-2038

crashed into a house in New York State. The FAA and National Transportation Safety Board (NTSB) deemed pilot error as the primary cause for the accident. The accident resulted in the death of all 49 people on board, and one on the ground.⁵ Following its passage, the act significantly slowed the number of qualified applicants coming into the regional airlines.⁶ This regulation is cited as a factor in the struggle of regionals to attract pilots, mainly because this required additional time building for pilots to meet the new 1,500 hour rule in order to even be looked at by regionals. Further examples of the impact that the pilot shortage has had on regional airlines are included below.

- **Great Lakes Airlines:** On March 26, 2018, Great Lakes Airlines ceased all commercial operations, citing the pilot shortage as the primary cause in their decision. The company has not entered into bankruptcy, and plans to continue flight operations through a partnership with Aerodynamics Inc., but they will sell the remaining fleet of Beechcraft 1900Ds and Embraer 120 Brasilias registered to the Great Lakes Airlines name.⁷
- **Republic Airways:** In February of 2016, Republic Airways filed for Chapter 11 bankruptcy and cited the primary cause for the decision being the pilot shortage. Republic was still operating at a profit; however, they used the Chapter 11 protections to re-structure their lease agreements with aircraft manufacturers. Prior to their bankruptcy, Republic Airways was leasing smaller Embraer E170 and 175's. These aircraft are typically configured to hold 60 to 70 passengers. Through the bankruptcy procedures, Republic Airways intends to cancel their future orders with the Brazilian aircraft manufacturer Embraer and restructure their fleet with larger regional jets, to fit a more successful business model. The smaller E170 and E175 aircraft required more flights and more routes, and thus more pilots, to meet the demand for Republic's passengers. By using larger aircraft, the airline can now enplane the same amount of passengers while using fewer aircraft, thus reducing the total need for pilots.⁸
- **Horizon Air:** Horizon Air, a regional subsidiary of Alaskan Air Group (Alaskan Airlines), cancelled more than 300 flights during the summer of 2017 as they did not have the pilot capacity to fulfill their contracted air routes.⁹

Cargo Pilots

Like commercial airlines, cargo carriers also track total revenue by the mile. Instead of by passenger, carriers will track Revenue Ton Miles (RTM). The FAA predicts the RTM for the air cargo industry will increase .20 percent each year domestically, and 5.1 percent internationally from 2018 to 2038, Figure 4 shows the forecasted increase of RTMs². The demand of pilots for cargo carriers will continue.

⁵ NTSB/AAR-10/01, NTSB.gov

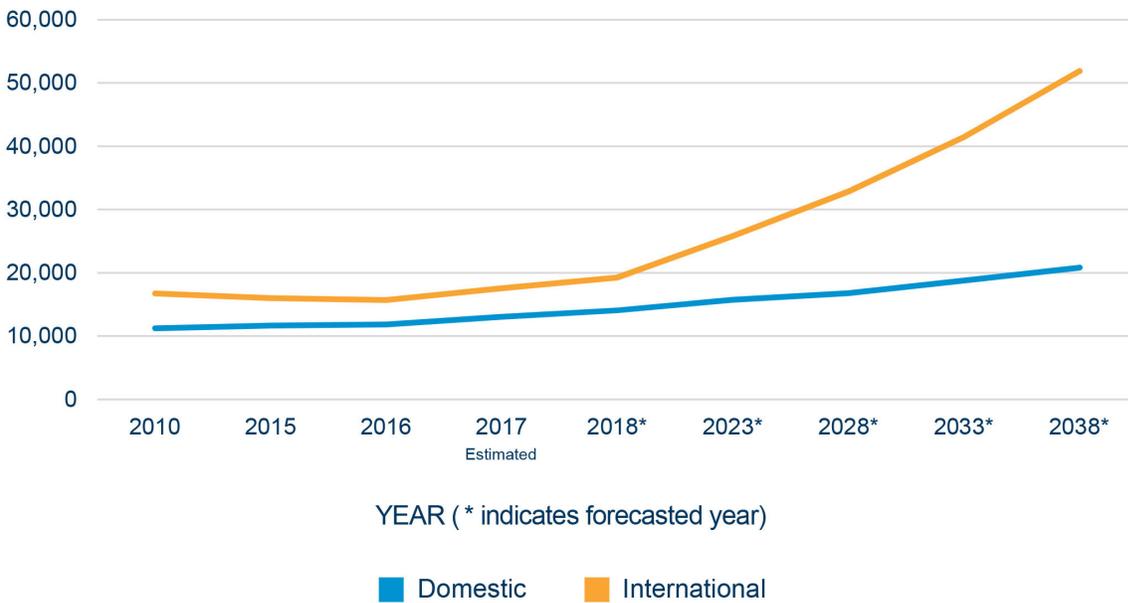
⁶ FAA Press Release – FAA Boosts Aviation Safety with New Pilot Qualification Standards

⁷ U.S. Pilot Shortage Claims a Casualty: Will More Airlines Shut Down?, 2018, Skift.com

⁸ Why Republic Airways filed for bankruptcy even though it's profitable, usatoday.com

⁹ Horizon Air cutting hundreds of flights this summer due to pilot shortage, seattletimes.com

Figure 4: Air Cargo Revenue Ton Miles in Millions



Military Pilots

In the spring of 2018 it was reported that the US Air Force was operating at about 90 percent of the total amount of pilots they require to fly their fleet of fighters, bombers, airlifters, cargo planes, and rescue helicopters. The total military pilot demand is around 20,000 pilots, but supply is currently around 18,000 pilots and shrinking. To meet the demand, the Air Force has offered incentives to more than 1,000 recently retired pilots in an effort to reinstate to active duty.¹⁰ The Navy is predicting a 10 percent shortage of pilots in 2020.

Space

Commercial space travel is a new branch of aviation and also demands qualified pilots. Currently, there are only a handful of companies entering this new frontier of aviation. As of the summer of 2018, there are no air carriers with consistent operations, but companies such as Virgin Galactic, Blue Origin, and SpaceX are expecting to open a limited number of space travel routes by 2019. The FAA states in their annual fact sheet that there were 22 authorized commercial launches and reentries in 2017. Due to the many uncertainties in the commercial space travel market, the FAA has predicted the amount of commercial launches/reentries to increase anywhere from 77 percent to nearly 200 percent by 2020.¹¹

General Aviation

The current pool of private pilots has decreased in the past nine years. In 2010, the total number of private pilot certifications was 202,020, and was recorded at 162,455 by the end of 2017. The decreasing number of new private pilots has caused the average age of the private pilot population to increase by nearly three years (46.2 to 48.9 years old) in the past decade and a half (2002 – 2017).² Piston powered airplanes are typically the primary aircraft used by general aviation pilots. The recession of 2008 caused the greatest reduction of sales for this type of aircraft sales in the past two decades. The general aviation aircraft market has yet to recover to the heights it once saw in the early 2000's.¹² Figure 1 depicts the change in active private pilots since 2008 and forecasted numbers through 2038

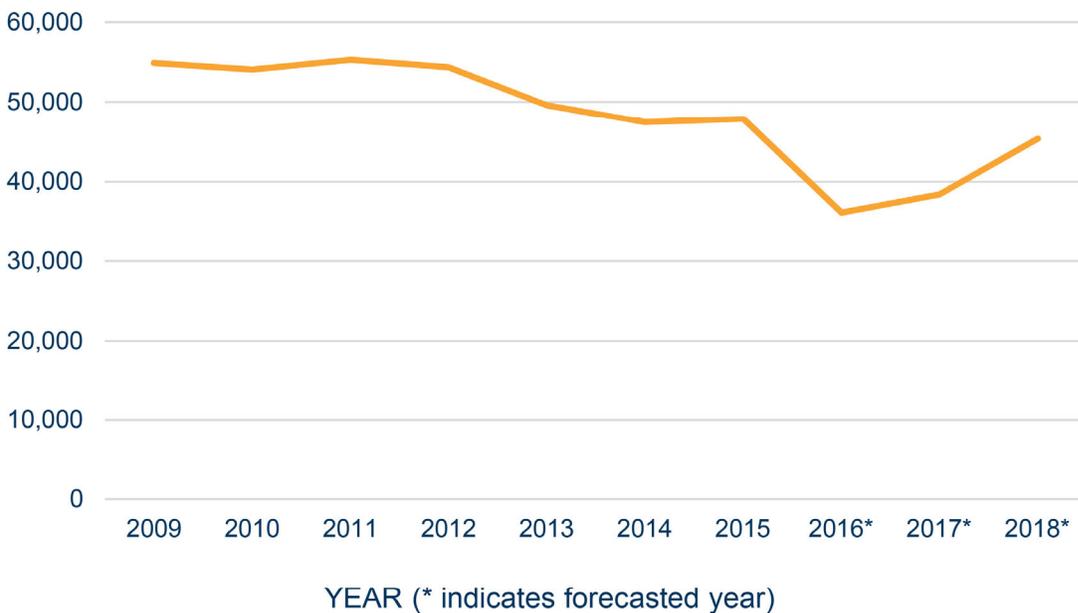
¹⁰ What's driving the U.S. Air Force Pilot Shortage?, foreignpolicy.com

¹¹ Ibid.

¹² General Aviation Trends in 12 Charts, airfactsjournal.com

The number of student pilots has continuously increased since 2010 as shown in Figure 5. The number of student pilots increased from 72,280 in 2009 to 149,121 by the end of 2017.¹³ This large increase in student pilots is likely due to regulatory changes in 2010 that allow student pilot certificates to be valid for 60 months rather than 36 months for pilots under 40 years of age. As of 2016, new student pilot certificates no longer have an expiration date.

Figure 5: Student Pilot Certificates Issued



Women in Aviation

Haley Richey became the first woman pilot for a commercial airline in the United States in 1934¹⁴. Since then, women have entered into the aviation workforce, which had been, and still is, a predominately-male career field. By the end of 2018, 46,463 active women pilot certificates had been issued, accounting for 7.3 percent of all estimated active certificates¹⁵. At the end of 2018, women held 4.4 percent of active ATP certificates. Non-profit organizations such as Women in Aviation, International (WAI) has been dedicated to the encouragement and advancement of women in all aviation fields. Stars of the North is the Minnesota chapter of WAI. The group of women and men are working together to increase female participation in aviation and aerospace. Stars of the North hold monthly events that focus on education, networking, and community engagement throughout the state¹⁶.

Figure 6 shows the number of type certificates issued to women compared to men as of December 31, 2018.¹⁷

¹³ Ibid.

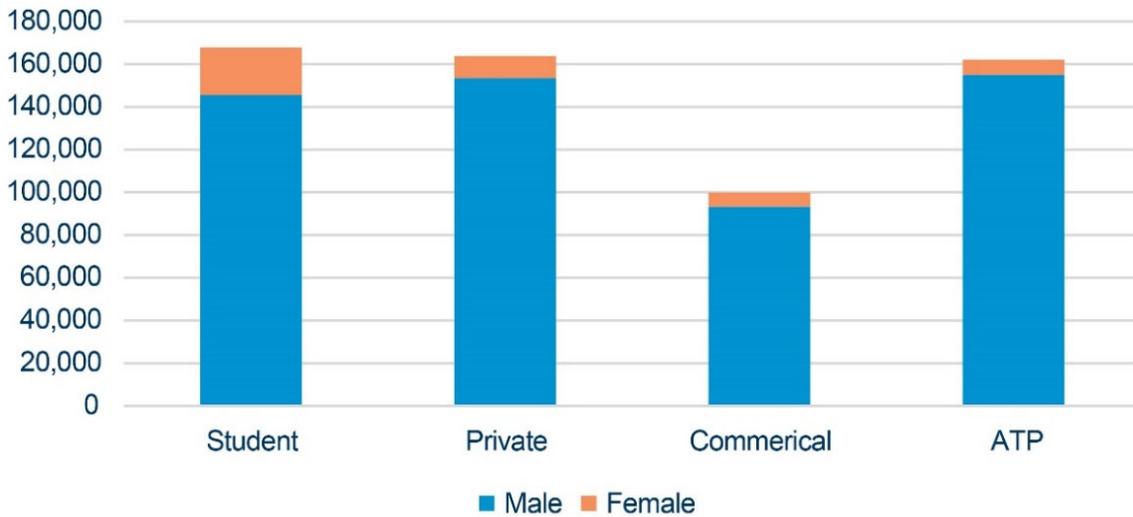
¹⁴ About WAI, wai.org

¹⁵ U.S. Civil Airmen Statistic, 2018

¹⁶ Starsofthenorth.org

¹⁷ Ibid.

Figure 6: Pilot Certificates Issued by Gender



Commercial Pilot Shortage Factors

The aviation industry continues to warn of the existing and continuing impacts of the shortage of commercial pilots. Several factors contribute to the shortage of commercial pilots available in the job market. The demand for pilots is caused by many factors including industry growth, cost to enter the job market, retirements of existing pilots, new regulatory requirements, and other factors.

Education Costs

One factor impacting the pilot shortage is the cost to enter the job market compared to the salaries earned by entry level professional pilots. The costs of flight training, both at a 4-year degree program as well as non-degree seeking programs, is high compared to the entry level salaries being offered for commercial pilots. College flight schools such as Minnesota State University, Mankato (MSU) and the University of North Dakota (UND), estimate total flight expenses to exceed \$70,000 throughout a student's flight training. This estimate does not include college tuition, room and board, or materials needed for those programs.

Upon graduation of a four-year bachelor course, such as the one offered at MSU and UND, many graduates continue to work for the same flight school they trained with as Certified Flight Instructors (CFI) in order to build hours to qualify for airline or other commercial positions. Flight instructor jobs are generally lower paying career opportunities. Upon completing a tenure as a flight instructor, many pilots enter the market with the regional airlines as an Airline Transport Pilot (ATP) where they will gain experience in more complex aircraft and continue to build hours.¹⁸

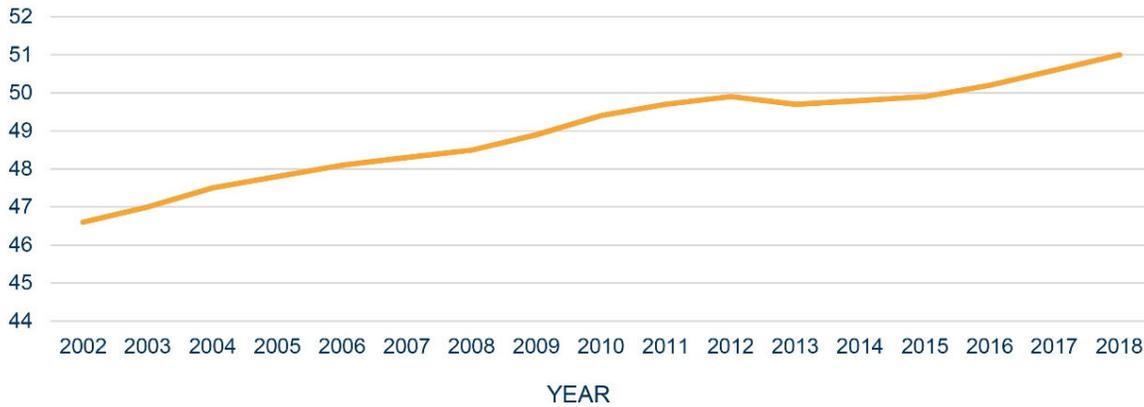
Age Demographics

On a national scale, licensed Airline Transport Pilots (ATP) average 51 years old. Figure 7 shows how the average age of ATP rated pilots has continued to increase in 15 of the past 16 years, from 2002 to 2018, and is 4.4 years higher than it was in 2002.¹⁹

¹⁸ UND Aviation Degree Programs – Individual Flight Costs

¹⁹ U.S. Civil Airmen Statistic, 2018

Figure 7: Average Age of ATP Certificate Holders



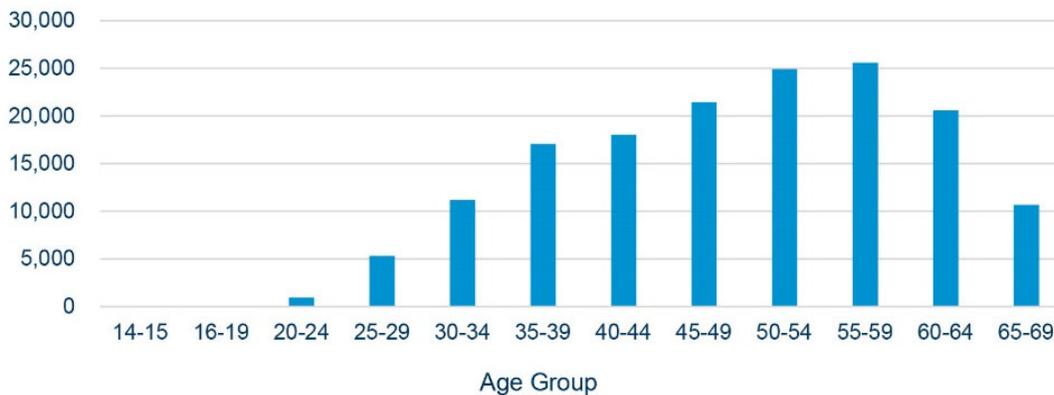
In the past decade, the United States has also seen a decrease in the total quantity of professional pilots (Commercial or ATP rated). Since 2008, the Federal Aviation Administration (FAA) has recorded only a minor increase in the number of ATP rated pilots from 146,838 in 2008 to 159,825 by the end of 2017 (+0.98 percent annual growth rate), whereas commercial rated pilots have decreased from 111,677 in 2008 to 89,335 by the end of 2017 (-2.37 percent annual decrease).²⁰

Retiring Pilots

A large number of professional pilots are quickly approaching the mandatory retirement age of 65 years. According to the FAA's U.S. Airmen Statistics Report of 2018, 68,613 ATP pilots are currently 55 years of age, or older. This means that of the 145,147 licensed ATP pilots between the ages of 23 and 65, more than 30 percent will be required to retire by 2027.²¹ Figure 8 shows the number of ATP certificates issued grouped by age.

Figure 8: Estimated Active ATP Certificate Holders by Age Group

There will be negative effects on pilot availability as significant percentages of the pilot population near retirement. Countries have



enacted legislation aimed at mitigating the shortfall, while capitalizing on keeping experience in the cockpits. In the U.S., the mandatory retirement age was increased from 60 to 65 in 2007 when the Federal Government put the Fair Treatment for Experienced Pilots Act into law. In 2015, countries such as Japan increased their mandatory retirement age from 65 to 67²² increasing the retirement age allows for a larger pool of professional pilots in the short-term.

²⁰ Fact Sheet – Federal Aviation Administration (FAA) Forecast Fiscal Years (FY) 2018-2038

²¹ Ibid.

²² Japan making efforts to address expected pilot shortage in 2030

Military Pilots

Commercial and cargo airlines have historically relied on a steady stream of military pilots to make the career change from military to commercial aviation. In recent years, the ability to rely on this source has lessened as the various military branches are having difficulty satisfying the demand for their own pilots. As military pilots continue their flying in the armed forces longer than they have historically, there are less former military pilots entering the commercial and cargo pilot work force.

Pilot Pay

As stated earlier, the average starting salary for a first officer in the regional airline industry was only \$22,400 as of 2014.²³ While wages for pilots are increasing at both regional and mainline carriers to match market demands, the salaries may not be enticing enough to encourage new pilots to pay for the needed increased training hours to enter the market. The ability of the market to provide sufficient numbers of qualified pilots willing to work in the industry may be directly linked to the airlines' willingness to pay increasingly higher salaries. Once a first officer reaches enough hours, they have the option to upgrade to a captain at their regional airline. Captains on average earn \$55,000 a year at a regional airline. For comparison, a captain at a major airline on average earns \$190,012 a year.²⁴

Retaining qualified pilots has been another challenge of regional airlines. These airlines are competing from the same, limited, pilot pool. In efforts to attract more pilots, regional airlines are offering sign on bonuses for new as well as experienced pilots to join their airline whilst limiting the amount of yearly raises for their experienced pilots. Pilots with enough hours consider leaving their current airline to take advantage of a sign on bonus at a competing regional airline. Working for a major airline takes time and requires hours.

Aviation Mechanics Workforce

An aircraft maintenance technician holds an Airframe and/or Powerplant (A&P) certificate issued by the FAA. An A&P certificate requires training just like a pilot license, is federally regulated and requires the certificate holder to be at least 18 years of age. Employment of and demand for aircraft and avionics equipment mechanics and technicians is projected to grow 5 percent between 2016 and 2026, roughly the average rate for all occupations.²⁵

Education

In early 2019 three schools offered an FAA approved aviation maintenance training program in Minnesota. Northland Community & Technical College located in Thief River Falls, MN offers an FAA approved aviation maintenance program. The college had 10 graduates from this program in 2017.²⁶ The College works with various local and regional employers to help students be placed in a career before they graduate and employers are calling ahead to entice them to work for their organization.

Lake Superior College in Duluth, MN also has an FAA approved aviation maintenance technology degree program. Enrollment in their aviation maintenance program was forecasted to be 72 in the fall of 2016.²⁷ Lake Superior College is a Delta Air Lines approved college partner. Additionally, Lake Superior College partners with AAR, a company providing maintenance on Airbus A-320 family of aircraft, on marketing, recruiting and apprentice opportunities. Local aviation employers such as AAR as well as Cirrus have a growing demand for mechanics and work with the College to assist in career placement.

²³ Competition for Pilots Remains Fierce, but Higher Pay Helps, The Embry Riddle Newsroom

²⁴ Payscale.com

²⁵ Occupational Outlook Handbook, bls.gov

²⁶ Northland Community Technical College Fact Book 2018

²⁷ Lake Superior College Fact Book 2017

Minneapolis Community College in Minneapolis also offers an FAA approved aviation maintenance program. This course starts once per year in the fall and is located at the Delta Air Lines facility at MSP. This program includes a public-private partnership between Delta Air Lines and the Minneapolis Community College.

Candidates must receive 18 months of practical experience with either power plants or airframes, or 30 months of practical experience working on both at the same time. These requirements are waived if a candidate graduates from an approved FAA program such as one of the three Minnesota programs. Once completing the required training, three exams must be passed to receive an A&P.

The United States military also employs aircraft mechanics to perform maintenance on their fleet. Branches of the military will provide the necessary training to perform the maintenance tasks.

Aircraft and Avionics Mechanic Opportunities

In 2017 aircraft and avionics equipment mechanic technicians earned a mean salary of \$61,260 per year or \$29.45 an hour. Employment in this profession is projected to grow at the same rate as other occupations in the United States between 2016 and 2026.²⁸

Major airlines hire mechanics to perform maintenance on their fleet, generally at one of the hubs for the airline. Average base pay for an Aircraft Mechanic at Delta is \$35 an hour.²⁹ Private companies also perform maintenance for airlines or companies under contract. AAR is a private company that provides aviation services to both commercial airline and government clients. AAR has an aircraft maintenance location in Duluth at the Duluth International Airport (DLH) and has over 385 full-time employees.

General aviation (GA) aircraft are required under federal regulations to receive an annual inspection performed by an A&P mechanic. This A&P is required to hold an inspection authorization by the FAA. GA aircraft used for flight training or that carry passengers for hire are also required to receive a 100-hour inspection, which is required to be performed within each 100 hours of time in service. Over the past nine years, total general aviation pilots have declined as has ownership of piston aircraft, potentially resulting in lesser demand for A&Ps for GA aircraft.

The FAA tracks U.S. Civil Airmen Statistics, including Mechanic Certificates. Figure 9 shows the number of A&P Certificates issued and Figure 10 shows the total active Mechanic certificates issued.

²⁸ Ibid.

²⁹ Glassdoor.com

Figure 9 - Mechanics Certificates Issued

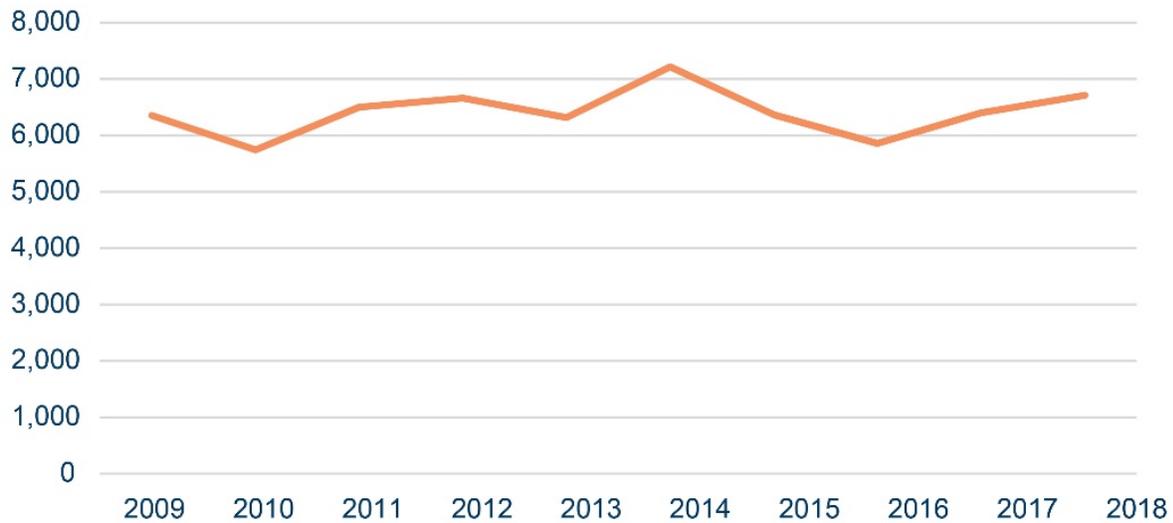
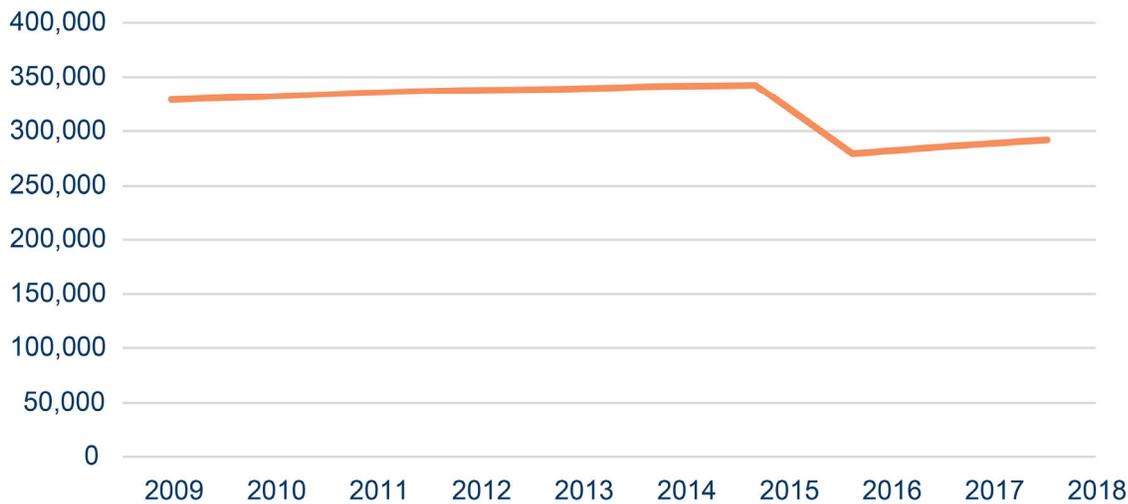


Figure 10 – Estimated Active Mechanics Certificates



Unmanned Aircraft System (UAS)

An Unmanned Aircraft System (UAS) is an aeronautical device, sometimes referred to as a drone, controlled by an operator on the ground in place of a pilot in the cockpit. Over the 10-year period from 2015-2025, 100,000 jobs are anticipated to be generated contributing \$82 billion in direct and indirect economic activity.³⁰

UAS Workforce

Universities around the country have started offering formal college training in UAS. Programs such as one at the University of North Dakota (UND) offers two paths to prepare students for advanced high altitude unmanned aircraft systems or to focus on the newly emerging small UAS market. Northland Community Technical College in Thief River Falls also offers an Unmanned Aerial Systems certificate that prepares students to enter the UAS workforce.

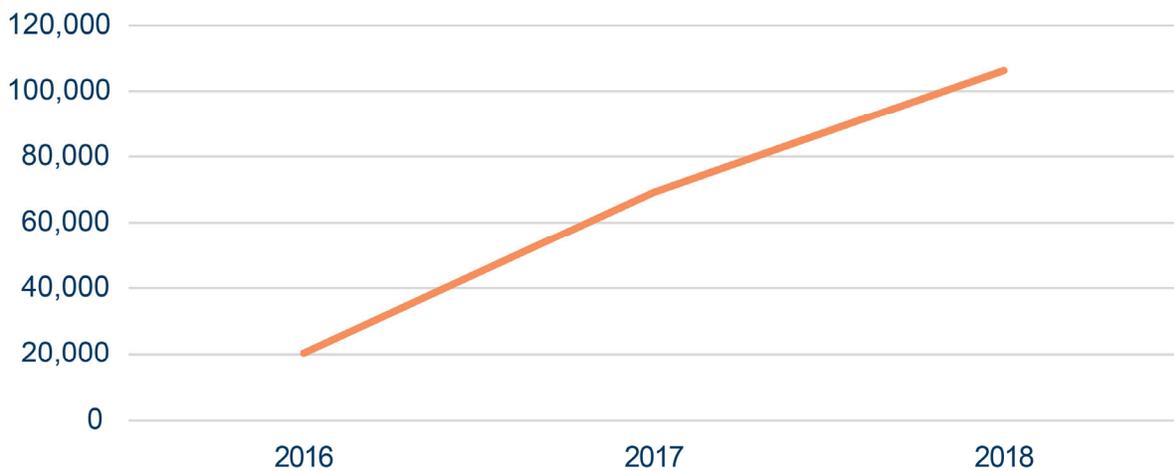
³⁰ The Economic Impact of Civil Aviation on the U.S. Economy, FAA, November 2016

Drones have entered into the public and private sector for various uses in the military, public safety and private organizations. The education system will need to keep pace with the rapidly growing industry to ensure a steady supply of qualified and educated drone pilots.

Remote Pilots

Remote Pilot Certificates (RPCs) are the fastest growing type of licensed airmen. This refers to pilots who are certified to operate UAS for commercial operations. This certification was first introduced and regulated by the FAA in 2016. In 2018, over 106,000 RPCs had been issued. Significant growth is expected in RPCs over the next five years and the FAA estimates that the total RPCs will exceed 300,000 in that period.³¹ Figure 11 shows the estimated number of Active RPCs held per year, since 2016.

Figure 11: Estimated number of Active RPCs held per year



Future UAS Trends

The FAA acknowledges there is a lot of work that needs to be accomplished to have drones fully integrated into the NAS. The FAA forecasts that the growth the industry has seen over the past several years will continue as businesses explore various applications of drones within their business models and as local and federal agencies integrate drones into their mission. The growing industry has potential for continued workforce growth and demand.

³¹ Ibid.