

2019

Effects of the Pilot Shortage on the Regional Airline Industry: A 2023 Forecast

Ethan S. Klapper

Embry-Riddle Aeronautical University, klappee1@my.erau.edu

Hans-Joachim K. Ruff-Stahl

Embry-Riddle Aeronautical University, ruffha@erau.edu

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Klapper, E. S., & Ruff-Stahl, H. K. (2019). Effects of the Pilot Shortage on the Regional Airline Industry: A 2023 Forecast. *International Journal of Aviation, Aeronautics, and Aerospace*, 6(3). Retrieved from <https://commons.erau.edu/ijaaa/vol6/iss3/2>

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In the next 5 years and beyond, it is predicted that the U.S. airline industry will face a substantial pilot shortage. Pilots in the US mandatorily retire at the age of 65, while at the same time, the barriers to entry to earning an FAA airline transport pilot (ATP) certificate have arguably never been higher, with training costs increasing and new minimum-hour requirements taking effect in 2013. Regional airlines, which provide a significant stream of new pilots to the major airlines operating under Part 121, will be hit the hardest, as major airlines ramp up hiring from the regional airlines to replace pilots who are retiring.

Given the important impact of regional airlines in supplying pilots to the major airlines, a regional pilot shortage could have devastating effects for the overall U.S. airline industry, and the broader U.S. economy. In other words, a near-term shortage of regional pilots could have longer-term effects in the industry.

This nonexperimental study focused on those near-term effects by asking how many aircraft will have to be taken out of service by 2023 if the pilot shortage materializes, and how many passengers that loss of aircraft will impact. Building on research conducted by Higgins et al. (2013) and later updated by Higgins, Bjerke, Lovelace, and Leonard (2016), three different regional pilot shortage scenarios are explored for 2023. From there, a model is created that predicts how many regional aircraft will need to be taken out of service, based on the deficit of pilots. Since the number of aircraft a regional airline has in service is correlated to the number of passengers it carries, the loss in passengers for the regional airline industry is then predicted. This metric is important, because it shows the corresponding loss in demand when supply is cut. Then, the results are put in context, and a discussion of impacts and possible strategies to mitigate the pilot shortage follows.

Review of Literature

Higgins et al. (2013) created a widely-cited academic model that projects the cumulative deficit of airline pilots in the US, and it provides the foundation for this study. It is a supply-side model that bases its projection on the number of pilots earning certified flight instructor (CFI) ratings, as instructing is a popular way for civilian pilots to build time and, according to the study's authors, 84% of ATP certificate holders also hold (or have held) a CFI rating.

In addition to its supply-side model, the forecast also factors in the demand side by predicting how many new pilots will be needed. It does this by accounting for mandatory pilot retirements at age 65, attrition due to a pilot losing his/her medical certificate, as well as other voluntary or involuntary factors. The work of Higgins et al. in 2016 is an update to their 2013 research, and projects a

cumulative industrywide deficit of around 8,000 airline pilots by 2023, and 14,439 airline pilots by 2026.

Further complicating the supply of pilots is the fact that regional airlines are hiring CFIs away from flight schools faster than they can be replaced, according to the U.S. Government Accountability Office (Von Ah, 2018). A lack of CFIs indicates there will be a pilot shortage further up the supply chain and is another ominous data point when talking about a pilot shortage in 2023 and beyond. The GAO report also encountered some of the same data limitations that this study encountered.

Forbes and Lederman (2006) provided a practical overview of the role that regional airlines play in the U.S. air transportation system. While this paper is over a decade old, it provides important background on the business relationships between regional airlines and the mainline airlines that work with the regional airlines, a relationship explored more in-depth later on.

In August 2013, new FAA regulations took effect, requiring all flight crew members operating for a Part 121 air carrier to have an ATP certificate. An ATP certificate requires 1,500 hours (though that minimum lowers when one has a restricted ATP certificate (R-ATP), which is awarded through a combination of flying time and higher education or military experience). The 2015 Pilot Source Survey analyzed new hires at 19 regional airlines since the new regulations took effect, and compared the data to similar studies conducted before the regulations were implemented. The study found that 17% of the pilots hired in August 2013 or afterward had R-ATP certificates, compared to 83% having full ATP certifications (Bjerke et. al., 2016). The study, which had industry participation, provides a high-level statistical overview of the backgrounds of regional pilots and provides a model for future research.

While Bjerke et. al. (2016) conducted a comprehensive study involving the background of hired regional pilots, no such study exists for the pilots that major airlines hire. Therefore, it is difficult to precisely quantify the exact source of new hires for major airlines, but generally speaking, regional airlines provide a large majority of new pilots for major airlines. For example, half of American Airlines' new hires come from pilots "flowing through" from its three wholly-owned regional airlines, essentially giving pilots a guaranteed job at American Airlines down the road when they're hired by one of American's regionals (PSA Airlines, n.d.). While American's program is the most significant, other regional airlines have career path programs that at the very least give regional pilots a guaranteed interview at a major airline; it is fair to say the infrastructure exists to enable regional pilots to advance to the majors. In addition, retired military aviators are historically a significant source of new pilots for major airlines, but that number has slowed in recent years (Svitak, 2012).

Approximately 78% of potential airline pilots make a cost-benefit analysis when considering a career as an airline pilot (Higgins et al., 2013). This involves weighing economic costs of the career (expensive training, initially low pay) with the potential economic benefits (considerably higher pay later on in one's career). As a result, there is strong incentive for regional airline pilots to accept job offers at major airlines, and with the demand side of the pilot shortage driven by accelerating retirements of pilots at major airlines when they turn 65, it may be assumed that the majority of the pilot shortage will be at regional airlines, but it's unclear just how big it will be.

Method

Because of this unknown, and the fact this research focuses primarily on the short-term effects of the pilot shortage and not on its causes, three scenarios will be run. The first scenario will be the unlikely event where 100% of the pilot deficit (~8,000 industrywide by 2023) consists of regional pilots ("scenario 1"). The second scenario is one where 75% of the deficit consists of regional pilots ("scenario 2"), and the third scenario is where 66% of the deficit consists of regional pilots ("scenario 3"). These splits were chosen because they represent the belief that a majority of the pilots in the forecasts of Higgins et al. (2013) will be regional pilots.

The author's intent was to expand on the work of Higgins et al. (2013) by (a) predicting regional airline fleet withdrawals ("aircraft parking") based on the scarcity of pilots; and (b) forecasting the loss in passengers the regional airline industry transports as a result of the pilot shortage. The work of Higgins et al. looks at the industry as a whole, and not regional airlines specifically.

Regional Airline Fleet Withdrawals Based on Pilots Scarcity

In the US, certificated airlines that fly aircraft with 60 or more seats are required to report certain operating and traffic statistics to the U.S. Department of Transportation (n.d.), a dataset known as Form 41. Included in this comprehensive data is detailed information about airline fleets and airline workforces. This covers all but three regional airlines (

Table 1), and those three airlines were supplemented with similar data from Airline Pilot Central, a frequently-updated website aimed at pilot recruitment. To increase statistical confidence, data for all the current Form 41-reporting airlines dating back to 2008 was entered, bringing n to 123.

Table 1
Regional Airlines Included in Analysis, Sorted by USDOT Reporting Status

Form 41-Reporting Airlines	Non-Form 41-Reporting Airlines
Air Wisconsin Airlines Corp.	Piedmont Airlines
Compass Airlines	Commutair
Endeavor Air Inc.	Trans States
Envoy Air	
ExpressJet Airlines Inc.	
Horizon Air	
Mesa Airlines Inc.	
Republic Airline	
SkyWest Airlines Inc.	
PSA Airlines	
GoJet	

An analysis of regression was computed, and found that airline pilot staffing, X , can significantly predict an airline's fleet size, \hat{Y} , $F(1, 121) = 1918.53$, $p < .001$, $R^2 = .941$, with the following equation, $\hat{Y} = .104X + 2.821$.

Using Fleet Deficit to Calculate Loss of Passengers

A number of different metrics were considered to illustrate the decline in demand for regional airline service when there's a corresponding drop in supply. Passenger enplanements proved to be the best metric to explore because it shows this decline in the most straightforward fashion, compared to metrics such as available seat miles. To calculate this regression, Form 41 passenger enplanement and fleet data from 2008 to 2017 ($n=110$) was used to calculate another analysis of regression, and showed that fleet size, X , can be used to significantly predict an airline's passenger enplanements, \hat{Y} , $F(1, 108) = 1304.22$, $p < .001$, $R^2 = .924$, with the following equation, $\hat{Y} = 71699.586X + 1357461.434$.

Unlike the fleet calculation, 2018 data was not included in this calculation because the year had not concluded at the time, and thus final 2018 numbers had yet to be reported on Form 41. Non-Form 41 airlines were also not included because this data is unavailable for those airlines.

Limitations of this Method

This analysis does not consider a number of factors that could significantly impact its results. This includes economic downturns (either in the airline industry or the broader U.S. economy), industry consolidation, and future

industry regulatory changes. The results of this study should be interpreted as an extrapolation of a broader airline industry forecast that was conducted in 2016, and an analysis of the effects on the regional airline industry as a result of that extrapolation.

In the event that a study similar to the one that Bjerke et. al. (2016) conducted for the regional airline industry is conducted for major airlines, this methodology should provide a simple framework for higher-confidence results.

Results and Discussion

Results are summarized in Table 2.

Table 2

Fleet and Passenger Enplanements Impacted by Regional Pilot Shortage Scenarios by 2023

Scenario	Cumulative Regional Pilot Deficit	Cumulative Aircraft Parked	Passenger Loss (since 2016)
1	8,000	835	61,226,616
2	6,000	627	46,313,102
3	5,333	557	41,294,131

As expected, the results are highly linear. The larger the deficit of pilots, the more aircraft that the regional airline industry will have to park. Having fewer aircraft to operate due to regional airlines employing fewer pilots to operate them directly corresponds to a loss of passengers. Less demand due to supply-side issues causes revenue issues for major airlines and contractual issues for the regional airlines.

However, these results are part of a broader regional airline industry contraction. Since at least 2009, the U.S. airline industry has been adding capacity while flying fewer planes. This is done by flying larger planes, often ones operated by major airlines as opposed to regional airlines. Meanwhile, as shown in Figure 1, regional airline enplanements have dropped from a high of 164.1 million in 2010 to 153.25 million in 2017 (Regional Airline Association, 2018).

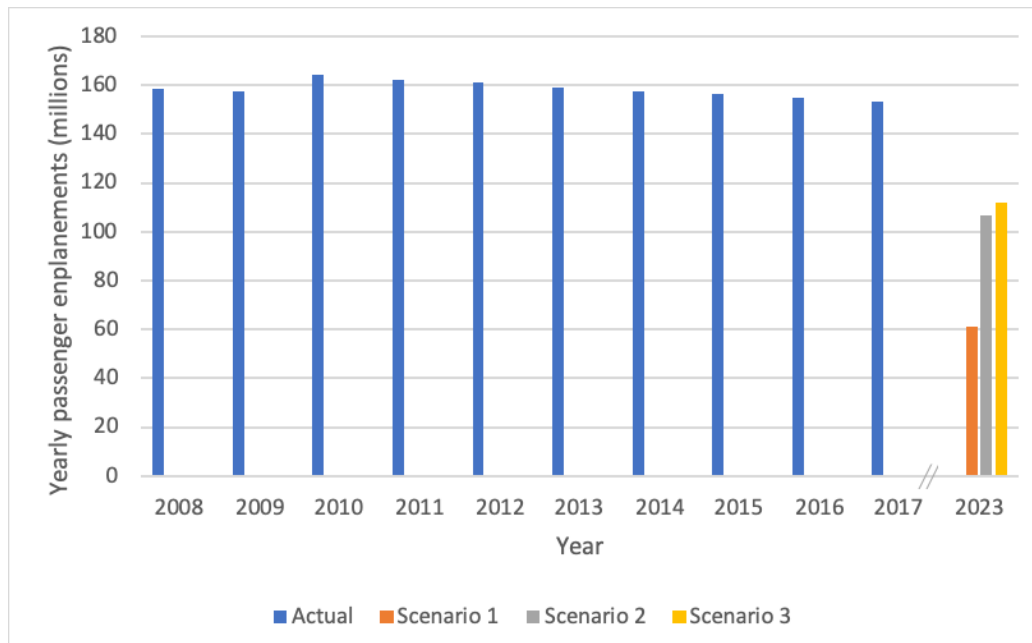


Figure 1. *Regional airline passenger enplanement contraction. 2008-2017 data adapted from Regional Airline Association, October 2018 Industry Update.*

It is important to contextualize these results - and the broader regional pilot shortage - with an understanding of the regional airline business model. Regional airlines earn their revenue from capacity-purchase agreements (CPA) with major airlines. In a CPA, major airlines pay a fixed, contracted rate to regional carriers for the flights that the regional carriers operate on the major airlines' behalf. The major airlines earn 100% of the direct revenue from flights that the regional carriers operate, and the regional carriers are largely shielded from demand and cost risk (Forbes & Lederman, 2006). In other words, a CPA guarantees revenue for a regional airline that enters into one with a major carrier.

When a regional airline lacks pilots to operate flights it is contractually obligated to operate, this becomes a legal issue and can lead to bankruptcy, as was the case with Republic Airways. Republic was stuck in contract negotiations with its pilot union for 8 years. As a result, it was paying pilots well below market rates, and was having severe difficulty recruiting new pilots. Attrition got to the point where Republic did not have enough pilots to operate the flights it was under contract to operate, and it had to park planes. In 2015, Delta sued Republic for breaching its CPA (Associated Press, 2015). At the same time, when Republic and the union reached an agreement (shortly prior to the bankruptcy filing), that required new CPA negotiations with the major airlines, to finance the more expensive collective bargaining agreement (Declaration of Bryan K. Bedford, 2016).

When Republic restructured following its February 2016 Chapter 11 bankruptcy filing, it emerged as a smaller, privately-held company. The airline ultimately exited bankruptcy in April 2017 (Hemmerdinger, 2017).

While Republic's bankruptcy is an extreme example of an airline-specific pilot shortage, accelerated by an impasse with a key labor union during a time of major change in the industry, it is an important pretext to any discussion about pilot shortages throughout the regional airline industry.

If regional airlines do not have the supply of pilots to fly contracted routes, the airlines will have to park planes, as is forecast here. Parking planes directly impacts the number of passengers that are carried, as is also forecast. That affects the major airlines that are business partners with the regional airlines, since the major airlines earn 100% of the revenue from CPA flights, and use regional airline capacity as essential components of their overall networks.

As has been the case for a number of years, and a key factor in Republic's bankruptcy, a shortage of pilots leads to higher costs for airlines, because during times of scarcity, airlines are required to offer more incentives, such as higher pay and signing bonuses, to recruit pilots, which costs more money. These costs are passed on to the major airlines through CPAs, as they are renegotiated.

The broader question, and one to answer in subsequent research is if, driven by the pilot shortage and other supply-side costs, the regional airline business model is becoming outdated. For example, Delta Air Lines has replaced some regional flying with secondhand Boeing 717s that have low operating costs due to their lower acquisition costs (Center for Aviation, 2018). "The 717 is very much about how do we get out of the regional jets," Delta's CEO said in late 2017 (Zhang, 2017, The Rebirth section). Those small narrowbodies were later augmented at Delta by Airbus A220-100s (formerly known as the Bombardier CS100), which were said to be purchased at a steep discount, so the operating costs will also be relatively low. Perhaps one way to help solve the pilot shortage is for major airlines to take over more regional-style flying. With first-year first officer pay at major airlines around double that of what's offered at regional airlines (Airline Pilot Central, n.d.), the cost-benefit analysis that pilots initially make about their careers becomes an easier one in this scenario, and perhaps more pilots would have enough economic incentive to join airlines. While costs could initially be higher, airlines would not have to worry about reliability issues, as happened when Delta sued Republic, and it would likely be easier for airlines to recruit pilots. Airlines such as Delta and JetBlue Airways are also now starting to offer career path/cadet programs that either entirely bypass regional airlines or place participants at a regional airline for a fixed amount of time, removing the uncertainty that is also part of that consumer decision (JetBlue, 2018; Simmons, 2018).

Conclusion

By 2023, it seems likely the regional airline industry will contract, both in the number of aircraft flying and the number of passengers being carried by those aircraft. A pilot shortage would be a major driving factor for this contraction, though other factors will likely contribute to this contraction.

Some airlines, such as Delta, are taking steps to slowly eliminate traditional regional flying. Delta has a growing fleet of small mainline jets, while at the same time is offering a way for pilots to earn jobs at Delta without the uncertain economics that traditionally deter potential candidates from becoming regional pilots.

New pilot pathway programs will be an important topic in the next few years, and one that deserves more research. Are the efforts of airlines such as Delta and JetBlue enough to fix the overall industry pilot shortage, and at what cost? What other strategies are there to get a new generation of pilots excited about the industry, and to mitigate the high costs of becoming a pilot?

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