THE PILOT SHORTAGE: IMPLICATIONS, REPERCUSSIONS, AND TRIED SOLUTIONS

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ABSTRACT

The global pilot shortage in the aviation industry is a growing concern, affecting airlines worldwide as they struggle to meet the demand for qualified pilots. This article delves into the causes and implications of the shortage, highlighting its impact on airline operations, travel costs, and safety. It provides a comprehensive overview, including a historical background, current situation analysis, and an exploration of potential future consequences. Case studies are presented to showcase strategies employed by airlines and organizations to combat the problem, such as training local individuals, expanding flight capacities, partnering with flight schools, implementing autonomous aircraft plans, and introducing innovative training programs. The intended audience comprises aviation industry professionals, policymakers, educators, and stakeholders like airline executives, regulators, training organizations, schools, government officials, and researchers. The article aims to deliver valuable insights and influence decision-makers and stakeholders to take proactive measures in addressing the pilot shortage.

KEYWORDS

Pilot Shortage; Aviation industry; Aging Workforce; Airline Safety; Autonomous eVTOL; Regional Airlines

1. INTRODUCTION

The pilot shortage has become a growing concern within the aviation industry as airlines struggle to meet the demand for qualified pilots. This issue is not limited to a particular region or country but is a global phenomenon. Factors contributing to the shortage include an aging workforce, increased competition for pilots from emerging markets, and changes in pilot training and certification requirements. The implications of the pilot shortage are significant and will affect airline operations, air travel costs, and ultimately, the safety of air travel. Failure to address the shortage will result in reduced flight schedules, higher ticket prices, and potential safety hazards.

The article highlights the global pilot shortage in the aviation industry, explores its causes and implications, and emphasizes how it affects airline operations, travel costs, and safety. It presents a historical background, discusses the current situation, and examines the potential future consequences of the pilot shortage. Case studies are provided to illustrate various strategies adopted by airlines and organizations to tackle the problem, including training local individuals, expanding flight capacities, partnering with flight schools, implementing plans for autonomous aircraft, and introducing innovative training programs.

Targeted at aviation professionals, policymakers, educators, and stakeholders such as airline executives, regulators, and academic leaders, this article seeks to provide insightful information and encourage those in decision-making positions to take proactive steps towards mitigating the pilot shortage.

2. HISTORY AND CAUSES OF THE PILOT SHORTAGE

Carey et al. (2012) reported that U.S. airlines are facing an imminent pilot shortage, which is considered the most severe scarcity of skilled aviators since the 1960s. The previous significant shortage of pilots during the 1960s was attributed to the fact that a large portion of the trainable population was engaged in the Vietnam War, leaving a limited pool of individuals available for pilot training.

In November 2012, leaders from major airlines such as United, JetBlue, and American, along with the Embry-Riddle Aeronautical University, came together to address the impending shortage of qualified pilots. According to reports, including one from Boeing, there will be a global need for approximately 460,000 pilots and over 600,000 aircraft maintenance technicians in the next two decades. Experts in the U.S. industry warn that the expected rise in pilot retirements and upcoming stricter pilot qualification standards could have a significant impact on domestic airlines (Hanns, 2012).

Further exacerbating the situation, Lutte's 2014 study highlighted alarming retirement projections showing that more than 45,000 pilots are expected to retire from major airlines over the next 20 years. At the time of the study, there were only about 18,000 regional pilots, underscoring a dire need for substantial new pilot recruitment to avoid a critical shortage. The data points to a pressing need for strategic initiatives to bolster pilot numbers in order to maintain industry stability.

3. CURRENT STATE OF THE SHORTAGE

The pilot shortage in the U.S. airline industry had been a growing concern for several years, significantly worsened by the COVID-19 pandemic. The shortage, which is estimated at around 8,000 pilots, has resulted in the loss of air service to communities across the country with 76% of U.S. airports experiencing a reduction or complete loss of air service since October 2019 (Hardee, 2022).

The pandemic has had a significant impact on the rate of newly qualified pilots entering the industry. According to Axelrod et al. (2022), the year 2021 saw only 4,300 pilots graduate, a stark decrease from previous years. Simultaneously, the pandemic induced many seasoned pilots to accept buyout offers, further depleting the pool of experienced aviators.

Looking forward, recent studies, such as the analysis conducted on the United States airline pilot labour supply, predict an impending shortage of approximately 35,000 pilots over the next two decades, driven by retirements, attrition, and increasing demands from new aircraft growth and regulatory changes. This significant forecasted deficit highlights the urgent need for innovative recruitment and retention strategies that can efficiently address the shortfall. Lutte (2014) emphasizes the influence of training costs, the availability of qualified candidates, and the impact of regulatory requirements on the pilot supply, suggesting that addressing these factors could mitigate the looming shortage and ensure operational continuity for the airline industry.

To address the pilot shortage, airlines are taking proactive measures. They are actively increasing their hiring efforts and exploring long-term solutions for the pilot pipeline. One approach mentioned by Axelrod et al. (2022) is the establishment of in-house flight schools to train new pilots. This enables airlines to develop a dedicated pool of talent to meet their future needs. Furthermore, programs are being implemented to assist existing staff members in transitioning to pilot careers, allowing them to contribute to filling the shortage.

Segal (2023) states that in 2023 the pilot shortage became more severe as airlines incentivized pilots to retire early during the decline in air travel in 2020. Throughout this decade, there will be an average of approximately 18,100 job openings annually for airline and commercial pilots, with a significant portion of these positions being replacements for retirees.

Wolfsteller (2021) demonstrated that in 2021 airlines that were previously struggling financially due to the pandemic suddenly found themselves facing a surge in passenger traffic. This unexpected growth led to a shortage of experienced pilots, as many senior captains had retired during the pandemic.

The industry had previously anticipated a pilot shortage due to factors such as retirements, weak pilot pipelines, and high training costs. Airlines had implemented training schemes and offered incentives to attract recruits, but the pandemic disrupted these efforts. As air travel bounced back, airlines had to adopt new strategies, including recalling pilots and promoting first officers to captain positions. However, the recovery remains uneven, with regions like North America and Asia-Pacific projected to face the largest shortages. The high cost of pilot training continues to be a barrier, and efforts are being made to find solutions, such as sponsorships and funding options.

Baldwin (2023) indicated that the nation is currently facing a significant pilot shortage that poses risks to both our economic stability and the welfare of our people. Airline pilots must undergo training that is regulated by the Federal Aviation Administration (FAA), and this training comes with a considerable price tag. The University Aviation Association estimates that the average cost

of pilot training, including a four-year degree, amounts to around $80,000. However, existing federal loan limits do not cover the full expense of pilot training, making it challenging for students who cannot afford to pay upfront or take on expensive private loans.

The detrimental effects of the pilot shortage were underscored during a 2023 subcommittee hearing of the House Transportation and Infrastructure. The decline in air service is widespread across the United States, with 42 states reporting a decrease in airline operations to levels below those seen before the pandemic (Black, 2023). Approximately 136 airports have experienced significant reductions in service, and 11 airports that serve as connections between smaller cities and major hubs have had to completely suspend flights.

Regional airlines have been hit particularly hard. More than 500 of their aircraft are currently grounded, a direct result of the acute shortage of pilots. This has led to a substantial 40% reduction in their flight operations, severely impacting their service and operational capacity (Turing, 2023). The ongoing pilot shortage continues to strain the aviation industry, necessitating urgent and effective solutions to stabilize and enhance air connectivity.

Amidst a backdrop of rapid airline industry growth, the escalating cost of pilot training emerges as a pivotal challenge compounding the global pilot shortage. The research by Valenta (2018) highlights a significant rise in training expenses, nearly doubling over a decade, thus posing substantial barriers to entry for prospective pilots. This financial burden, coupled with the stringent requirements imposed by regulatory bodies, necessitates a re-evaluation of funding models and sponsorship opportunities in pilot training programs. By addressing these economic hurdles, the aviation industry can enhance accessibility to training, thereby expanding the pool of qualified pilots and mitigating the ongoing shortage.

4. SAFETY RISKS AND PILOT FATIGUE AMIDST SEVERE SHORTAGES

The aviation industry is currently experiencing its most severe pilot shortage, which has resulted in airlines pushing pilots to their maximum limits. On August 15th, 2022, an Ethiopian Airlines Boeing 737-800 operating flight ET-343 from Khartoum, Sudan, to Addis Ababa, Ethiopia, experienced a situation where the pilots fell asleep while the aircraft was at FL370. Instead of descending as required, the aircraft continued at the same altitude and followed the pre-set route for an approach to runway 25L. Despite attempts by air traffic control (ATC) to contact the crew, they were unsuccessful in establishing communication. The incident was confirmed by the airline on August 20th, 2022, and it was announced that both pilots have been suspended pending further investigation (Hradecky, 2022).

This occurrence is not an isolated event. Another incident involved pilots from ITA Airways who also fell asleep for approximately 10 minutes during a flight from New York to Rome. Their failure to respond to radio calls triggered a terror alert (Ganesh, 2022). The incidents highlight the grave consequences of the pilot shortage. Airlines are grappling with the challenge of meeting the escalating demand for qualified pilots, leading to overworked and exhausted flight crews. Falling asleep at the controls poses serious risks to the safety of passengers and the aircraft. It underscores the urgent need for the aviation industry to address the pilot shortage comprehensively and implement measures to prevent such incidents from occurring in the future.

5. 1,500-HOUR RULE AND THE IMPACT ON AIRLINE SAFETY

The pilot shortage in the aviation industry has been further aggravated by the implementation of the 1,500-Hour Rule. This regulation has significantly raised the bar for aspiring pilots, as they are now required to accumulate a substantially higher number of flight hours before they can obtain a license. Consequently, the pool of qualified pilots has dwindled, intensifying the shortage and posing significant challenges for airlines in meeting the growing demand for pilots.

A proposal to change the 1,500-hour rule in the U.S., which mandates that airline pilots must fly for 1,500 hours before obtaining a license, has been put forward by the transportation committee of the Senate (Silk, 2017). The current 1,500-hour rule was enacted after Colgan Air Flight 3407 crashed in February 2009. This incident resulted in the loss of 49 individuals who were on board. The National Transportation Safety Board (NTSB) determined that the crash occurred because the plane's two pilots did not appropriately react to the cockpit alerts indicating an imminent stall of the aircraft (Spangler & Park, 2010). Following the tragic incident, the entry-level requirements for U.S. airline pilots were reviewed, and, as a result, the FAA raised the minimum flight training hours for commercial pilots from 250 to 1,500 hours (FAA, 2010).

However, when considering it from a policy perspective, the justification behind the law is weak. Firstly, it is worth noting that both the captain and the first officer on the Colgan flight had significantly more than the mandated 1,500 hours of flight experience. Additionally, studies such as the Pilot Source studies, conducted by universities before and after the new requirements were introduced, have revealed that trainees with fewer than 1,500 logged flight hours demonstrated better performance in regional airline pilot training compared to those with more than 1,500 hours. This suggests that the correlation between flight hours and training proficiency may not be as straightforward as presumed (Silk, 2017). There is no other country with a comparable mandate for pilot training (Wolfsteller, 2022).

A study by Wang et al. (2023) explored the relationship between pilot s' age, flight exposure, and their performance in terms of exceedance rates. The findings indicated that pilots' flight exposure and exceedance rates increased from ages 21 to 40 before stabilizing. Age had a positive impact on exceedance rates for pilots over 40, while flight exposure mediated the relationship between age and exceedance rates for young pilots aged 21-35. The study emphasizes the need to consider age and flight exposure throughout pilots' careers to manage exceedance risks effectively, incorporating psychological competence and fluid intelligence factors in pilot training and matching processes. Evaluating the risk associated with age and flight exposure throughout pilots' professional lifecycle can help address shortcomings and improve professionalism and safety in the aviation industry.

6. POTENTIAL IMPACT ON THE FUTURE OF THE AVIATION INDUSTRY

A shortage of pilots in the regional airline industry is likely to lead to fewer aircraft being operated, causing major airlines losses of passengers and revenue, and contractual issues for regional airlines (Klapper & Ruff-Stahl, 2019). These results are part of a larger reduction in the regional airline industry, where larger planes are being used by major airlines rather than regional airlines, leading to a decrease in regional airline passenger enplanements.

The bankruptcy of Republic Airways serves as an illustration of how an airline can experience a pilot shortage that is particular to the industry, which resulted from a deadlock with a critical

labour union during a significant period of transformation in the sector. When regional airlines lack adequate pilots to operate their contracted routes, they may be forced to ground their planes, leading to a reduction in the number of passengers who they can transport (Klapper & Ruff-Stahl, 2019).

7. CASE STUDIES

The purpose of the case studies in this article is to provide real-world examples and illustrate various approaches that are being taken to address the global pilot shortage within the aviation industry. These case studies highlight different strategies employed by organizations, airlines, and flight schools to tackle the shortage of qualified pilots. By examining these examples, readers can gain insights into the diverse initiatives being undertaken to mitigate the effects of the pilot shortage and ensure a sustainable workforce for the future. These case studies shed light on the proactive measures taken by industry players, the use of innovative technologies, collaborations with flight schools, and other creative solutions aimed at addressing the ongoing pilot shortage issue.

An empirical study on C-130J pilot upgrade training underscores the importance of stringent, uniformly applied training standards across geographical locations to enhance pilot proficiency and safety outcomes. By applying a rigorous Six Sigma methodology, Slottje et al. (2022) identify substantial variances in training quality that affect pilot performance. These findings emphasize the necessity of implementing standardized training procedures that ensure all pilots, regardless of their training base, achieve the same high levels of skill and operational competence. Integrating such methodologies could significantly bolster the effectiveness of strategies aimed at alleviating the global pilot shortage by optimizing training outcomes and ensuring consistent safety standards.

In addressing the persistent pilot shortage, an exploratory study of pilot training and recruitment practices across Europe reveals critical deficiencies in current training programs, where a significant number of Commercial Pilot's License applicants fail to meet airline assessment standards. Adanov et al. (2020) identify primary shortcomings in preparation, technical knowledge, and soft skills such as communication and teamwork. The study proposes enhanced regulatory oversight and the adoption of the Airline Pilot Standard Multi Crew-Cooperation system to elevate training quality. Implementing these recommendations could significantly improve the success rate of pilot candidates, thereby helping to mitigate the pilot shortage and ensuring that new pilots are better prepared to meet the demanding requirements of commercial aviation.

In light of the evolving dynamics within the aviation industry, effective human resource management plays a pivotal role in addressing the pilot shortage crisis (Mızrak, 2023). Strategies such as targeted recruitment, specialized training programs, and enhanced employee engagement initiatives are critical. These measures not only aim to attract and develop skilled pilots but also focus on retaining them by improving job satisfaction and operational efficacy. By implementing robust HR strategies that prioritize continuous learning and career development, airlines can mitigate the impact of the pilot shortage on their operations. This integration of strategic HR management not only supports the stabilization of workforce levels but also ensures the maintenance of safety and service quality in the face of growing industry demands.

As the aviation industry grapples with a severe pilot shortage, innovative partnerships between higher education institutions and airlines have emerged as a pivotal strategy (Lutte & Mills, 2019).

These partnerships, often framed as cadet programs, provide a structured pathway for aspiring pilots, integrating academic education with hands-on training and guaranteed career progression. This collaborative approach not only ensures a steady supply of well-trained pilots but also enhances the appeal of a piloting career by lowering barriers to entry and aligning educational outcomes with industry needs. Such programs are instrumental in sustaining the aviation industry's growth and operational capacity by directly addressing both the quantity and quality of the pilot pipeline.

7.1 Yuut Yaqungviat LLC - Local Pilot Training in Bethel, Alaska

Yuut Yaqungviat LLC, based in Bethel, Alaska, addresses the pilot shortage by training local residents to meet airline standards and promoting regional employment (Stapleton, 2005). Directed by William Johnson, former owner of Yute Air Alaska, the school significantly supports the local economy by employing pilots trained in Alaska's unique flight conditions, saving air taxi operators around $50,000 annually per pilot.

The initiative began through a collaboration between the local tribal college and regional air taxi operators to combat pilot turnover to major airlines. By employing local residents, the school fosters a deep connection between pilots and their community, enhancing job retention.

With substantial financial aid from organizations like the Association of Village Council Presidents, the school makes pilot training accessible, with programs costing around $30,000. Current facilities include four aircraft and plans for expansion to accommodate larger aircraft and an A&P apprenticeship program.

Yuut Yaqungviat's approach not only mitigates the pilot shortage but also strengthens the local economy by training and employing residents, making it a model of community-focused vocational education.

7.2 American Airlines' Strategic Response to Pilot Shortage

During the COVID-19 pandemic, American Airlines faced a significant pilot shortage when 1,000 out of its 15,000 pilots accepted early retirement packages (ch-aviation, 2022). This shortage was exacerbated by a subsequent surge in air travel, prompting the airline to recruit pilots from regional carriers. However, this solution strained these carriers, as they struggled to train new pilots quickly enough to meet demand. The situation is poised to worsen, with over 700 pilots expected to retire annually from American Airlines between 2023 and 2026.

As a result, approximately 100 regional jets, about one-sixth of those operated under the American Eagle brand by subsidiaries such as Envoy Air, Piedmont Airlines, and PSA Airlines, as well as independent providers like Mesa Airlines, Republic Airways, and SkyWest Airlines, are currently grounded. This shortfall in available pilots has led American Airlines to adapt by upgauging - replacing smaller regional flights with larger mainline aircraft. This strategy, while necessary, has led to reduced frequencies to some of the airline's less-traveled destinations.

The ongoing pilot shortage highlights a critical challenge facing not only American Airlines but also other major carriers. For instance, Republic Airways and SkyWest have expressed difficulties in meeting operational demands due to pilot deficits, with United Airlines suspending 15 regional routes due to similar issues. These adaptations underline the broader impacts of the pilot shortage on service provision and operational strategies within the aviation industry.

7.3 Delta Air Lines Collaborating With Flight Schools

Delta Air Lines is actively addressing an imminent pilot shortage, exacerbated by the COVID-19 pandemic, which accelerated retirements and reduced the pilot workforce (AirGuide Business, 2021). This situation was further strained by an aging pilot demographic and fewer military-to-civilian pilot transitions, traditionally a key recruitment avenue.

Recognizing the severity of the impending shortage, highlighted by a Boeing report predicting a demand for over 637,000 pilots in the next 20 years, Delta's CEO Ed Bastian has taken proactive steps. The airline has partnered with flight schools to ensure a continuous influx of qualified pilots, addressing both immediate needs and future demands. This initiative is part of Delta's broader strategy to mitigate workforce challenges, discussed by Bastian at the U.S. Travel Association's conference, and includes tackling barriers such as the high cost of pilot training.

Delta's approach demonstrates a strategic response to the pilot shortage, emphasizing the need for airlines to engage with educational institutions to maintain a sustainable pilot supply amidst ongoing industry challenges.

7.4 Wisk Aero Plans to Go Autonomous

Wisk Aero, backed by Boeing, is pushing forward with a fully autonomous air taxi model, diverging from competitors who plan to start with piloted crafts (AirGuide Business, 2022). Wisk's design philosophy focuses on building air taxis specifically for autonomy, which they believe leads to better performance and safety than retrofitting later. Jonathan Lovegren, leading Wisk's autonomy efforts, argues that designing for autonomy from the start simplifies the integration of safety systems, contrasting with the industry trend of starting with piloted EVTOLs (Electric Vertical Takeoff and Landing aircraft) due to regulatory and public trust barriers.

Wisk's new design features a four-seat air taxi with tilting rotors, intended to operate without a pilot. Equipped with sensors to autonomously detect and avoid obstacles, these air taxis will be monitored by ground control, with human supervisors able to intervene in emergencies.

Though Wisk's entry to market might lag behind peers like Joby Aviation and Archer Aviation, targeting a launch by 2024, Wisk focuses on a long-term vision for urban mobility without exacerbating pilot shortages. Leveraging advanced autopilot technologies, Wisk is enhancing systems to handle all piloting operations, including emergencies. This ambitious approach positions Wisk to potentially redefine urban air mobility by pioneering standards in autonomous aviation technology.

7.5 Uber Vacating the Pilot's Seat

Partnering with Bell and other industry leaders, Uber plans to launch urban air taxi operations in Dallas and Los Angeles by 2023, with initial tests starting in 2020 (Benson, 2018). The company envisions a high-frequency operation, aiming for 400 to 1,000 takeoffs and landings per hour at each vertiport.

To accommodate this rapid throughput, Uber's vertiports will feature innovative designs with multiple landing pads and conveyor systems to move and recharge air taxis quickly. These facilities will require significant electrical power and substantial infrastructure development, underscoring the scale of Uber's vision.

However, the project's success hinges on several factors, including regulatory approvals and public acceptance. The design and operation of Uber's air taxis begin with human pilots, but the plan includes a transition to semi-autonomous and then fully autonomous control. This progression aims to enhance operational efficiency by increasing seat capacity and reducing pilot dependency, which is crucial given the ongoing pilot shortage.

Autonomy in air taxis is part of Uber's broader strategy to increase productivity and manage operational costs effectively. By eliminating the need for a pilot, each air taxi can carry more passengers, potentially increasing revenue per flight. Uber is advocating for eVTOL aircraft to be certified under lighter regulations similar to those for light sport aircraft, arguing that the simpler design and reduced pilot workload justify less stringent certification.

Uber's approach reflects a proactive adaptation to the challenges of modern urban transport, leveraging advanced technology to redefine mobility. The transition towards autonomous air taxis represents a significant step in this direction, promising to reshape how cities handle congestion and mobility.

7.6 Mesa Air Group Introduces New Pilot Training Programs

Mesa Air Group Inc., a regional airline flying for major carriers like United Airlines and American Airlines, has launched an innovative training program to address the critical pilot shortage (Sider, 2022). The airline has purchased 29 small two-seat planes, with an option to buy up to 75 more, to provide aspiring pilots with a cost-effective way to accumulate the necessary flying hours for airline certification.

The program is a response to the fierce competition for pilots and the difficulties regional carriers face in maintaining adequate staffing levels. To attract more candidates, Mesa is offering interest-free loans to pilots to fly these planes, allowing them to build up their required 1,500 flying hours more rapidly. This strategy is particularly crucial as many pilots struggle to accumulate hours through traditional methods such as flight instructing or charter flights, which can be both time-consuming and expensive.

Jonathan Ornstein, CEO of Mesa, believes this program will significantly impact the industry by providing a quicker pathway for pilots to enter the workforce. Mesa's pilots can fly up to 40 hours a week at a rate of $25 per hour—far below typical rental costs. This accelerated pace means pilots could potentially complete their hour accumulation in less than a year, a significant reduction from the usual timeframe.

Mesa also offers pilots who join the program benefits like building seniority and "priority status" for future employment with the airline once they meet the qualifications. This not only helps pilots financially but also integrates them into Mesa's operations early on, fostering loyalty and reducing turnover.

This program is set to start in Florida and expand to Arizona, aiming to support over 1,000 pilots annually. Despite not resolving the broader debates around the 1,500-hour rule, Mesa's initiative presents a proactive approach to easing pilot shortages by making flight time more accessible and affordable.

8. CONCLUSION

The global pilot shortage is an ongoing concern in the aviation industry due to factors such as an aging workforce, increased competition, and changes in training and certification requirements. The shortage has led to the loss of air service, reduced flight schedules, higher ticket prices, and potential safety hazards. The industry must take action to increase the number of qualified pilots and ensure a sustainable workforce.

Various strategies are being implemented to address the pilot shortage such as in-house flight schools, covering the cost of pilot training, and attracting more young people to the cockpit. The implications of the pilot shortage issue are significant for the aviation industry and society. The shortage could lead to reductions in flights, which could affect businesses and individuals who depend on air travel.

The article emphasizes the need to address the pilot shortage promptly by raising awareness about the issue, identifying its causes and implications, and showcasing various strategies and initiatives being undertaken by industry stakeholders. By understanding the scope and complexity of the problem, stakeholders can work together to develop comprehensive solutions that ensure a sustainable workforce and the continued growth and safety of the aviation industry.

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