

Global Pilot Shortages: Regional Risks and the Impact on Airline Costs

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AVM6517 – Airline Operations and Management

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August 30, 2026

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The author reports no conflicts of interest.

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Abstract

The global airline industry faces increasing pressure on the availability of qualified pilots as passenger growth, fleet expansion, retirements, training constraints, and competition for experienced aviators converge. North America, Europe/Eurasia, China, Southeast Asia, South Asia, and the Middle East are particularly vulnerable, although the causes and severity of shortages differ among regions. In the United States, pilot shortages have already contributed to substantial compensation increases, recruitment incentives, expanded airline training partnerships, and operational difficulties among regional carriers. European airlines are expected to experience increasing competition for experienced captains and qualified pilots during the next decade, while rapidly expanding Asian and Middle Eastern markets will require substantial growth in training capacity. The continuing pilot shortage within the U.S. military further complicates civilian supply because military and commercial operators increasingly compete for the same highly experienced aviators. Pilot shortages ultimately increase airline labor, recruitment, training, and operating costs while potentially reducing frequencies, constraining fleet utilization, and increasing passenger fares. Addressing the problem will require coordinated expansion of training capacity, improved career pathways and retention strategies, reduced financial barriers to professional flight training, and preservation of rigorous safety and qualification standards.

Keywords: Pilot shortage, airline costs, workforce development

Global Pilot Shortages: Regional Risks and the Impact on Airline Costs**Figure 1.**

Global pilot shortage risk, projected commercial pilot demand, supply pipeline constraints, military competition for qualified aviators, airline cost impacts, and the ten-year outlook for the United States and United Kingdom/Europe.

The global airline industry is entering a decade in which pilot availability is likely to become one of its most important workforce constraints, although the severity will differ considerably by region. The greatest exposure is likely to occur in North America, China and the broader Asia-Pacific region, Eurasia/Europe, and rapidly expanding markets in South and Southeast Asia and the Middle East. Boeing's 2026 Pilot and Technician Outlook projects a worldwide requirement for approximately 674,000 new commercial pilots between 2026 and 2045, including about 153,000 in Eurasia, 123,000 in China, 122,000 in North America, 67,000 in the Middle East, 66,000 in Southeast Asia, and 48,000 in South Asia (Boeing, 2026). These figures represent replacement as well as growth demand, so they should not be interpreted as a forecast shortage of 674,000 pilots. Nevertheless, they demonstrate the extraordinary scale of recruitment and training that will be required. Academic research has reached similar conclusions regarding the structural causes of pilot-supply pressure. Lutte and Lovelace (2016) found that training costs, qualification requirements, starting compensation, retirement patterns, and the time required to accumulate flight experience can restrict the collegiate pilot pipeline. The problem therefore involves more than simply finding people who want to fly; the industry must produce sufficient numbers of qualified and experienced pilots at approximately the same rate that airlines expand and existing pilots retire.

The United States provides an especially useful example because its shortage has already produced measurable operational and financial consequences. Major airlines can generally offer higher salaries, better benefits, larger aircraft, and more attractive career progression than regional airlines, allowing them to recruit experienced regional pilots and effectively move the shortage downstream. Government research found that post-pandemic hiring by larger airlines depleted regional-airline pilot ranks and particularly affected the supply of captains. Some regional carriers responded with extraordinary compensation increases: Mesa Airlines raised first-year first-officer wages to \$100 per flight hour and first-year captain wages to \$150, while SkyWest increased first-year first-officer pay from \$46 to \$90 per flight hour and substantially increased captain compensation (U.S. Government Accountability Office [GAO], 2026). This demonstrates how a pilot shortage increases airline costs directly. Airlines must raise wages, provide signing and retention bonuses, subsidize training, establish pathway programs or flight academies, and devote additional resources to recruiting. Lutte and Mills (2019) found that competition for pilots has encouraged partnerships between airlines and higher-education institutions, allowing carriers to establish pilot pipelines much earlier in students' professional development. Those programs may strengthen long-term supply, but they also transfer additional recruiting and training expenses onto airlines.

The financial consequences extend beyond pilot salaries. An airline that owns or leases an aircraft but cannot crew it loses productive capacity while continuing to incur financing, insurance, maintenance, airport, and other fixed expenses. A shortage of captains can be particularly damaging because having numerous qualified first officers does not solve the problem when regulations require an appropriately qualified captain in each cockpit. The result can be fewer frequencies, canceled routes, reduced service to smaller communities, slower fleet

expansion, and higher unit costs. These effects can ultimately contribute to higher fares because labor costs are incorporated into the cost of producing each available seat-mile. Research into the U.S. pilot-training system suggests that simply expanding recruitment may not solve the problem quickly. Thomas and O'Toole (2020), for example, found capacity constraints among FAA Part 141 flight schools, with shortages of flight instructors and aircraft limiting training output and 14 of the 33 surveyed schools already operating at or above full capacity. Consequently, airlines can increase compensation almost immediately, but producing an additional ATP-qualified pilot requires years rather than months.

Asia presents a somewhat different challenge because much of its demand will result from expansion rather than predominantly replacement. China alone is projected to require approximately 123,000 new pilots through 2045, while Southeast and South Asia together require another approximately 114,000 (Boeing, 2026). These markets are adding aircraft and air service rapidly, meaning that their training systems must expand simultaneously with their airline networks. Earlier research identified Asia-Pacific as the largest long-term growth market and emphasized that pilot shortages are affected by training expense, retirements, growing passenger demand, and declining military-to-civilian pilot flows (Lutte, 2018). The Middle East faces another variation of the problem. Large international hub carriers can recruit globally by offering attractive compensation and benefits, but this effectively redistributes experienced pilots rather than increasing worldwide supply. Aggressive international recruitment can therefore deepen shortages elsewhere, particularly among smaller airlines that cannot compete financially.

Over approximately the next decade, the U.S. market will probably experience cycles of tightness rather than a perfectly linear shortage. Hiring can temporarily slow because of aircraft-delivery delays, economic conditions, airline restructuring, or temporary imbalances between

newly qualified first officers and experienced captains. The underlying demographic and training pressures nevertheless remain. Academic research has previously projected substantial long-term U.S. shortfalls; research summarized in *The Aeronautical Journal* estimated a potential U.S. shortage of approximately 35,000–40,000 pilots by 2035, with regional carriers carrying much of the burden (Harris, 2023). Over the 2026–2036 period, I therefore expect the U.S. system to move toward substantially higher pilot compensation, more airline-sponsored academies and university partnerships, aggressive cadet and pathway programs, greater use of training technology, and continued pressure to increase training throughput. The strongest carriers will probably obtain the pilots they require, while regional, cargo, charter, business-aviation, and smaller operators experience greater difficulty because they occupy lower positions in the pilot-employment hierarchy.

The United Kingdom and continental Europe should follow a somewhat different path. Europe has a large established professional-pilot population and does not face the same mandatory 1,500-hour airline-entry structure found in the United States, but retirement, traffic growth, expensive ab-initio training, and competition from rapidly expanding Middle Eastern and Asian airlines will place increasing pressure on supply. Boeing currently groups Europe within Eurasia and projects approximately 153,000 new pilots will be required in that region through 2045, the largest regional requirement in its 2026 forecast (Boeing, 2026). Over the next decade, the United Kingdom and European Union are therefore likely to move from localized shortages toward increasingly competitive recruitment, particularly for experienced captains, instructors, and pilots with specific aircraft type ratings. Airlines are likely to expand sponsored cadet programs, partnerships with approved training organizations, and financing arrangements designed to lower the enormous financial barrier confronting prospective pilots. Unlike the

United States, where regional airlines often function as pilot pipelines to major carriers, European competition may increasingly involve pilots moving between low-cost, legacy, charter, and Middle Eastern airlines. Thus, the European shortage may manifest less as an absolute absence of licensed pilots and more as a shortage of pilots possessing the experience, type qualifications, and command credentials airlines require.

An important and sometimes overlooked component of the U.S. problem is the military pilot population. The military historically supplied civilian airlines with highly trained, experienced aviators, but the military now has significant pilot-retention and production problems of its own. The Air Force has repeatedly struggled to achieve its objective of producing approximately 1,500 pilots annually and has redesigned portions of undergraduate pilot training in an effort to reach that level beginning in fiscal year 2026. More significantly, current Air Force budget projections indicate total aircraft-pilot manning declining from approximately 91.9% in FY2025 to 90.1% in FY2026 and 88.5% in FY2027, with particularly serious projected shortages among fighter and bomber pilots. The military and commercial airlines are consequently competing for overlapping human capital. RAND research has demonstrated that civilian airline hiring opportunities influence military aviators' decisions about remaining in service, particularly because experienced military pilots possess qualifications highly valued by commercial airlines (Mattock et al., 2016). If the military responds with larger retention bonuses, longer commitments, improved quality-of-life incentives, or other measures that successfully retain aviators, fewer experienced military pilots may enter the civilian labor pool. Conversely, aggressive airline hiring can worsen military retention. Either outcome demonstrates that the military and civilian pilot shortages cannot be viewed as completely separate labor-market problems.

Ultimately, the pilot shortage is likely to increase airline costs while simultaneously changing how airlines develop their workforce. The greatest risk does not necessarily belong to airlines that need the largest absolute number of pilots, but to carriers that cannot compete successfully for a limited supply of experienced aviators. Large U.S., European, Middle Eastern, and Asian carriers can respond with higher compensation and sophisticated training pipelines; smaller regional and developing-market carriers have fewer options. The industry therefore faces a cascading labor-market effect in which major airlines recruit from regional airlines, regional airlines recruit instructors and newly qualified pilots, and flight schools subsequently struggle to retain instructors needed to train the next generation. This relationship explains why increasing salaries alone cannot permanently resolve the problem. A sustainable solution requires simultaneously expanding training capacity, reducing unreasonable financial barriers to professional flight education, improving retention, developing civilian and military training pipelines, and maintaining rigorous qualification and safety standards. Given continued traffic growth and Boeing's projection that the industry must produce hundreds of thousands of new pilots during the next two decades, pilot availability will remain an important strategic airline-management issue well into the 2030s.

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