

A wide-angle photograph of an airport runway at sunset. The sun is low on the horizon, creating a golden glow and long shadows. The runway is marked with yellow lines and lights, leading towards the horizon. The sky is filled with colorful clouds in shades of blue, orange, and yellow. In the distance, a city skyline is visible.

**PILOT AND TECHNICIAN
OUTLOOK** 2020–2039

The 2020 Boeing Pilot and Technician Outlook projects that 763,000 new civil aviation pilots, 739,000 new maintenance technicians and 903,000 new cabin crew members will be needed to fly and maintain the global fleet over the next 20 years. The forecast is inclusive of the commercial aviation, business aviation and civil helicopter industries and assumes air traffic recovers to 2019 levels within the next few years.



Meeting the projected long-term demand will require a collective effort across the global aviation industry. As tens of thousands of pilots, technicians and cabin crew members reach retirement age over the next decade, educational outreach and career pathway programs will be essential to inspiring and recruiting the next generation.

While the current industry downturn, driven by COVID-19, has resulted in a temporary oversupply of qualified personnel, the long-term need remains robust. In recent decades, aviation has experienced external forces that have affected demand, such as 9/11, SARS and the Great Financial Crisis. Recovery has generally followed several years later, as the fundamentals driving passenger and air traffic demand remain strong.

Prior to the downturn, the commercial aviation industry was poised to experience a shortfall of qualified pilots and technicians. Analysis of new licenses and certificates issued over the past few years had indicated that the number of new personnel entering the industry was lagging demand. The short-term oversupply allows operators

the opportunity to build their pipeline in anticipation of growth returning in the next few years.

Some personnel who are currently furloughed because of the market downturn will find employment in the government and business and general aviation sectors that have previously struggled with shortages amid surging commercial demand. Additionally, as commercial traffic demand returns in upcoming years, aspiring aviators will have the opportunity to fill open positions created by a combination of personnel retirements and fleet growth.

Amid challenges posed by COVID-19, the training industry has begun to adopt increasingly innovative solutions. Many providers have transitioned their offerings to online and virtual formats where possible, allowing students to continue their learning safely. Immersive technologies, adaptive learning and flexible distance learning methods are also being explored to enable optimum learning and knowledge retention. Investments in technology that are being made today will likely lead to a long-term fundamental shift in how training is conducted.

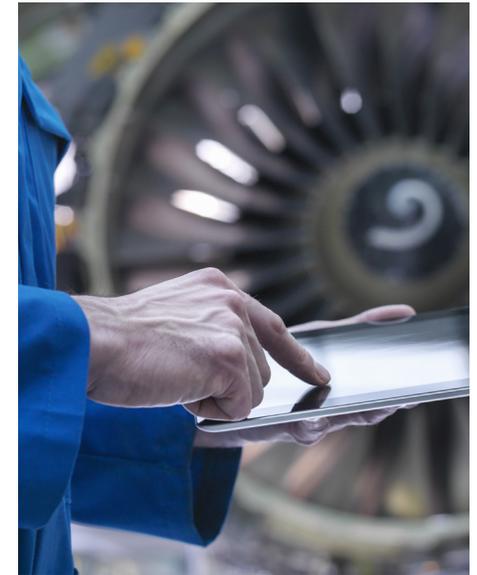
Competency-based training and assessment programs are gaining traction, which enables a shift from prescriptive, task-based training to a more holistic approach. Advances in adaptive learning capabilities, artificial intelligence and learner analytics will further personalize training to the individual student so that greater emphasis can be placed on closing knowledge gaps.

As the industry navigates the market downturn, effective training and an adequate supply of personnel remain critical to maintaining the health, safety and prosperity of the aviation ecosystem.

Forecast Methodology

New personnel demand is calculated based on a 20-year fleet forecast for commercial aviation aircraft with more than 30 seats, business jets and civil helicopters. Based on fleet growth, aircraft utilization, attrition rates and regional differences in crewing specific to aircraft type, Boeing's Pilot and Technician Outlook estimates the number of new pilots, technicians and cabin crew members needed worldwide.

Slight variations to the forecast can occur on a year-over-year basis as a result of many factors, some of which include changes in regulations, crew productivity and aircraft mix. The forecast does not currently include assumptions for single-pilot commercial operations or autonomous airplanes. We continue to track the market for indications of regulatory movement and will update our forecast accordingly.



Air traffic demand and operator flight-hours have declined significantly over the past year, resulting in large numbers of pilot furloughs and layoffs. Given the current oversupply of qualified pilots, labor shortages may seem a distant memory. However, as the industry positions itself for recovery, adequate qualified pilot supply remains an important consideration as a large contingent of the workforce approaches mandatory retirement age. Positions left vacant because of retirements will need to be filled, which is likely to coincide with industry recovery, fleet growth and efforts by other operators to recruit new pilots for similar purposes.

Prior to the downturn, many airlines had begun utilizing cadet programs to recruit, develop and train aspiring pilots. It generally takes two or more years for an aspiring pilot to achieve a commercial pilot license. Aspiring aviators who begin their training today will be well positioned to take advantage of new job opportunities as the industry recovers.

As many aspects of training transition to digital formats, new opportunities to

use data analytics, artificial intelligence and machine learning have emerged, which provides a more personalized and adaptive learning experience. Instruction is evolving to train pilots to proficiencies and competencies rather than a prescriptive, task-based syllabus. Continuous improvement in training technologies and methodologies will ensure pilots are effectively trained to address the most common operational risks, both now and in the future.



This photo was taken before Boeing implemented COVID-19 pandemic safeguards.

The market downturn has spurred large-scale parking of the global fleet, creating new challenges for the industry. Despite a large number of aircraft in storage, technicians continue to play a vital role in ensuring the aircraft remain airworthy. Improper or incomplete maintenance could lead to corrosion, damaged wires and other issues that lead to more extensive and expensive repairs. The need for continued maintenance of the parked fleet has mitigated the impact on technician employment worldwide.

In the near term, operators are deferring noncritical maintenance to conserve cash, which has led to a decline in maintenance, repair and overhaul (MRO) demand. This has resulted in a temporary decrease in technician demand; however, MRO demand is expected to recover as airlines bring parked aircraft back into service and regular maintenance checks resume. Talent pipeline challenges that the industry has been facing for years remain a concern as large numbers of experienced technicians approach retirement age.

While efforts continue to be made to modernize the aviation technician training curriculum and improve training outcomes, organizations have faced various challenges. The short-term impact of local jurisdictions limiting in-person instruction has served as a catalyst, driving additional investment in modernization and nontraditional instruction platforms such as virtual training. The long-term outlook for these alternative platforms is quite positive as some of the regulatory exemptions issued because of COVID-19 evolve to become industry standards.



This photo was taken before Boeing implemented COVID-19 pandemic safeguards.

While cabin crew members are most visible in their customer service role, their primary purpose is to ensure the safety of passengers. This responsibility has been further emphasized during the past year, as cabin crews have taken extra precautions to strengthen traveler confidence.

In the near term, passengers will experience a modified level of service as cabin crews focus on maintaining hygiene, safety and sanitation throughout the aircraft cabin. Training continues to focus on ensuring cabin crew members have the skills to recognize and mitigate safety risks. Advances in scenario-based training and distance learning technologies support continuous learning and prepare cabin crews for situations that may occur in the cabin.

Over the forecast period, regulatory requirements, attrition replacement and business-model differentiation will continue to drive cabin crew demand across the industry.



This photo was taken before Boeing implemented COVID-19 pandemic safeguards.

PILOT AND TECHNICIAN OUTLOOK BY REGION

PILOT AND TECHNICIAN
OUTLOOK 2020–2039

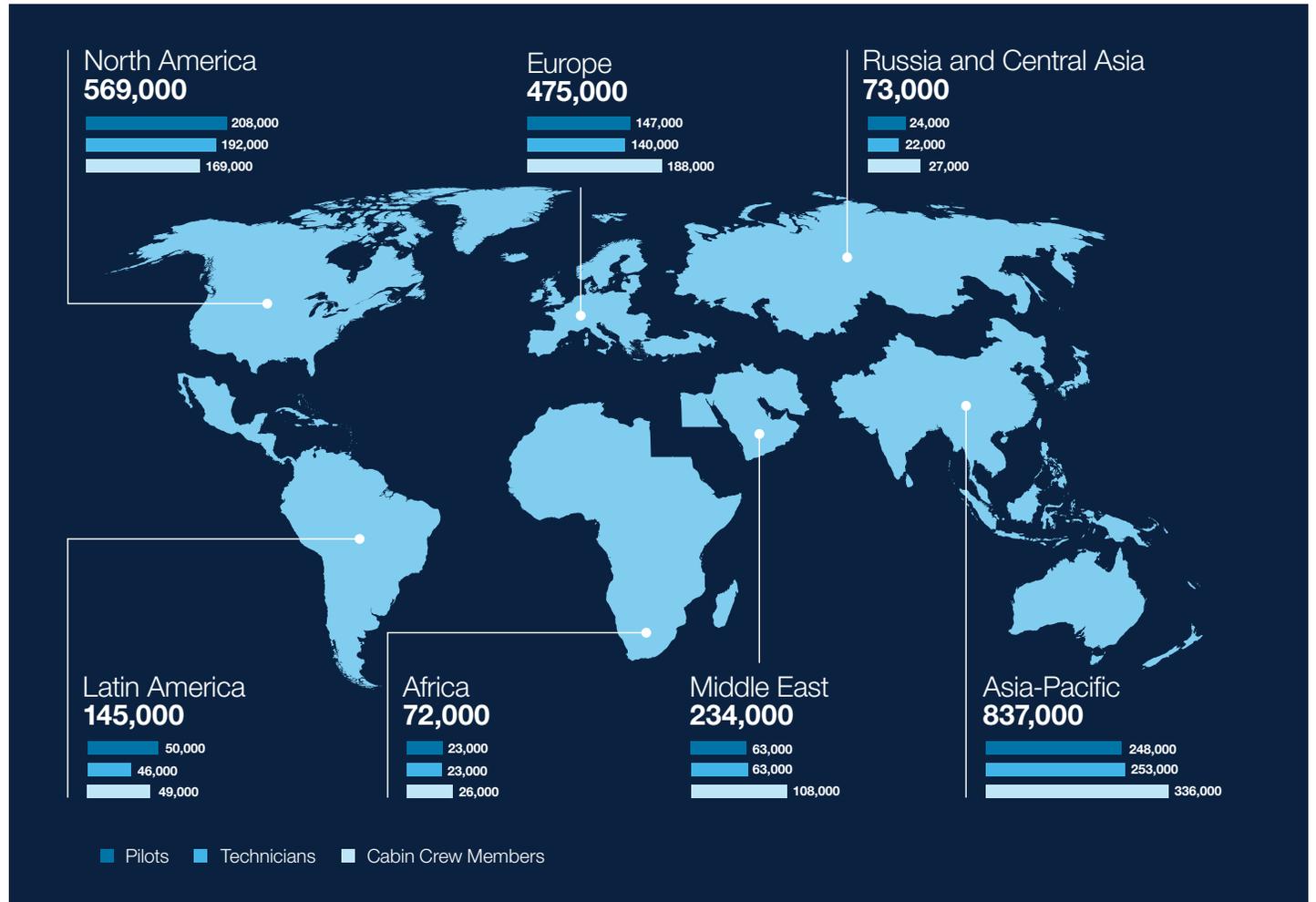
New Personnel Demand



Commercial Aviation
2,086,000
New Personnel



Business Aviation
and Civil Helicopter
319,000
New Personnel



Region	Asia-Pacific	North America	Europe	Middle East	Latin America	Russia and Central Asia	Africa	World
GROWTH MEASURES								
Economic growth (GDP)	3.6%	1.9%	1.2%	2.3%	2.2%	1.5%	2.6%	2.5%
NEW COMMERCIAL PERSONNEL DEMAND								
Pilots	226,000	129,000	115,000	58,000	36,000	22,000	19,000	605,000
Technicians	237,000	123,000	113,000	59,000	34,000	21,000	20,000	607,000
Cabin crew members	333,000	156,000	181,000	106,000	47,000	26,000	25,000	874,000
Total	796,000	408,000	409,000	223,000	117,000	69,000	64,000	2,086,000
NEW BUSINESS AVIATION AND CIVIL HELICOPTER PERSONNEL DEMAND								
Pilots	22,000	79,000	32,000	5,000	14,000	2,000	4,000	158,000
Technicians	16,000	69,000	27,000	4,000	12,000	1,000	3,000	132,000
Cabin crew members	3,000	13,000	7,000	2,000	2,000	1,000	1,000	29,000
Total	41,000	161,000	66,000	11,000	28,000	4,000	8,000	319,000
TOTAL NEW PERSONNEL DEMAND								
Pilots	248,000	208,000	147,000	63,000	50,000	24,000	23,000	763,000
Technicians	253,000	192,000	140,000	63,000	46,000	22,000	23,000	739,000
Cabin crew members	336,000	169,000	188,000	108,000	49,000	27,000	26,000	903,000
Total	837,000	569,000	475,000	234,000	145,000	73,000	72,000	2,405,000

2020–2039 values, rounded



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