



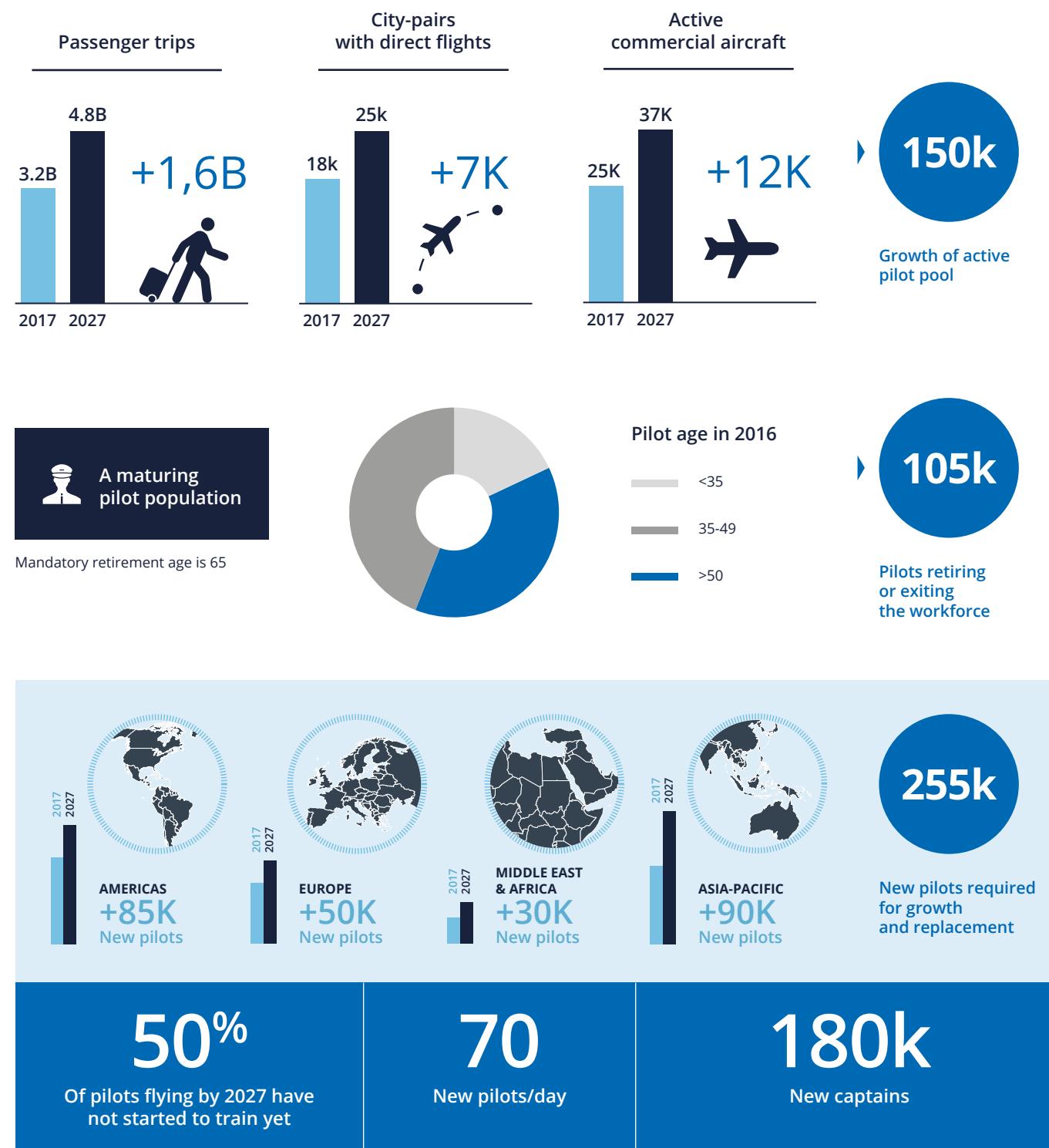
Airline Pilot Demand Outlook

10-year view

Your worldwide
training partner
of choice



Airline Pilot Demand, 10-year outlook at a glance



Dear aviation colleagues,

As you may know, the projected increase in passenger air traffic is expected to double the size of the commercial aviation industry over the next 20 years. This growth has significant implications for the professional pilot pipeline worldwide.

As the industry's training partner of choice, we work with over 300 airlines and train more than 120,000 pilots annually at every phase of their career. These relationships give us a privileged vantage point of both the market and industry needs.

On behalf of CAE, I am proud to share these insights with the broader industry for the first time through our Airline Pilot Demand Outlook. This 10-year view builds on a detailed forecast and addresses airline pilot needs globally.

Our analysis identifies a global requirement for 255,000 new airline pilots over the next 10 years to sustain and grow the commercial air transport industry. Rapid fleet expansion and high pilot retirement rates create a further need to develop 180,000 first officers into new airline captains, more than in any previous decade.

These numbers mean that over 50% of the pilots who will fly the world's commercial aircraft in 10 years have not yet started to train. This record demand will challenge current pilot recruitment channels and development programs. In turn, new and innovative pilot career pathways and training systems will be required to meet the industry's crewing needs and ever-evolving safety standards.

At CAE, we look forward to shaping the future of pilot training with you. Together let's ensure that our industry has the qualified pilots it requires to continue leading the way in safety and security — cost effectively and efficiently.

Nick Leontidis
CAE Group President
Civil Aviation Training Solutions



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Part I

Current airline pilot landscape

The CAE Airline Pilot Demand Outlook doesn't consider major disruptions to key drivers, such as regulatory changes in retirement age or global health pandemics. Our analysis is based on the steady evolution of the environment surrounding these drivers, including new aircraft designs.

Where today's airline pilots come from

In 2016, approximately 20,000 pilots entered the airline profession around the world from three main sources.

Airline-focused flight training academies

Some 6,500 pilots hired in 2016 were trained at professional academies that work directly with airlines to identify and meet their recruitment needs. These academies focus on creating professional pilots and, in general, over 90% of their graduates become airline pilots.

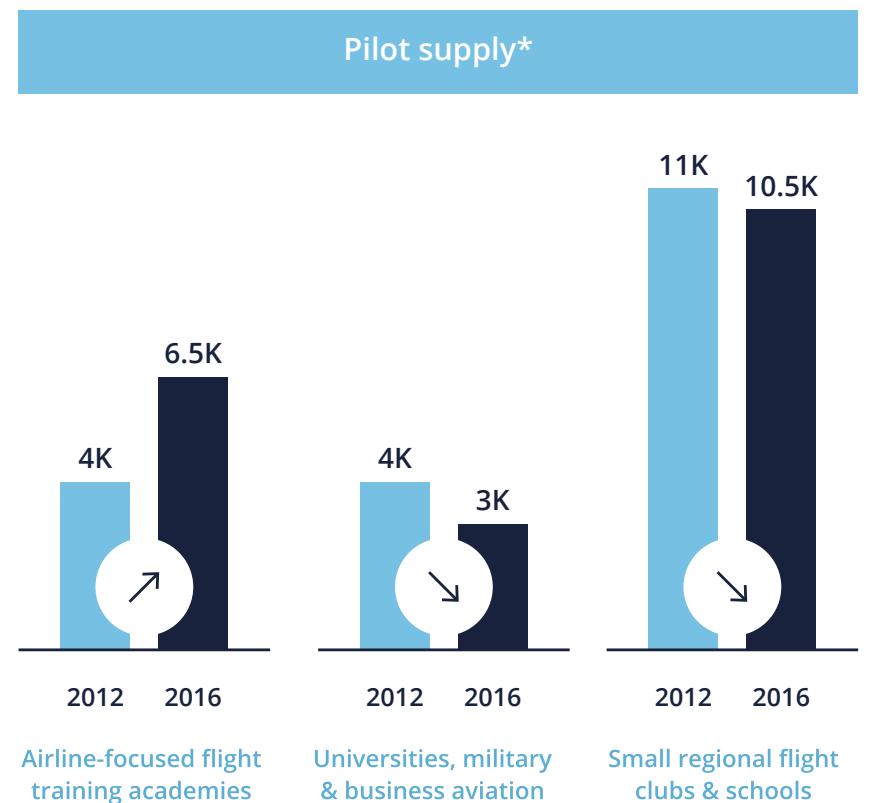
Universities, military & business aviation

Approximately 3,000 pilots came from military, business jet or university backgrounds. Some universities offer undergraduate programs in combination with commercial pilot training. However, a small portion of these individuals pursues a career as airline pilots.

Small regional flight clubs & schools

Some 10,500 pilots came from smaller independent training organizations generally located at smaller airports and serving both recreational and commercial pilots. Less than 70% of these trainees become airline pilots.

Airline-focused flight training academies produce an increasing proportion of the pilots flying in today's commercial airlines. These professional academies provide an environment with set schedules, access to pilots, mentoring, mandatory uniforms and an airline mindset. When enrolled in programs built to airline-specific operating procedures, cadets train to a professional standard from day one.



* Based on CAE analysis

Airlines are more actively involved in ensuring cadets are trained to their professional standard from day one.

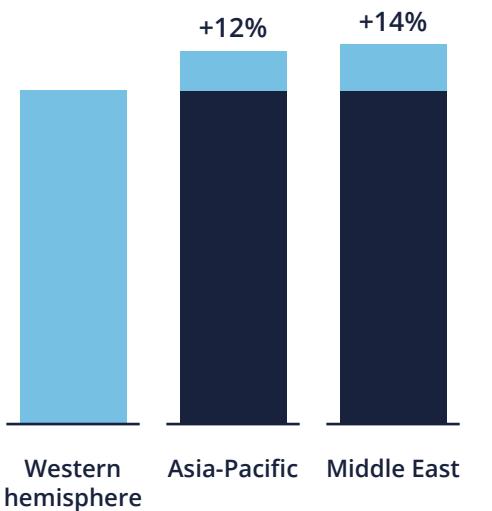
Today, almost 10% of airline pilots in Asia-Pacific are expatriates.

Airlines in regions of rapid growth face limited access to experienced pilots in their markets. To address this challenge, they focus on accelerating the development of junior first officers, a lengthy process, and on hiring experienced first officers and captains from more mature markets.

Almost 10% of airline pilots today in Asia Pacific are expatriates. In some instances, airlines in the Middle East source over half of their pilots from outside their region.

Compensation is a key tool used by airlines to attract experienced pilots. Middle Eastern and Asia-Pacific carriers offer, on average, a 10% to 15% salary premium to their pilots compared to carriers in the western hemisphere. Airlines in China sometimes offer salary premiums in excess of 70%. Combined with advantages such as tax relief, many fast growing markets continue to attract experienced pilots.

2016 average narrow-body pilot salary*



* Based on CAE analysis



Pilot training progression

The continuous evolution of pilot training regulations has contributed to the air transport industry's safety record. Over the past few decades, the industry has consistently improved pilot training to further enhance safety.

Former regulatory requirements emphasized highly structured and rigid training programs to ensure global compliance and standardization.

AQP/ATQP

The FAA introduced the Advanced Qualification Program (AQP) as an alternate means for complying with existing rigid regulated training. The European equivalent, the Alternative Training and Qualification Program (ATQP), was introduced later under EASA.

AQP and ATQP allowed the industry to leverage line-flying experience to inform and improve training.

Airlines were now able to modify their training programs to address their unique operational requirements.

Today, over 80% of airline pilots in the US are training under an AQP.

However, over the past two decades, regulated training has increasingly leveraged the use of data and competencies to improve training outcomes.

Complemented with structure for line data

Integrated pilot competencies framework

Combined competencies and training data

Extended addressability of data and competency-driven systems

Added data beyond flight envelope

Incorporated line flying observations

FOQA

Supported by ICAO, Flight Operations Quality Assurance (FOQA), also known as Flight Data Monitoring (FDM), brought in a structured approach to collecting line flying data.

Recurrent AQP/ATQP programs benefited from FOQA by leveraging line-data analysis to improve training outcomes.

The majority of airlines training under AQP programs today have FOQA and data analysis capabilities.

ICAO pilot competencies

The International Civil Aviation Organization (ICAO) developed a framework of eight competencies covering the knowledge, skills and attitude required to fly in a commercial environment.

This elevated the importance of leadership, communication, situational awareness and decision making by providing a framework to develop and assess pilots.

MPL

The advent of the Multi-Crew Pilot Licence (MPL) is a key milestone that marked the industry coming together to improve the pilot creation process.

MPL leveraged ICAO's competency framework and introduced an objective development process for cadets.

MPL further leverages the increased use of simulation based training by having cadets spend over half of their practical training in a commercial aircraft cockpit as opposed to a small private aircraft.

These ab-initio programs provide an effective way to train high-quality pilots in a line-flying environment. The first MPL graduates are now successful captains.

EBT

Evidence-Based Training (EBT), a joint effort between ICAO, IATA and IFALPA (International Federation of Air Line Pilots' Associations), incorporates operational data (flight data analysis, flight observations and air safety reports) into pilot training and assessment to improve air safety.

This helps develop and assess the overall capability for training across the range of competencies.

EBT provides a baseline, ready-made training program that allows smaller operators to adopt data-driven, competency-based training.

UPRT

Upset Prevention and Recovery Training (UPRT) uses competencies and data from inside and outside the regular flight envelope.

It addresses the number one cause of accidents leading to fatalities by focusing on the competencies related to situational awareness and manual flying.

UPRT training is now required by EASA and will be required by the FAA for all FAR 121 operators by 2019, alongside full stall and adverse conditions training (bounced landing, icing and crosswinds on takeoff).

Regulated training increasingly leverages the use of data and competencies to improve training outcomes.

Part II

Drivers of airline pilot demand

Pilot demand is driven by the overall demand for commercial flights, how these flights are crewed and the need to replace pilots exiting the workforce.

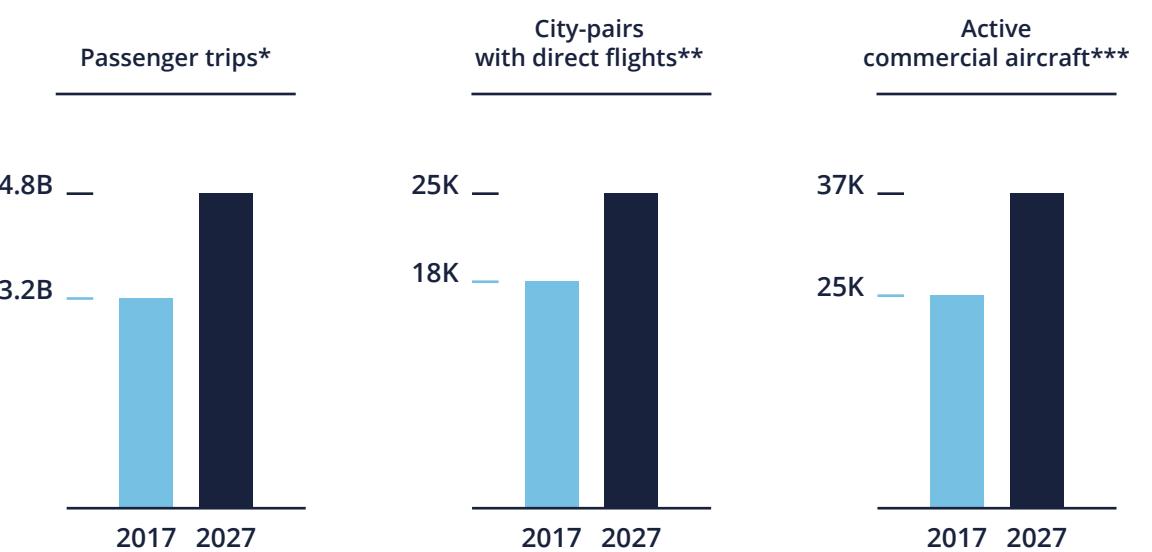
Fleet growth

2016 saw ongoing growth in global air passenger traffic and a corresponding increase in the number of commercial aircraft operated by airlines.

Over the next 10 years, the International Air Transport Association (IATA) forecasts **4.2% annual passenger growth** and a market of **4.8 billion air passengers** by 2027 – that's **an additional 1.6 billion passengers**. Along with passenger growth, IATA reports that the number of unique city-pairs has roughly doubled in the past 20 years to over 18,000. If this trend continues, the number of city-pairs will exceed 25,000 by 2027, requiring additional aircraft to serve these new routes.

Airlines today are flying commercial aircraft at high load factors and utilization rates to maximize revenues and reduce unit operating costs. To meet the expected rise in passenger numbers and city-pairs, the world's airlines have placed record orders for new generation commercial aircraft and the largest commercial aircraft manufacturers are operating at high production rates.

By 2027, we expect the global commercial fleet to grow by 12,000 aircraft to roughly 37,000 aircraft.

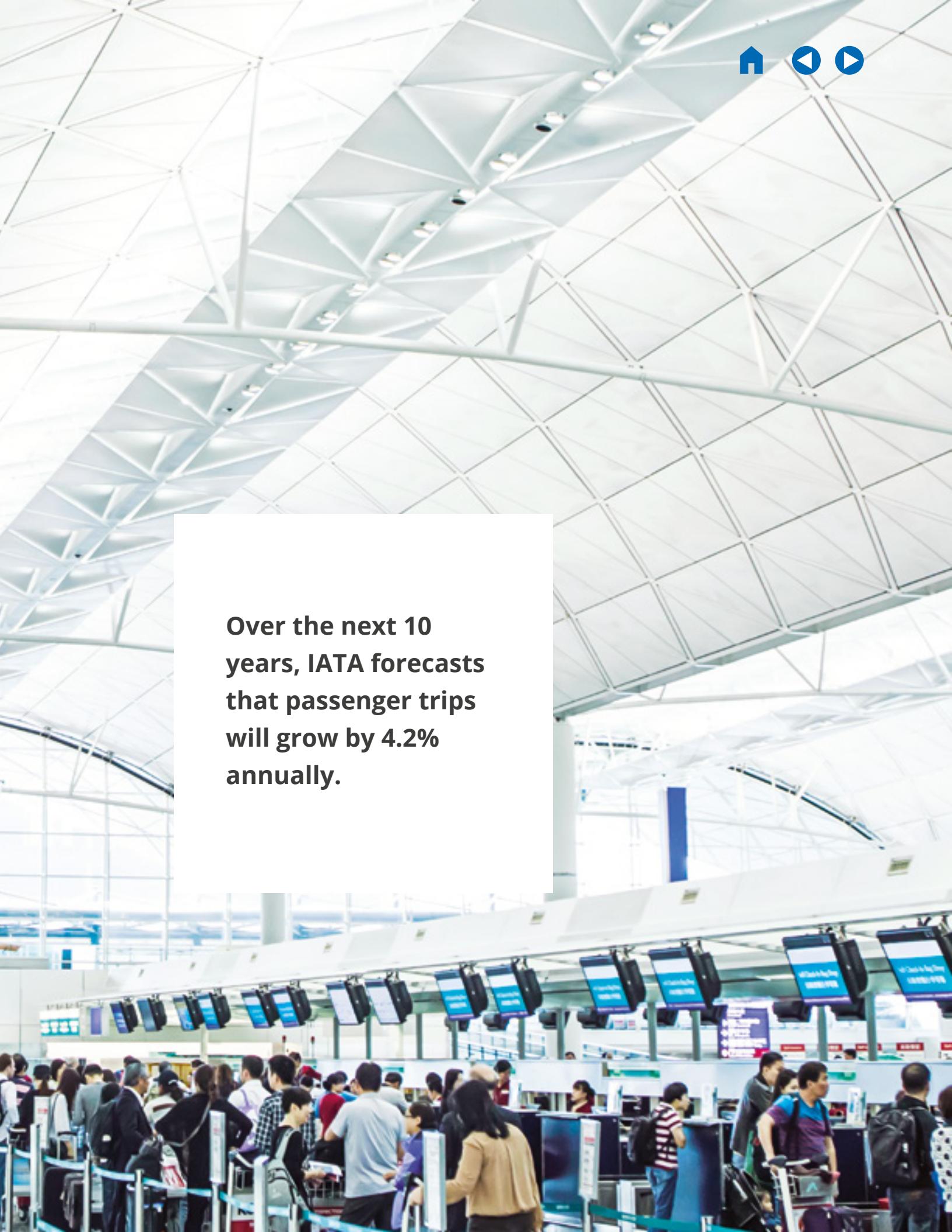


* Based on IATA Air Passenger Forecasts, October 2016

** Based on IATA city-pairs data, 2016

*** Based on a combination of aircraft manufacturer and industry forecasts

Over the next 10 years, IATA forecasts that passenger trips will grow by 4.2% annually.



Pilot/aircraft ratios

The number of pilots required per aircraft is primarily determined by aircraft utilization and related regulations.

All commercial aircraft require at least one licensed captain and a second pilot, who is either a captain or first officer, in the cockpit.

To maximize aircraft utilization, airlines need to adequately crew their aircraft. The majority of today's airlines fly fleets of regional aircraft, narrow-body jets and wide-body jets to serve a variety of short-, medium- and long-range routes with aircraft size and seat capacity optimized to match passenger demand.

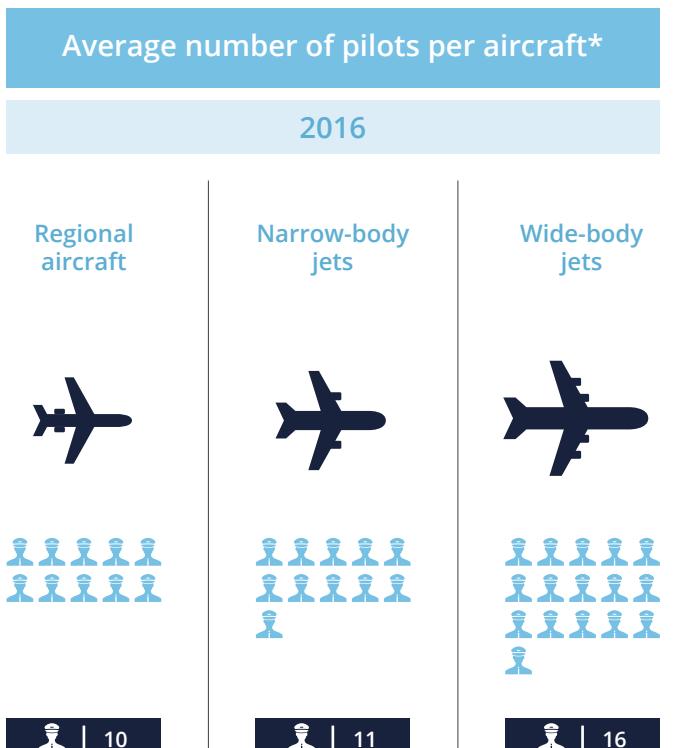
Over the last 10 years, the increase in aircraft utilization resulting from efficiency improvements has driven a slight growth in the average crew ratio and is expected to remain at a similar level over the next decade.

Regional aircraft (typically 19 to 100 seats) are used mainly to link smaller markets to hub-and-spoke networks as well as shorter point-to-point routes. Regional pilots typically fly 30-minute to two-hour routes and rarely operate late at night. A crew will usually fly several sectors a day before reaching its daily flight time, duty time or operational limit.

Narrow-body jets (typically 100 to 220 seats) are widely used by network carriers and low-cost carriers (LCCs) on short- and medium-haul routes of up to five to six hours, including overnight 'red eye' services.

Today, narrow-body jets represent 55% of the global in-service fleet. This number is expected to grow to over 60% during the next 10 years.

Wide-body jets (typically 220-plus seats) are primarily used for longer range non-stop domestic and intercontinental routes. New generation aircraft are enabling airlines to profitably link more distant mid-sized city-pairs with non-stop services. These more fuel-efficient wide-body aircraft can fly more than 15 hours non-stop and require the addition of relief pilots to meet regulations and reduce crew fatigue.



* Based on CAE analysis



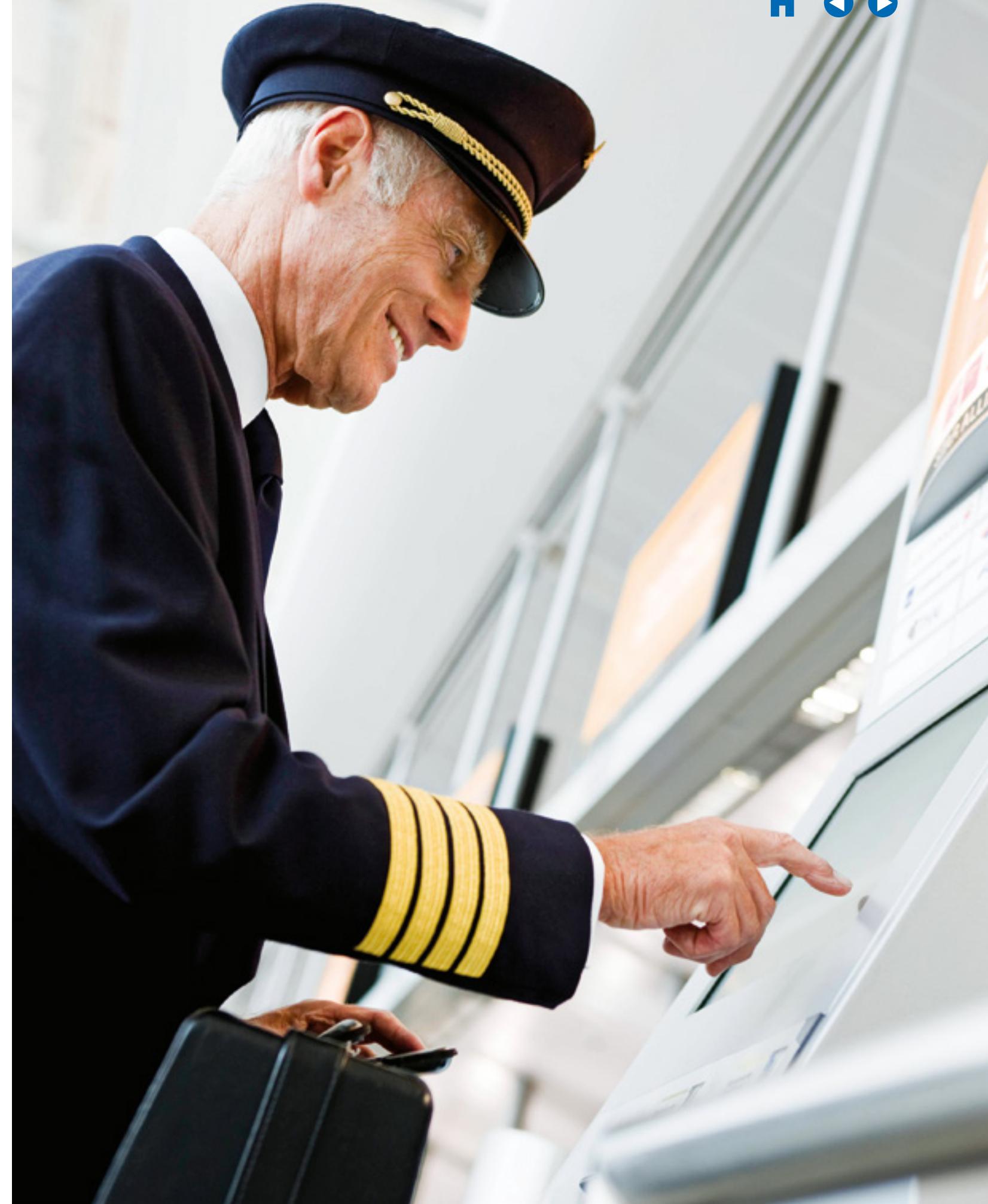
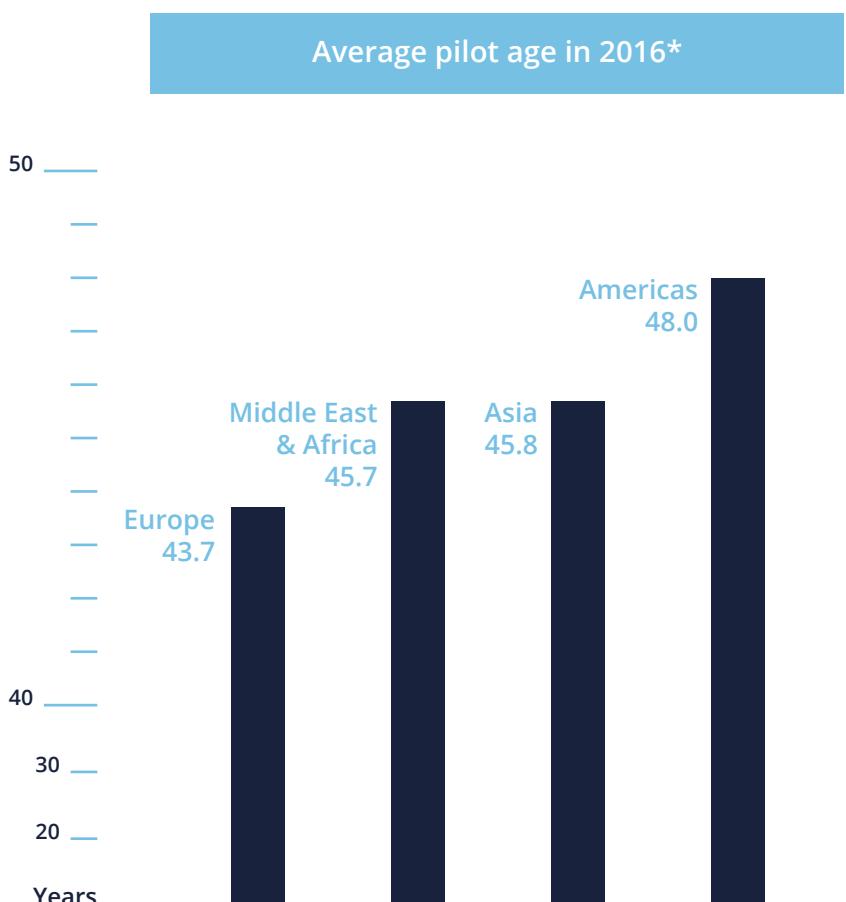
Pilot retirement and attrition

Most national regulators impose a mandatory retirement age of 65 for airline pilots. Other reasons for leaving the workforce include early retirement, the pursuit of a non-flying career, loss of medical fitness, etc.

The Americas have the highest average pilot age. North America's high percentage of senior pilots reflects significant recruitment activity in the 1980s and 1990s as airline deregulation expanded the industry and major hubs were developed. The recent consolidation of network carriers and their focus on efficiency slowed new hiring.

Europe has seen an influx of younger professional pilots over the past 15 years which can be partially attributed to the rapid expansion of LCCs. In addition, many experienced European pilots have moved to the more rapidly growing Middle East and Asia-Pacific regions. This has left Europe with the youngest average pilot group of any region.

As experienced captains retire, a chain reaction of pilot upgrades and new hires is triggered. For example, the departure of an experienced wide-body captain creates the need to upgrade a first officer to fill the vacant seat. This then creates downward pressure on airlines to develop and upgrade more first officers and captains.



Part III

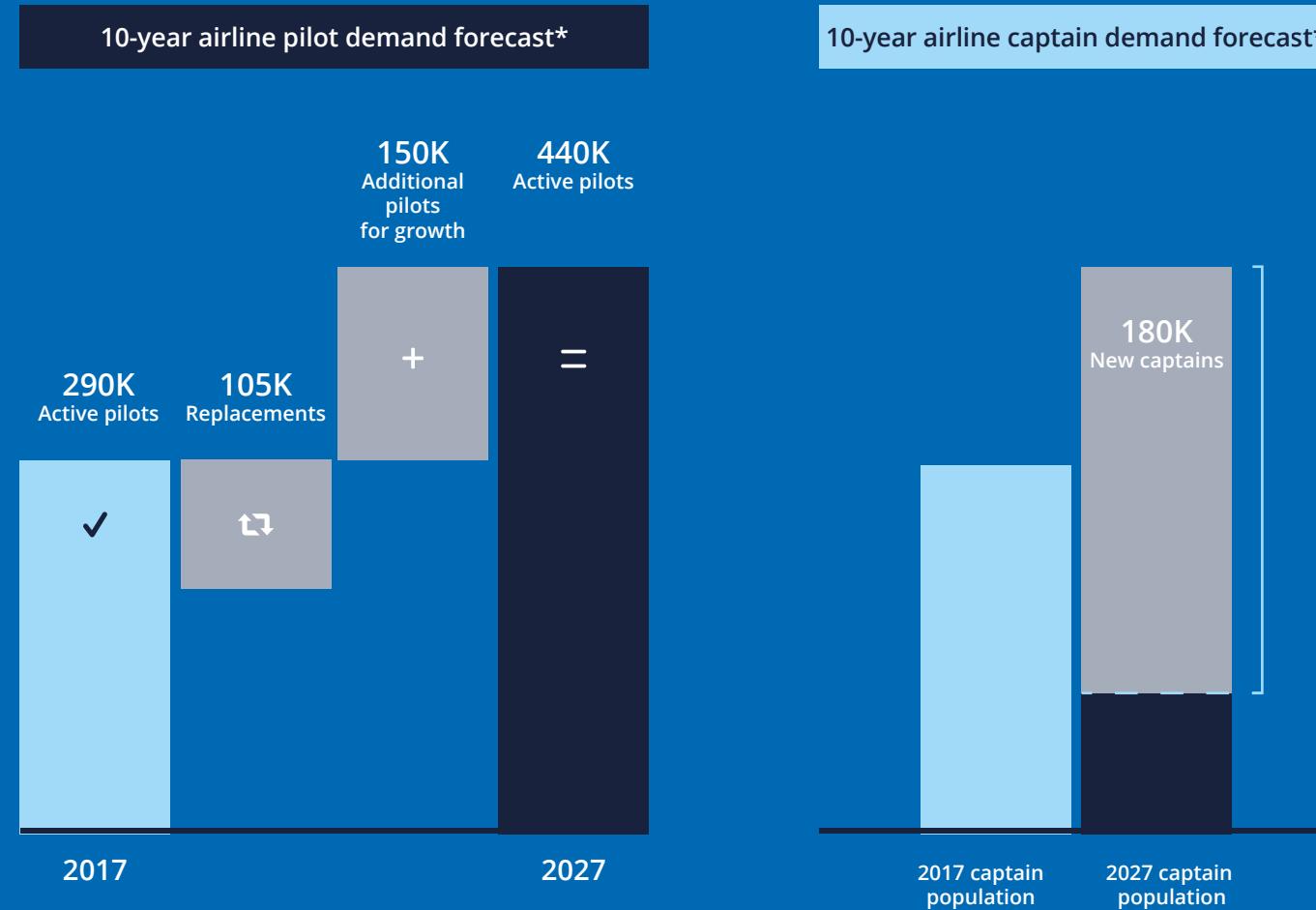
CAE 10-year forecast

CAE's Airline Pilot Demand Forecast is based on a model that considers key drivers, variables and trends to forecast the number of pilots we expect airlines to hire over the next 10 years. The forecast covers four regions - the Americas, Europe, the Middle East and Africa, and Asia-Pacific.

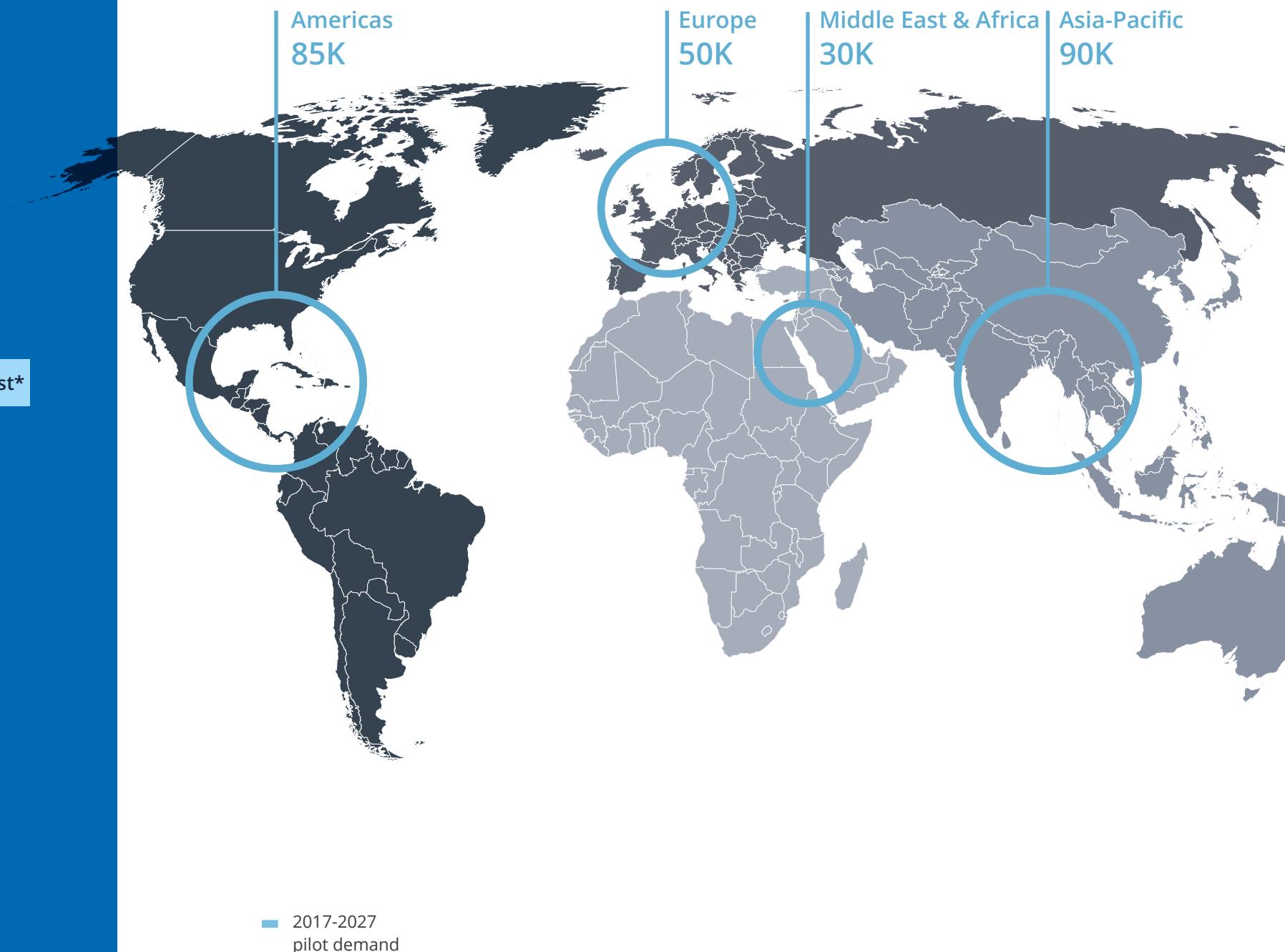
Summary

CAE forecasts that the industry will need 255,000 new airline pilots over the next 10 years, for a total of 440,000 active pilots by 2027 – 60% for fleet growth and 40% to offset retirement and attrition. In addition, 180,000 first officers will need to be promoted to captain, over half of which will be to replace retiring captains.

Asia-Pacific will see the strongest growth in pilot demand as the region's fleet of in-service aircraft is projected to significantly increase in size. The Americas will experience the most pilot retirements. Airlines and their training partners will need to produce an average of 70 new type-rated pilots per day globally to match the record-high aircraft delivery rate and account for pilot attrition.



A look at the four regions



Americas



The Americas region includes the mature economies of Canada and the United States along with emerging economies in the Caribbean and Central and South America.

The United States is the world's largest air travel market thanks to its large population, broad infrastructure, strong economy and highly liberalized airline industry. In 2016, airlines collectively marked their 7th consecutive year of profitability*, driven by industry consolidation, high yields and load factors as well as low fuel prices. These profits help fund capital expenditures for next-generation fuel-efficient aircraft.

In Latin America, pockets of healthy growth will ensure a modest increase in pilot demand.

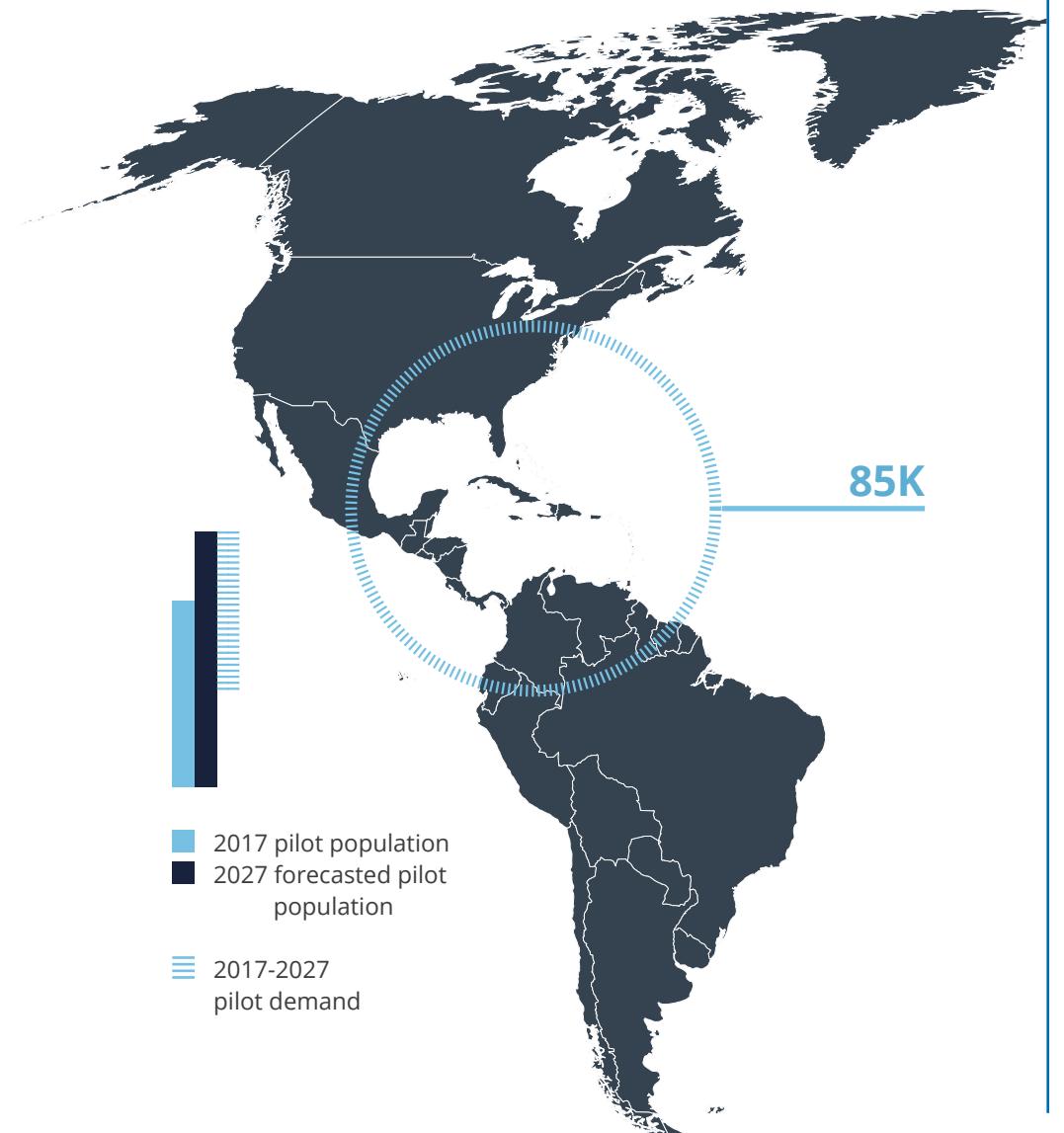
Most major US and Canadian airlines have flow-through agreements with feeder airlines. After accumulating several years of experience flying regional jets and turboprops, most pilots will leave the feeder airlines to fly larger aircraft for the major airlines. This will continue putting tremendous pressure on regional airlines to ensure they have enough pilots to maintain service.

US regional airlines and low-cost carriers have also faced increased pilot supply challenges since August 2013 when the Federal Aviation Administration (FAA) introduced a new regulation requiring up to 1,500 total flight hours to become a professional airline pilot. This increase left many prospective co-pilots short of the required hours.

In addition, some pilots leave to pursue careers in the Middle East and Asia where the demand for experienced pilots is high.

Around 105,000 airline pilots are working in the Americas, over 80% of them employed by US and Canadian airlines.

- 85,000 new airline pilots needed
- 62,000 new captains needed
- Large number of retirements, particularly in North America



jetBlue

Introduced in 2016, jetBlue's Gateway Select program partners with CAE to offer qualifying candidates the opportunity to become jetBlue pilots after successfully completing a rigorous four-year training program that incorporates classroom learning, extensive real-world flying experience and full-flight simulator instruction.

jetBlue received over 1,500 applications for Gateway Select's first 24 positions. The competency-based program is modelled after the US military pilot training program and exposes cadets to a professional environment from day one. By helping reduce the barriers, jetBlue is providing candidates, who would otherwise not be able to explore their passion for flying, with access to a career as a pilot.

* Based on IATA airline industry profitability forecast, 2016

Europe



The European region includes Western Europe, Eastern Europe, Russia and the Commonwealth of Independent States (CIS).

Europe is expecting slower traffic growth given geopolitical uncertainties, such as the departure of the United Kingdom from the European Union, as well as lower economic growth in certain countries.

As the LCC business model continues to expand, several airlines are moving their aircraft and aircrew bases to airports in countries they serve. This is shifting the demand for and creation of pilots to these areas.

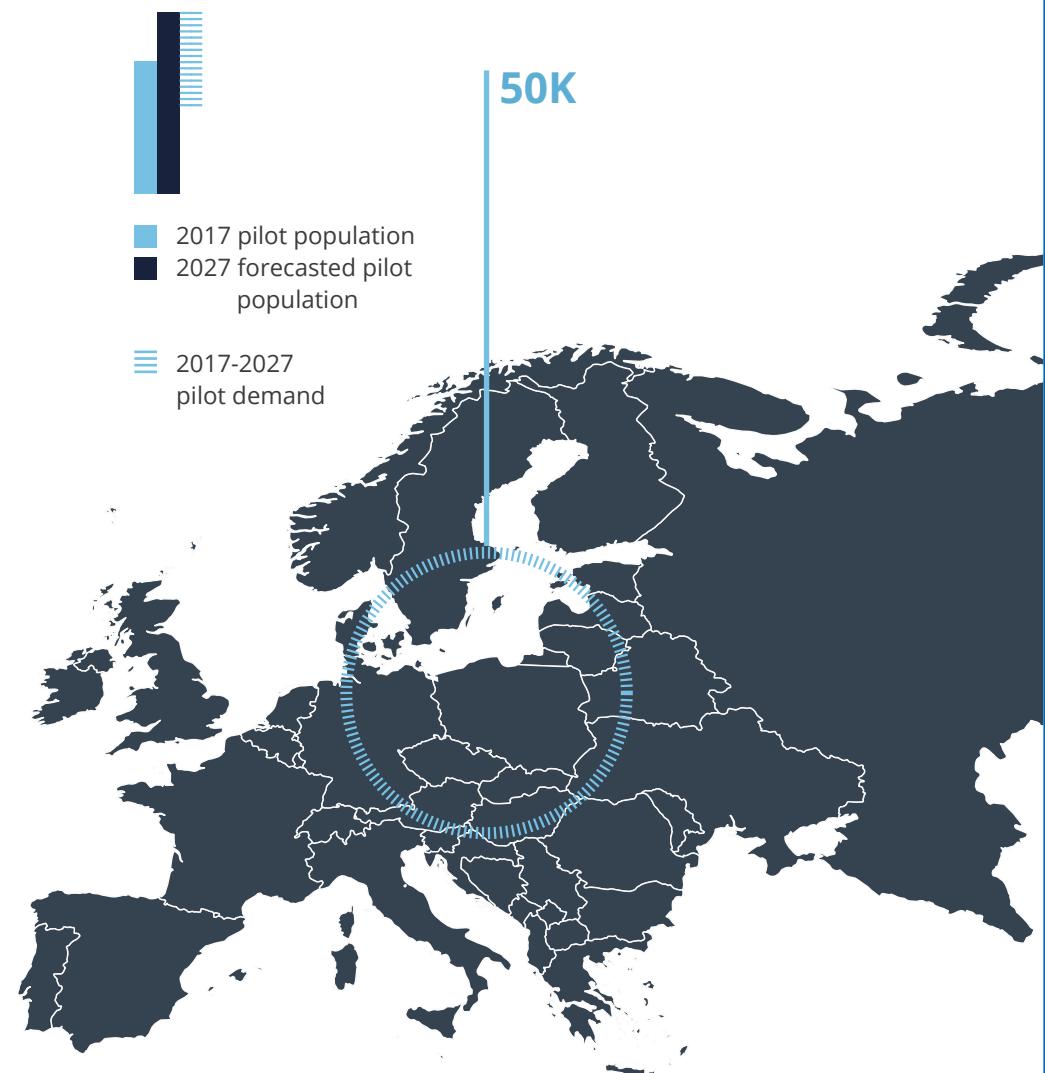
European airlines will renew their fleets with new generation fuel-efficient narrow-body and wide-body aircraft to reduce operating costs and meet Europe's tough environmental standards.

European airlines typically hire new pilots directly from cadet programs, without requiring a stint in the 'regionals' as in the United States. Europe's rapidly growing LCCs support pilot creation programs and have developed partnerships with airline-focused pilot training organizations. LCCs in particular are open to employing cost-effective solutions to recruit the top self-sponsored graduates of professional pilot programs.

Fast-growing LCCs will need to rapidly advance first officers to captain positions while ensuring they acquire the skills to effectively master critical situations. European LCCs will also hire pilots of different nationalities and cultures to increase the diversity of their talent pool and support their hubs.

Low-cost carriers employ a growing share of the 70,000 airline pilots active in the Europe region.

- 50,000 new pilots needed
- 36,000 new captains needed
- Demand split between growth and attrition replacement
- Young airline pilot workforce



easyJet

The Generation easyJet Pilot Training Programme is an umbrella for multiple pilot sourcing pathways including Multi-Crew Pilot License (MPL) and Airline Transport Pilot License (ATPL). Since 2011, easyJet has been selecting candidates to participate in CAE's MPL program and, upon graduation, these cadets become co-pilots with easyJet. In parallel, easyJet also selects cadets who have graduated from CAE's ATPL program, who then receive a narrow-body jet type-rating prior to flying as an easyJet co-pilot. CAE has trained over 500 such cadets to date and helped provide an additional 100 type-ratings for licensed pilots.

Ryanair

In 2016, CAE and Ryanair celebrated the type-rating of their 2,000th Ryanair cadet. With a large network of bases, Ryanair needs a diverse pilot workforce consisting of individuals who speak many languages. Through a rigorous screening process, CAE and Ryanair are able to train and recruit the quality pilots they need.

Middle East and Africa



The Middle East includes the Gulf region where airlines have been aggressively expanding their global networks, along with other countries where air travel and tourism growth face economic or geopolitical tailwinds.

The Middle East's aviation industry will continue to grow with the help of expatriate pilots, and airlines will look for longer term domestic pilot creation programs to build a local pool of pilot talent. Several leading airlines have already established training academies or created partnerships with professional academies to develop their own programs for local pilots.

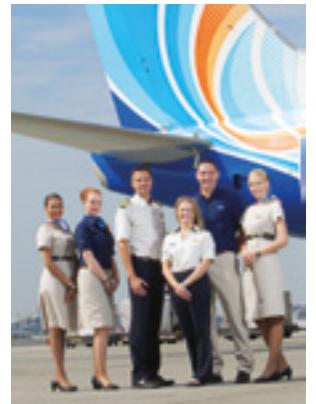
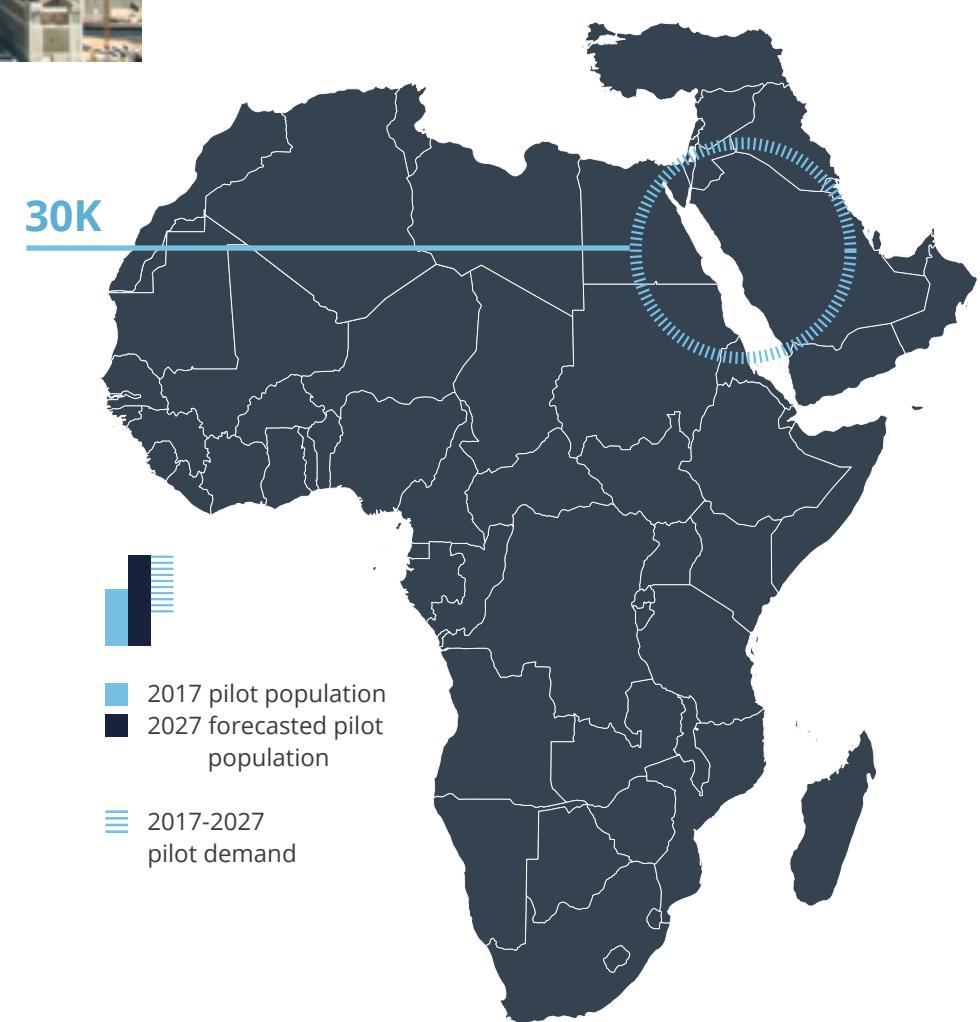
Africa is the world's smallest air travel region yet this vast continent relies on air transport. Africa is home to 54 nations with rapidly

growing populations, steady economic growth and increasing urbanization. These countries stand to benefit from greater intra-African air travel connectivity. African airlines offer attractive opportunities with desirable rosters for low-hour, direct-entry pilots to fly on a range of equipment including wide-body aircraft on long-haul flights.

The Gulf region's aircraft order backlog consists of a larger portion of wide-body aircraft compared to other regions.

Around 30,000 airline pilots are active in the Middle East and Africa.

- 30,000 new airline pilots needed
- 20,000 new captains needed
- Mostly for growth



flydubai

flydubai, a growing low-cost carrier, has been training exclusively with CAE since its inception in 2008. The flydubai Second Officer Program is one pathway the airline leverages to meet its increasing requirements.

The program offers the opportunity for low-hour, high-quality candidates to fly for the airline. Aspiring pilots with less than 1,500 hours of total flight time undergo a thorough assessment and selection process with CAE Dubai. The selected candidate must meet flydubai criteria and go through a 737NG type-rating with CAE Dubai. 80% of the CAE-selected candidates have been hired by flydubai. The first such candidate to be selected in 2014 has now been promoted to captain.

Asia-Pacific



Asia-Pacific is a vast geographic region that includes major as well as mature economies. Strong economic growth, an expanding middle class, new low-cost carriers, new routes and increasing competition make Asia-Pacific the fastest-growing region for air travel. Once limited to major Asia-Pacific cities, international airline service is now being extended to secondary and tertiary cities with new nonstop routes.

Countries with a large and swelling middle class like India and China require aircraft in large numbers to support their economic growth. Both countries have the potential to become even larger aviation markets with the relaxing of regulations and new investments in airports and air traffic management systems. In addition, India's recent implementation of less stringent foreign ownership rules may help stimulate air travel growth.

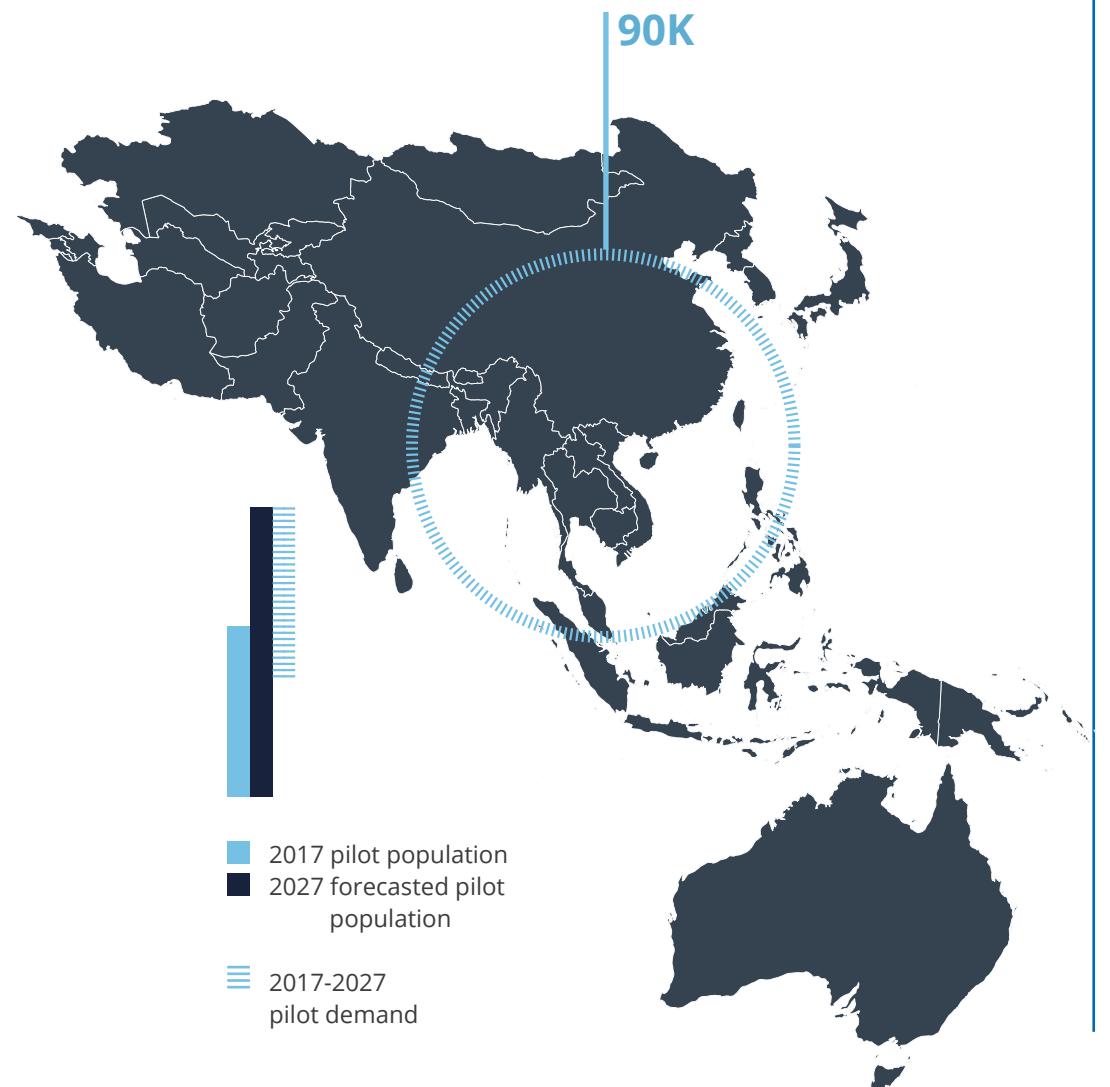
The demand for new pilots is uneven. Airlines experiencing rapid growth often need to leverage short-term solutions to meet their pilot needs. These solutions include infrastructure that supports workforce fluidity by placing the right pilot at the right place at the right time. A pilot roster containing highly experienced contract captains and first officers from diverse airline backgrounds not only addresses short-term operational requirements, it also plays an important role in accelerating the development of younger first officers.

While these contract pilots can be effective in addressing part of the demand, airlines are creating their own dedicated cadet programs to source local pilots for the long term.

Given the growing need for pilots in markets where English isn't the primary language, the assessment of language proficiency is becoming increasingly important.

Around 85,000 airline pilots are active in the Asia-Pacific region.

- 90,000 new airline pilots needed
- 62,000 new captains needed
- 70% of pilot demand for growth



Indigo

With over 400 aircraft on order, Indigo is one of the world's fastest-growing airlines. To achieve this growth, the airline requires an increasing number of pilots. Since 2011, IndiGo has been partnering with CAE to address this need through CAE's pilot training academy, direct entry pilots and the type-rating of external graduates. CAE and IndiGo conduct a combined assessment to ensure they acquire talented pilots who are potential future captains. Having access to five CAE training locations across the regions is enabling IndiGo to meet its sizeable demand. Over 250 cadets have already graduated and the airline plans for many more through to 2018.

Vietnam Airlines

Vietnam Airlines is rapidly growing and uses multiple pilot sourcing solutions. Since 2011, it has been selecting cadets from CAE. It also supplements its pilot recruitment pathway with direct entry pilots on assignment. These experienced contract pilots satisfy the immediate demand for captains while helping incoming cadets mature on the job.

Part IV

Moving forward

As the air transport industry prepares to address the travel needs of the next decade, we must collectively forge a strategy to ensure we have the mission-ready pilots our industry requires. This includes creating innovative and proactive development pathways and training systems enabling first officers to become competent captains.

Filling tomorrow's cockpits

Selecting the right fit

Airlines are not just looking for first officers to fill the right seat. They're looking for candidates with the potential to become captains within their organizations. As an industry, we must continuously improve and adapt our assessment and selection processes for different regions and airlines to reflect pilot competency requirements.

Careful matching of individual aptitude with airline needs will allow airlines to identify candidates today who can evolve into their future captains.

A thorough screening and selection process performed early in the training process has proven to be very successful in identifying candidates with the right mix of language proficiency, flying skills and attitude to evolve into high-quality pilots.

In addition to identifying future potential captains, airline requirements can be used to assess if the candidate, whether an aspiring cadet or a direct entry pilot, will be able to flourish within the airline's culture. For example, one airline might need a pilot willing to travel for extended periods prior to returning home, while another airline might only offer daily short-haul return flights. An in-depth mapping of airline needs along with a multifaceted assessment of each candidate can correctly match the right candidate with the right airline.

Airlines are also developing programs to tap into an underrepresented labour pool – female pilots. These programs encourage young women to consider an aviation career and provide airline sponsorship for flight training. Women currently represent less than 5% of airline pilots.

As the assessment and selection process improves, we're seeing lower dropout rates and higher placement rates. Ensuring the right fit is allowing candidates to flourish while increasing retention rates.



**Find the right talent
to meet your airline's
operational needs.**

Developing tomorrow's airline pilots

While onboarding 255,000 new first officers, the industry also needs to transition 180,000 pilots into captains by 2027.

The aviation industry continues to raise the bar for pilot training and increase its expectations of pilots. At the same time, we're seeing much faster promotions to captain.

A few years ago, it was common to see a co-pilot spend eight to ten years working in the right seat before becoming captain. Today, first officers are given the opportunity to upgrade with much less seniority than in the past. In fact, it's not uncommon to see a pilot taking full command of an aircraft after only a few years as a co-pilot. This steeper pilot learning curve places additional stress on the current training system. It's becoming a challenge to train to the new standards in the time allocated. As a result, the need for remedial training is increasing.

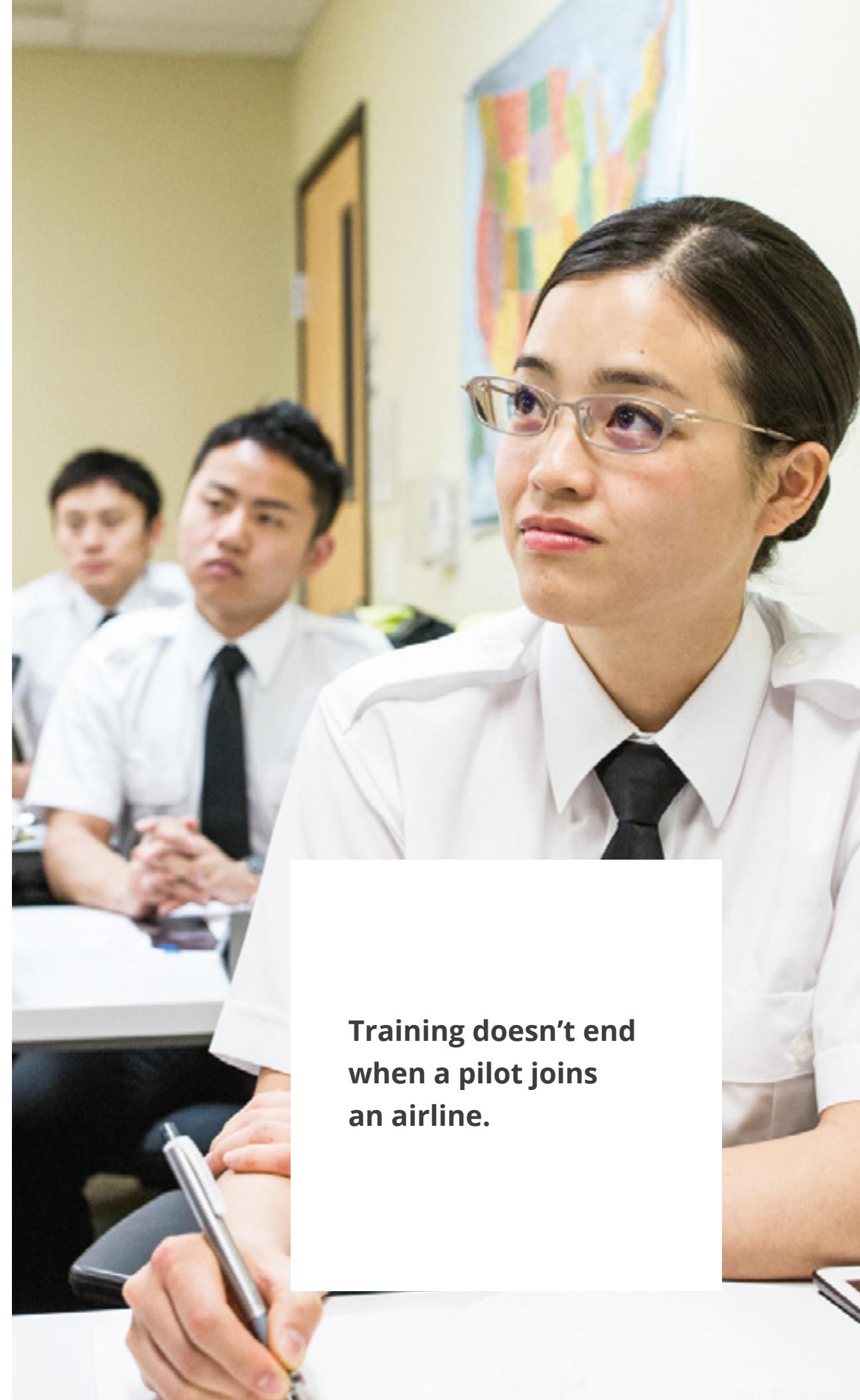
Although remedial training is a valid mitigation tactic, it impacts operations as pilots are removed from line flying to undergo addition training. To adapt to today's realities and ensure pilot readiness, we must improve training effectiveness.

An instructor armed with data-driven training insights is the first step towards ensuring effective training outcomes, reduced remedial training and a higher standard of readiness.

Emerging training and technology innovations that integrate training data with line performance data can help build such an approach.

Adaptive training delivery:

By providing an instructor with data-driven training insights, the instructor can adapt the training session to be more effective. This yields tools the instructor can leverage to objectively assess pilot performance. Through a better understanding of the pilot's profile, the instructor is able to adapt training and delivery to better address the competency gaps. A word of caution: not all senior pilots are effective instructors. We must look for instructors with the right mix of teaching and communication skills to ensure we provide the most effective training.



Training doesn't end when a pilot joins an airline.



AirAsia

In 2016, AirAsia and CAE launched the validation phase of its Next Generation Training System. Leveraging years of training innovation, this next breakthrough in pilot training is supported by advanced data collection and analysis techniques. This system promises to improve training quality and efficiency by integrating untapped data-driven insights into training. This next-generation training provides an objective evaluation of pilot skills and elevates the standard by which they are trained.

About CAE

CAE is a global leader in training for the civil aviation, defence and security, and healthcare markets. Backed by a 70-year record of industry firsts, we continue to help define global training standards with our innovative virtual-to-live training solutions to make flying safer, maintain defence force readiness and enhance patient safety. We have the broadest global presence in the industry, with more than 8,000 employees working at 160 sites and training locations in over 35 countries.

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