

GLOBAL FLEET AND MRO MARKET FORECAST 2024-2034



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FOREWORD

Oliver Wyman's *Global Fleet and MRO Market Forecast 2024–2034* marks our firm's 24th assessment of the 10-year outlook for the commercial airline transport fleet and the associated maintenance, repair, and overhaul (MRO) market. We are proud to say that this annually produced research, along with our *Airline Economic Analysis*, has become a staple resource of executives working in aerospace manufacturing, airlines, MRO, and aviation investment and private equity.

2024 marks a year when the industry is ready to start growing again after almost four years of challenges and turmoil around the COVID-19 pandemic. This year holds its own set of challenges, from continued labor shortages and supply chain fragility to production constraints, slower economic growth, and climate change. As always, we hope the data and insights in the *Global Fleet and MRO Market Forecast 2024-2034* help you better navigate the perils and seize opportunities moving forward.

And speaking of opportunities, we would like to share the news of our latest acquisition of SeaTec Consulting Inc, a leading provider of consulting, engineering, and digital expertise in aviation, aerospace and defense, and transportation.

SeaTec joins CAVOK, a division of Oliver Wyman focused on aviation services, to further elevate Oliver Wyman's commitment to aviation, aerospace and defense, and transportation. In 2022, Oliver Wyman also acquired Avascent, a top management consulting firm and boutique private equity and M&A adviser for the aerospace and defense sector. Avascent was also combined last year with CAVOK. Please contact us to find out more about our new capabilities.

Meanwhile, Oliver Wyman's Market Intelligence team, partners, and vice presidents are available to assist with any questions about this forecast, as well as with the *Airline Economic Analysis*, which is scheduled to be released in March.

Looking forward to another year of collaborating with you.



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EXECUTIVE SUMMARY



BACK ON A GROWTH TRAJECTORY

The global commercial aircraft fleet will be back to setting records again in 2024, the first year of real growth since the peak set before the onset of the COVID-19 pandemic. But despite rising demand for air travel, a return of profitability, and more new fuel-efficient aircraft, the fleet will experience slower growth than in the years before the pandemic.

Between 2024 and 2034, our latest *Global Fleet and MRO Market Forecast* expects the number of commercial aircraft worldwide to expand at a compound annual growth rate (CAGR) of 2.5%, reaching more than 36,400 aircraft by the start of 2034. That's up 28% from today's fleet of around 28,400 aircraft.

While that's decent growth, it falls far short of the 39,000 aircraft we predicted by 2030 in the last forecast Oliver Wyman published just before the outbreak of COVID. We now do not expect the global fleet to reach that size before 2036, meaning the industry essentially lost six years of growth to COVID.

The new forecast CAGR is also lower than the 2.9% Oliver Wyman forecast last year for 2023 through 2033. This year's CAGR has been tempered by the modest global economic growth that high interest rates courtesy of central bankers worldwide made inevitable.

Meanwhile, the global maintenance, repair, and overhaul (MRO) market will also begin to set records again. 2024's spending is expected to hit \$104 billion. In real terms, that's 1% above the peak set at the beginning of 2020 before COVID. By 2034, Oliver Wyman's global forecast expects MRO demand to reach \$124 billion, expanding at a 1.8% CAGR over the 10 years versus the 2.9% predicted by our 2023-2033 forecast.

NEW LEADERS

The location of the fleet will be changing over the next 10 years as well. By 2034, China will become the second-largest fleet worldwide — displacing Western Europe which slips to No. 3. Biggest-fleet honors throughout the decade will remain with North America, where the fleet today tallies around 8,200. It will grow to 9,850 by 2034.

China has around 4,100 aircraft and will grow to just over 6,400. That means China's fleet will be 65% as big as North America's in 2034, versus 50% in 2024. Despite the 56% expansion for China, that fleet will not be the fastest growing because of the slower underlying growth of the Chinese economy, which is dealing with an implosion of real estate values and an aging population.

Currently at just over 600 planes, India's fleet leads the forecast in terms of growth, adding aircraft at a rate of almost 13% annually over the first five years and nearly 10% for the 10-year forecast period. By 2034, it will be 2.5 times the size it is today. To give a sense of how fast it is expanding, India has more than 1,800 aircraft on order, more than triple its current size.

The other rapidly expanding fleet is in Eastern Europe — growing at a CAGR of 9.2% in the first five years and 7% over the 10 years. This is despite the inclusion of Russia in the regional numbers — the only major fleet to contract between 2024 and 2034. Russia’s fleet will shrink 8% over the forecast period, and because of the trade sanctions imposed after it invaded Ukraine, its narrowbody fleet will decrease by a stunning 44%.

PRESSURE ON PRODUCTION AND MRO

But the industry does face risks, even with this more modest growth. The two global airframe manufacturers — Airbus and Boeing — are pushing their production capacity to the limit to keep up with demand, hoping to reach new heights in monthly output over the next decade. Yet it appears unlikely at this point that either will hit their targets on time without significantly more investment in their own production facilities and those of their chief suppliers.

A new contender may also be entering the global aerospace market. This year China has brought two new aircraft — the C919, a narrowbody, and the ARJ21, a regional jet — to the Singapore Airshow with hopes to start delivering globally sometime in the 2030s. Even though the manufacturer, Commercial Aircraft Corporation of China Ltd. (COMAC), has limited production capacity at this juncture, Chinese airlines have placed orders for 1,000 C919s.

Four C919s are in service so far this year, flying for Chinese airlines. But despite the optimism behind the 1,000-plane order book, we expect COMAC to deliver only about 600 by 2033. COMAC’s need to ramp up production means it is unlikely to be a significant factor in the global aerospace market within this forecast period. Neither COMAC models have received approval from either the US Federal Aviation Administration (FAA) or the European Union Aviation Safety Agency (EASA).

MORE INVESTMENT NEEDED

After three years of COVID, inflation, and raw material and labor shortages, the aerospace industry is left with a dearth of skilled labor and a pressing need to modernize and optimize production at all points along the supply chain. The pressure to produce and the retirement of many skilled baby boomers during COVID may also be contributing to some of the quality-control issues plaguing the industry.

The MRO support network that keeps aircraft flying is simultaneously going through similar challenges. There is a critical shortage of aviation maintenance technicians (AMTs) and engineers, which is making it increasingly harder for the industry to keep up with rising demand for air travel. The shortfall in AMTs in North America is 24,000, based on an Oliver Wyman analysis.

But as the fleet and utilization of those aircraft grow more slowly, so too does MRO. Engine maintenance appears to be the exception, with a 10-year CAGR of 2.3% over the forecast period. This is because of a historically unprecedented number of next-generation engines entering the market as airlines seek cost savings from fuel efficiency and a cut in greenhouse gas emissions.

Yet the benefits anticipated from improved reliability and operational costs with new engines are not being fully realized because of operational issues facing the new engines. From CFM International's LEAP to Pratt & Whitney's GTF to Rolls-Royce's Trent XWB, each entrant has experienced delays and problems. For some, these issues have resulted in a raft of on-wing inspections, airworthiness directives, or extra unplanned visits to the shop, necessitating the addition of more engine MRO capacity.

PROLIFERATION OF NEXT-GEN ENGINES

So many new engines are putting enormous strain on both aerospace manufacturing and the aircraft aftermarket. One of the more publicized situations involved Pratt & Whitney's geared turbofan (GTF) platform, which led to the grounding and inspection of Airbus 320 fleets.

While the GTF was already facing durability questions, it was discovered last summer that contaminated powdered metal was used in the manufacture of certain internal engine parts. This meant these parts would need to be replaced sooner than expected. As a result, the FAA and EASA mandated inspections of 1,200 GTF engines, out of 2,500 in use, grounding hundreds of aircraft at a time. In late February, between 250 and 300 aircraft were parked, waiting for engine inspections.

At a time when aerospace manufacturing is being pushed to keep up with rising demand for air travel, the engine quality problems and delays are yet another potential impediment to pushing overall production and aircraft deliveries significantly higher.

FLEET AND MRO FORECAST SUMMARY

Region	Africa	Middle East	Asia Pacific	China	India	Latin America	North America	Eastern Europe	Russia	Western Europe	World
2024 Fleet											
Narrowbody	491	587	2,263	3,422	452	1,131	4,713	416	327	3,462	17,264
Widebody	188	818	1,362	488	65	170	1,440	40	57	1,129	5,757
Regional jet	179	45	215	215	7	246	1,509	86	189	352	3,043
Turboprop	281	22	687	1	86	213	569	82	20	373	2,334
TOTAL	1,139	1,472	4,527	4,126	610	1,760	8,231	624	593	5,316	28,398
2034 Fleet											
Narrowbody	625	1,056	2,468	4,847	1,253	1,508	6,186	904	184	3,945	22,976
Widebody	254	1,099	1,659	725	137	218	1,831	95	41	1,343	7,402
Regional jet	231	53	264	645	16	250	1,276	121	322	290	3,468
Turboprop	319	19	762	212	139	158	557	105	1	295	2,567
TOTAL	1,429	2,227	5,153	6,429	1,545	2,134	9,850	1,225	548	5,873	36,413
Fleet growth rates											
2024–2029	1.9%	6.1%	1.7%	3.9%	12.7%	-0.7%	2.0%	9.2%	-7.9%	0.8%	2.4%
2029–2034	2.7%	2.4%	0.9%	5.2%	6.9%	4.7%	1.6%	4.8%	6.9%	1.2%	2.7%
2024–2034	2.3%	4.2%	1.3%	4.5%	9.7%	1.9%	1.8%	7.0%	-0.8%	1.0%	2.5%
2024 MRO (US\$ in billions)											
Airframe	\$0.8	\$1.6	\$3.8	\$3.1	\$0.2	\$1.2	\$5.2	\$0.4	\$0.3	\$3.9	\$20.5
Engine	\$1.7	\$8.5	\$10.6	\$4.7	\$0.7	\$2.7	\$10.2	\$0.7	\$0.3	\$9.7	\$49.8
Component	\$0.7	\$1.5	\$3.3	\$2.7	\$0.4	\$1.1	\$5.2	\$0.4	\$0.4	\$4.0	\$19.7
Line	\$0.3	\$0.9	\$2.2	\$1.8	\$0.3	\$0.7	\$3.5	\$0.3	\$0.3	\$3.6	\$13.9
TOTAL	\$3.5	\$12.5	\$19.9	\$12.3	\$1.6	\$5.7	\$24.1	\$1.8	\$1.3	\$21.2	\$103.9
2034 MRO (US\$ in billions)											
Airframe	\$0.8	\$1.8	\$3.5	\$3.3	\$0.7	\$1.4	\$5.7	\$0.7	\$0.3	\$3.6	\$21.7
Engine	\$2.5	\$10.7	\$11.4	\$5.6	\$2.8	\$3.3	\$14.2	\$1.5	\$0.8	\$9.8	\$62.6
Component	\$0.9	\$1.9	\$3.5	\$3.4	\$0.9	\$1.4	\$5.7	\$0.7	\$0.3	\$3.8	\$22.3
Line	\$0.4	\$1.3	\$2.5	\$2.8	\$0.6	\$0.9	\$4.3	\$0.6	\$0.3	\$3.9	\$17.5
TOTAL	\$4.6	\$15.7	\$20.9	\$15.1	\$5.0	\$7.0	\$29.9	\$3.5	\$1.7	\$21.1	\$124.1
MRO growth rates											
2024–2029	1.6%	2.0%	0.7%	5.4%	11.9%	0.5%	1.9%	8.7%	-2.6%	2.2%	2.4%
2029–2034	3.9%	2.6%	0.2%	-1.4%	12.3%	3.2%	2.5%	5.9%	7.2%	-2.1%	1.2%
2024–2034	2.7%	2.3%	0.4%	2.0%	12.1%	1.8%	2.2%	7.3%	2.2%	0.0%	1.8%

STATE OF THE INDUSTRY



STARTING TO SET NEW RECORDS

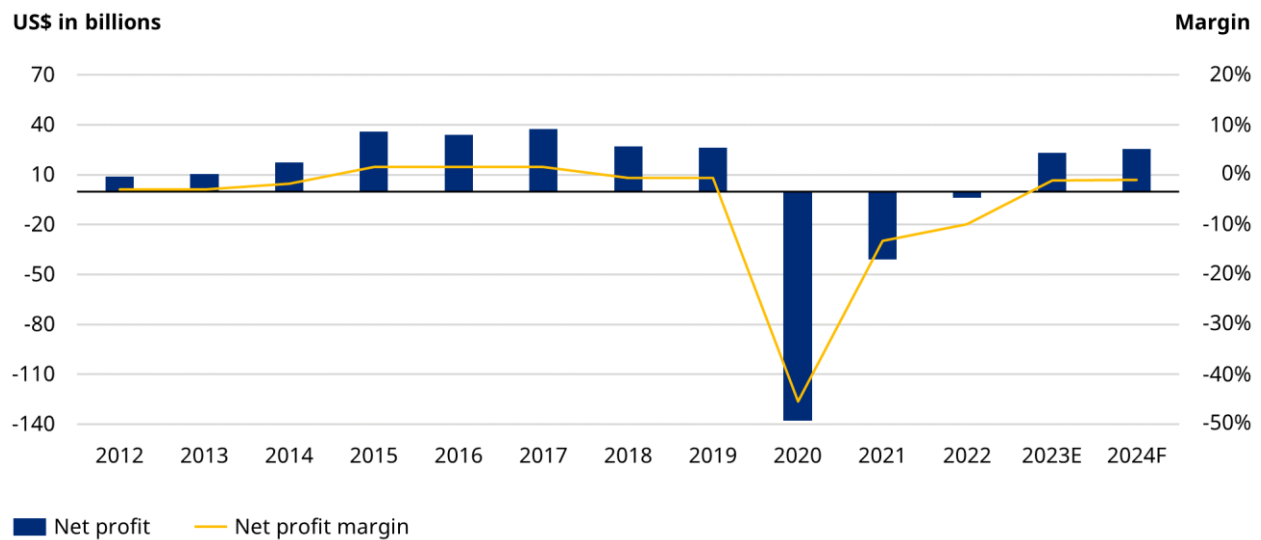
The COVID pandemic is continuing to reshape the aviation industry, despite revenue passenger kilometers (RPKs) and available seats kilometers (ASKs) close to pre-pandemic levels. In 2023, global RPKs were 94.1% of 2019 levels, [according to the International Air Transport Association \(IATA\)](#). The end of the year closed strong, with fourth quarter traffic at 98.2% of pre-pandemic numbers, which increased optimism for a solid 2024.

Just as it did in 2022, domestic air travel dominated the rebound, with 2023 domestic almost 4% above 2019 volume. International travel, on the other hand, still lagged, held back by slower recovery of international travel in China and Asia Pacific which remained down by nearly 20% from pre-COVID levels. This was not the case worldwide. North America and Europe saw a resurgence in international travel — just not enough to offset the lower demand in Asia. While international travel only reached 88.6% of 2019 globally, fourth-quarter travel jumped to 94.5% of the same 2019 quarter — again providing momentum for this year.

The trend indicates aviation should return to real growth in 2024 over the former peaks, albeit constrained by slower global expansion, especially in China, our analysis shows. IATA predicts that 4.7 billion people will fly commercially in 2024, breaking the record set in 2019 of 4.5 billion.

Meanwhile, airlines are expected to be more profitable in 2024, IATA predicts, hitting \$25.7 billion in net profits versus \$23.3 billion in 2023. The industry's net profit margin should rise to 2.7% from 2.6%. The 10% increase in profits represents a valuable start at offsetting the \$180 billion in net losses suffered by the industry during the pandemic, Total revenue will increase 7.6% to a record \$964 billion, while 2024 expenses are expected to rise 6.9% to \$914 billion.

Exhibit 1: Global airline industry financial performance, 2012-2024F



Notes: The net profit totals are rounded to the nearest whole number; E stands for estimate and F for forecast
 Source: International Air Transport Association

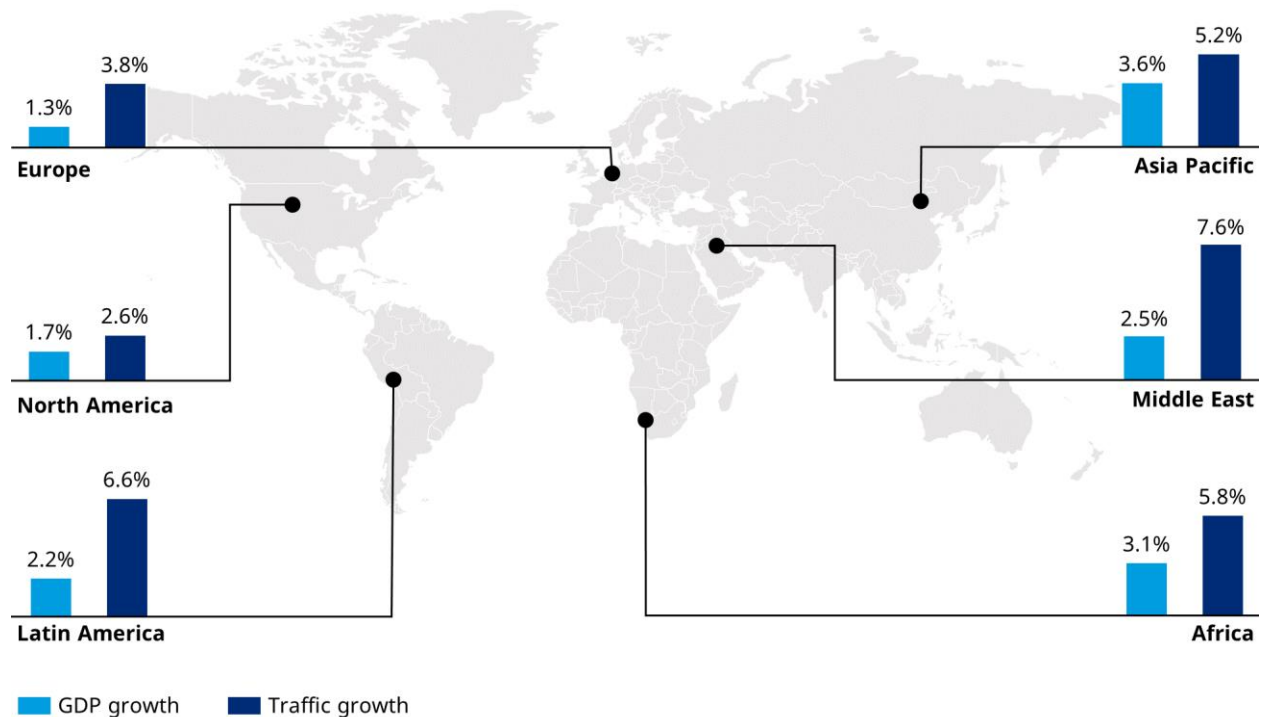
THE OUTLOOK FOR THE WORLD ECONOMY

Even though global economic growth is at its weakest since the early 1990s, the outlook is brightening. Relatively high interest rates have been stifling growth in almost all economies as central bankers worldwide have been successfully bringing inflation close to pre-pandemic levels in many nations. The International Monetary Fund’s (IMF) *World Economic Outlook* for January predicted 3.1% growth in 2024, 0.2% higher than in October, on the back of greater than expected resilience in the United States and China’s fiscal support for its waning economy.

In the US, inflation rates are now down below 3%, the IMF reported. Employment and industrial production are continuing to rise. Leading economists now conclude that the US economy is in for a soft landing and maybe better, given recent job creation numbers and fourth quarter 2023 growth in gross domestic product.

The European economy is expected to expand at less than half the rate of the US, but most nations will probably avoid recession. Two significant exceptions are Germany and the United Kingdom, which officially slipped into mild recession in the fourth quarter of 2023. On the other side of the world, Japan’s economy is also shrinking. Still, the IMF is thinking a soft landing is probable for the global economy as a whole.

Exhibit 2: 10-year growth forecast for gross domestic product and traffic, 2024-2034



Source: Oxford Economics, Oliver Wyman analysis

NEW ORDERS FOR AIRCRAFT

Global economic growth is pivotal for aviation, given air travel's discretionary nature and the historic connection between trends in GDP growth and air travel demand. With the more optimistic outlook, especially in the US and places like India, aviation capacity and order books show no signs of softening.

2023 was a year of jaw-dropping orders by airlines in India and the Middle East. In February, it started with an order by Air India for 470 aircraft — 220 from Boeing and 250 from Airbus. The Paris Air Show's 2023 comeback saw the largest single aircraft order in Airbus's history, with IndiGo ordering 500 A320s, alongside robust sales for other aircraft types.

At the Dubai Airshow in November, Emirates ordered 90 widebody Boeing 777Xs. New orders from both airlines and lessors coming out of Paris and Dubai far exceeded airframe manufacturer expectations, indicating confidence in the long-term growth of demand. With record profits for airlines, along with sold-out order books, we expect the fast pace of orders to continue, with operators rushing to boost capacity. But with current production challenges slowing deliveries, meeting that high demand — particularly for popular narrowbodies — will require operators to either delay retirement for some aircraft or lease more. The cost of leasing a narrowbody is already rising because of increased demand from airlines.

CHINA AND INDIA

It is no secret that a large share of economic momentum continues to come from Asia. But at this point, the leader is no longer China — it's India.

In April, India overtook China as the most populous country in the world with 1.4 billion people, generating enormous potential for air travel demand. Currently, only about 3% of Indians fly on a regular basis, leaving room for a lot of growth when coupled with the nation's projected high GDP expansion. The IMF expects Indian GDP to rise 6.5% during both 2024 and 2025.

By contrast, the collapse of an overheated real estate market has proved a drag on China's economy, which is slated to grow 4.6% in 2024 and 4.1% in 2025. Those rates are significantly lower than the annual growth between 2011 and 2019. Even in 2022, when there were sudden outbreaks of COVID that disrupted the economy, China grew at 5.2%. The government has attempted to prop up the economy through subsidies to the ailing housing market, but markets still appear to be weak.

From the aviation industry's perspective, Chinese travelers have been crucial to the international market, and their absence for the past few years has prevented that segment from growing or even returning to pre-pandemic size. China's continuing housing crisis, aging population, and high youth unemployment could depress growth for several years, according to the IMF.

RISKS FACING CARGO

Following spectacular pandemic buying in 2021, when global air cargo revenue hit a record \$210 billion and tight passenger aircraft belly capacity kept rates high, demand slipped in 2022 because of disrupted trade, the Russian invasion of Ukraine, more competition from shipping, and rising inflation. 2023 saw a pickup, particularly with a strong seasonal surge in the fourth quarter.

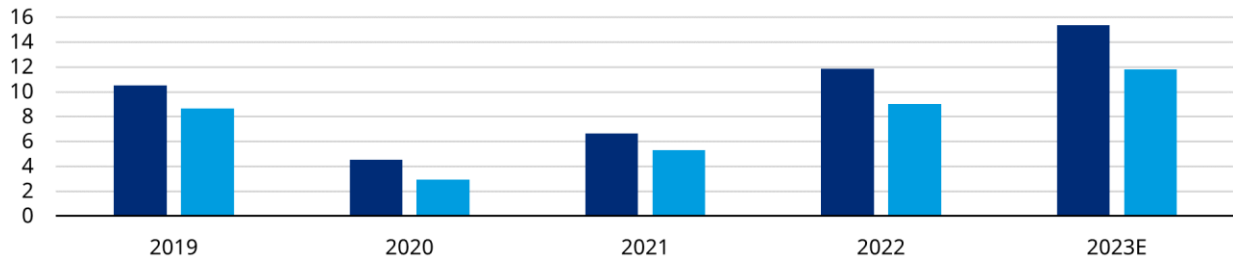
The IATA forecast for 2024 shows a drop in revenue to \$111 billion from an estimated \$134.7 billion in 2023. The 2024 forecast still puts revenue more than 10% higher than in 2019.

Cargo capacity in 2023, measured in available cargo tonne kilometers (ACTKs), was 11.3% higher than in 2022. Compared with 2019 pre-COVID levels, capacity was up 2.5%. December 2023 global capacity, reflecting a surge in shipments, increased 13.6% over the same month in 2022.

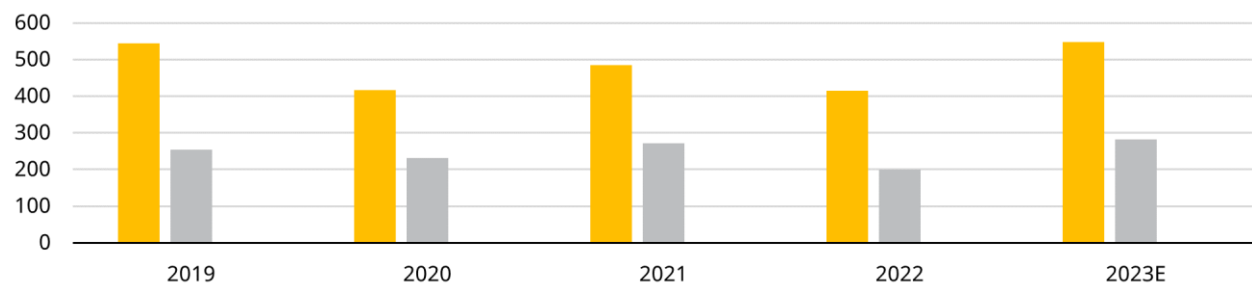
Belly capacity, the storage space in the underside of passenger aircraft, increased substantially in 2023 as domestic passenger traffic exceeded the 2019 peak and international volume also began to close in on its pre-COVID high. That expansion pushed load factors down. 2023 saw cargo yields rise for the first time in 17 months, backed by improving trade conditions, falling inflation, and a more confident economic outlook in the US.

Exhibit 3: Passenger and cargo traffic, 2019-2023E

Kilometers in trillions



Cargo tonne kilometers in millions



■ Available seat kilometers
 ■ Revenue passenger kilometers
 ■ Available cargo tonne kilometers
 ■ Cargo tonne kilometers

Notes: E stands for estimate; 2023 year-end data are estimated; tonne is the equivalent of a metric ton.
 Source: International Air Transport Association

GEOPOLITICAL RISKS

Threatening the otherwise sanguine outlook for aviation is the escalating conflict in the Middle East, which could in turn put at risk oil supplies and prices as well as travel to and from the Middle Eastern Gulf States. The recent attacks on cargo ships in the Red Sea have disrupted global trade yet have not so far made oil prices rise significantly and may have contributed to strong air cargo demand in late 2023. If the fighting were to involve state players, that might not continue to be the case.

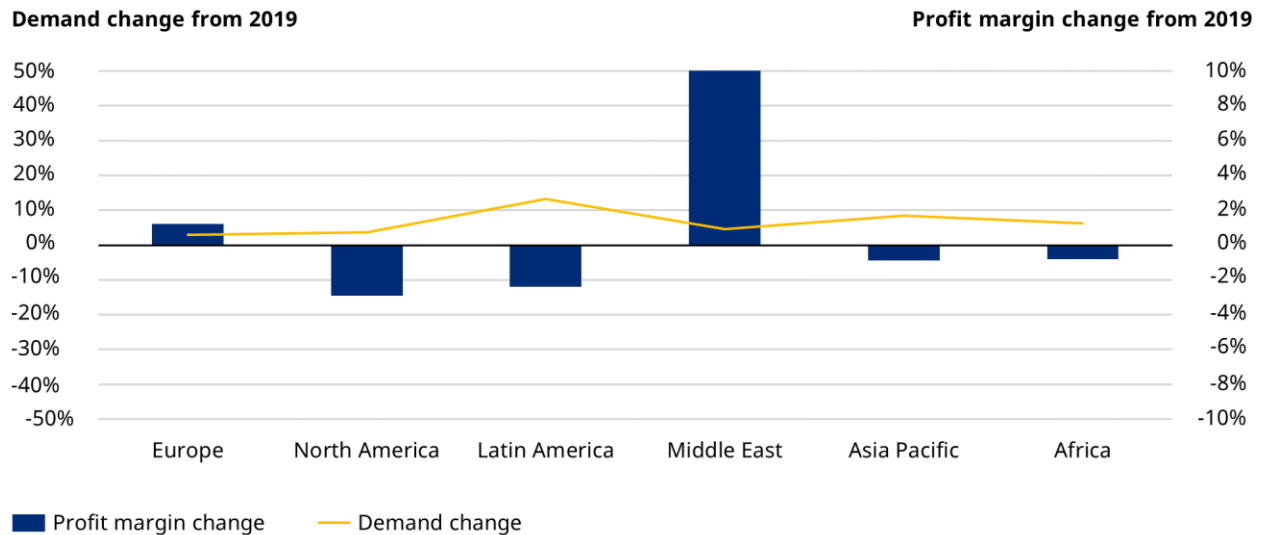
The ongoing invasion of Ukraine by Russia shows few signs of unwinding any time soon, which means the 1% to 2% of air travel lost to it will remain lost for the short term at least. This probably hurts the two nations fighting more than any other nation in Europe.

The US presidential election set for November is a wild card and certainly has destabilizing potential, although it is more likely to cause trouble in late 2024 or 2025 than in the run-up to it.

RISING COSTS

As they did last year, airlines are once again battling increasing and already elevated costs. First, higher interest rates have pushed up the cost of borrowing. But the airlines biggest costs are wages and oil. While wages are significantly rising, oil is lower than in 2022.

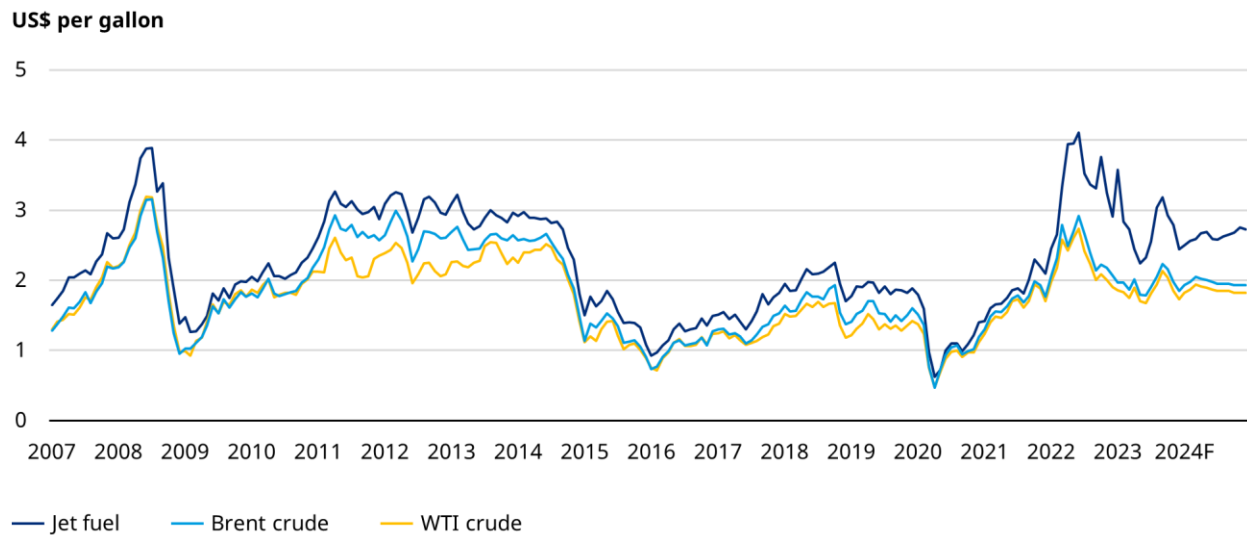
Exhibit 4: 2024 Demand and profit margin forecasts by region



Source: International Air Transport Association

In January and February, the spot price for kerosene-type jet fuel rose a bit, no doubt in response to the escalating conflicts in the Middle East and the attacks on cargo ships in the Red Sea. Still, per gallon spot prices remained substantially lower than they were through 2022 and the same or lower than in 2023.

Exhibit 5: Spot prices of crude oil and jet fuel, 2007-2024F



Note: WTI = West Texas Intermediate; crude prices are calculated by dividing the price by the number of gallons in a barrel; F stands for forecast

Source: US Energy Information Administration

Higher wages set by 2022 and 2023 labor contracts are putting significant pressure on airlines. For instance, captains' pay at US mainline carriers increased 46% between 2020 and 2023, while those flying for US regional airlines saw their wages rise 86%, although they still trail mainline pilot salaries. But wage pressures have been felt across the entire workforce.

On a positive note, the higher salaries are helping to provide relief from the pilot shortage which was playing havoc with airline schedules and on-time performance through most of 2022 and into 2023, particularly in the US.

Besides higher wages, the reasons for the slightly bigger supply of pilots included faster career progression, better job security, and a focus on quality-of-life scheduling. These better conditions have led to a jump in airline transport pilot (ATP) certificates and licenses in both the US and Canada and should continue to increase the pool of candidates over the decade. Of course, the flip side of better availability is higher costs, and airlines have to manage a larger percentage of less experienced pilots.

THE PILOT SHORTAGE

The pilot shortage was the result of thinning ranks from baby boomer retirements and COVID-related early retirements, with North American regional airlines the most profoundly impacted. Throughout the system, there were widespread flight cancellations and delays in 2022 and 2023. Regional airlines were forced to drop routes and cut flights as major airlines recruited heavily from their pilot ranks.

Pilot shortages globally and especially in North America will remain a significant pressure on the industry throughout the forecast period. The biggest supply gap in North America is expected in 2026, when it will reach 24,000. While the gap is expected to narrow after that, the shortage is expected to put pressure on airlines — particularly regional airlines and ultra low-cost carriers — for the next 10 years.

The same is true on the global front, although the shortage is less dire over the next few years. By 2033, the gap will widen to well beyond 22,000, with the Middle East being the worst affected region. The gap there is projected to be more than 15,000 by 2033.

AIRLINE MAINTENANCE TECHNICIANS

On the technician front, the news is not as encouraging. The technician workforce was also hit by a wave of baby boomer retirements, early retirements, layoffs, and a cohort of highly experienced personnel leaving the business for greener pastures. Forecasts for North America suggest a shortfall of nearly 25% by 2027.

While not every region faces the same kind of demographic and demand trends as North America, the shortage will be substantial and global, without much near-term relief anticipated. But the sector could seek to improve the imbalance with greater recruitment from demographic labor pools, such as women and people of color, that historically have been overlooked by aviation maintenance technician (AMT) recruiters.

At the same time, the need remains greater than ever for productivity innovation in all parts of the MRO sector. To date, progress incorporating higher tech tools has been incremental at best, which continues to make the industry less attractive to younger generations.

CARRIER CONSOLIDATION

The higher operating costs have made life particularly tough on low-cost carriers (LCCs). This has led to several merger attempts. In the last several months, Jet Blue and Spirit have announced plans to merge as have Alaska Airlines and Hawaiian Airlines. In Europe, Lufthansa bought a 41% stake in ITA Airways.

In January, a federal judge blocked the Jet Blue-Spirit union, leading to fears of a possible Chapter 11 bankruptcy by Spirit or even liquidation. It is unclear what the path forward is for both the merger and Spirit, leading to speculation on long-term options for the carrier.

These rising costs and a slowing global economy have already led to cash-strapped carriers filing for bankruptcy, including India's third largest carrier, Go First, and Brazil's Gol in January. With no relief from increased costs in sight, more consolidation is likely on the horizon.

SUPPLY CHAIN HURDLES

2023 saw leading airframe manufacturers Airbus and Boeing commit to ambitious production ramp-up schedules for all their aircraft classes as they strive to achieve rates far beyond the production peaks of the last decade. But their supply chains, still recovering from the COVID pandemic, are so far unable to handle the demands.

Aerospace parts suppliers faced rigorous financial challenges and widespread labor shortages in the wake of the pandemic — pressures that are still making it impossible for them to invest and grow at the unprecedented levels required by Airbus and Boeing.

The challenges facing the supply chain become apparent when looking at logjams at aerostructure and engine manufacturing providers. For example, aerostructure assembly remains a labor-intensive activity and has proved particularly vulnerable to the wave of pandemic-related layoffs and retirements.

In 2023, after manufacturing hiccups with the 737 and 787, Boeing tried to reset its relationship with its biggest aerostructure provider, Spirit AeroSystems, by making a \$100 million investment in Spirit's capabilities and machinery. It even demanded personnel changes. But the most recent incident on an Alaska Airlines flight during which a mid-cabin door plug fell off a 737-MAX 9 during flight was determined to be a problem on Boeing's final assembly line. This incident led to a temporary grounding of the MAX 9 fleet and is likely to prompt higher regulatory scrutiny of Boeing and its suppliers.

NEXT-GEN ENGINES

A new generation of engines is a big plus for fuel efficiency but may mean slower production rates for aircraft. These next-gen engines rarely have a smooth service entry, and technical issues with the current group is increasing pressure on overhaul shops and parts suppliers.

Already, hundreds of aircraft are expected to be grounded because of problems facing PW1000G engines. Inspections are being required following discovery of a quality failure at a powder-metal parts supplier.

Meanwhile, CMF International's LEAP engines require updates and fixes to improve operational reliability in hot or dusty environments, and Rolls-Royce's Trent XWB-97 has faced criticism over the short inspection intervals it requires. This XWB-97 issue will pose a challenge for Airbus' 350 fleet where the Rolls-Royce engine is the only option.

MOUNTING CLIMATE PRESSURES

Aviation is considered one of the hardest-to-abate industries when it comes to greenhouse gas emissions. That's because of the dearth of low-carbon technology substitutes immediately available and the extended time it will take for adoption once they are sufficiently developed and tested. The replacement of fossil-fuel-powered engines in commercial airliners cannot even begin for at least 20 years as manufacturers navigate regulatory hurdles worldwide to qualify for safety certifications. Once certified, it would then take several more decades to replace the current fleet with low-carbon aircraft, given aircraft retirement schedules. Ultimately, if the industry only relies on new propulsion technology for emissions reductions, it could be 20 to 50 years before significant progress is made to reduce the vast majority of aviation's emissions — 96% of which come from flying commercial airliners.

But there is another option — sustainable aviation fuel (SAF) — which can cut emissions by 50% to 80%. While that possibility faces problems with inadequate production capacity and supply of both fuel and feedstock, the technology does already exist and is in use. Significant capital investment in both production capacity, as well as the development of more feedstock alternatives, could provide aviation the most immediate relief from rising emissions, although it would be costly.

The European Union already has mandated the use of SAF beginning in 2025, requiring aviation fuel suppliers to make sure at least 2% of all fuel at EU airports is SAF. That percentage will rise to 6% in 2030, 20% in 2035, and 70% in 2050. Other regions are expected to follow the EU's lead eventually.

In response, aviation is starting to find ways to help SAF become more available. For instance, since 2021, Southwest Airlines has been in partnership with Neste, SAFFIRE, Velocys, Marathon Petroleum, and Phillips 66 to bring SAF to commercial scale.

In 2023 alone, more than 40 SAF offtake agreements were announced. These included:

- United Airlines, the first airline to pledge to reach net zero in 2050 without using carbon offsets, agreed last year to buy one billion gallons of SAF over 20 years.
- Delta Air Lines agreed to buy up to 10 million gallons of SAF from Shell Aviation over a two-year period for use at its Los Angeles International Airport hub and helped establish the first large-scale SAF hub in the US in Minnesota with Bank of America, Ecolab, and Xcel Energy.
- The United Airlines Ventures Sustainable Flight Fund was launched to finance SAF purchases. Reaching more than \$200 million within months, the fund also includes American Express Global Business Travel, Aramco Ventures, Aviation Bank of America, Hawaiian Airlines, and JetBlue Ventures.

Aviation, like other industries, has no choice but to address its emissions problems soon, given the growing number of regulations forcing corporations to report publicly their greenhouse gas emissions and penalize high carbon output. That disclosure is likely to increase pressure from regulators, investors, banks, and customers on all companies to reduce their carbon footprints. Already in Europe, public sentiment prompted some EU countries to eliminate some short-haul flights, instructing people to take the less carbon-intensive train instead. Additionally, several analyses over the past year have indicated that companies are cutting back on business travel to keep spending in check and shrink corporate footprints simultaneously.

IN-SERVICE FLEET FORECAST



CAGR CHALLENGED

As 2024 began, the global fleet had about 28,400 aircraft in service, finally surpassing the January 2020 peak set before the outbreak of the COVID pandemic. But while the fleet has fully recovered as far as size, growth hasn't. Based on our analysis, the global fleet will grow 28% to 36,400 aircraft by Jan. 1, 2034, a compound annual growth rate (CAGR) of 2.5%.

Albeit a respectable expansion, it remains significantly lower than the 3.9% CAGR and 39,000-plus fleet projected for 2030 in our last pre-COVID forecast. Given current growth rates, topping 39,000 is unlikely to happen before 2036, two years beyond the current forecast period. This represents around six years of lost growth, even if current CAGR is sustained.

But the slower growth of the active fleet is somewhat deceptive when it comes to capacity, which is how the industry can accommodate rising air travel demand. Next-generation aircraft, including the 737 MAX, A320neos, A220s, A330neos, and 787s, have on average 11 seats more per aircraft than earlier models. For instance, where old classes of narrowbodies had on average 170 seats, new models have 178. Where old widebodies have 307 seats on average, new classes have 319.

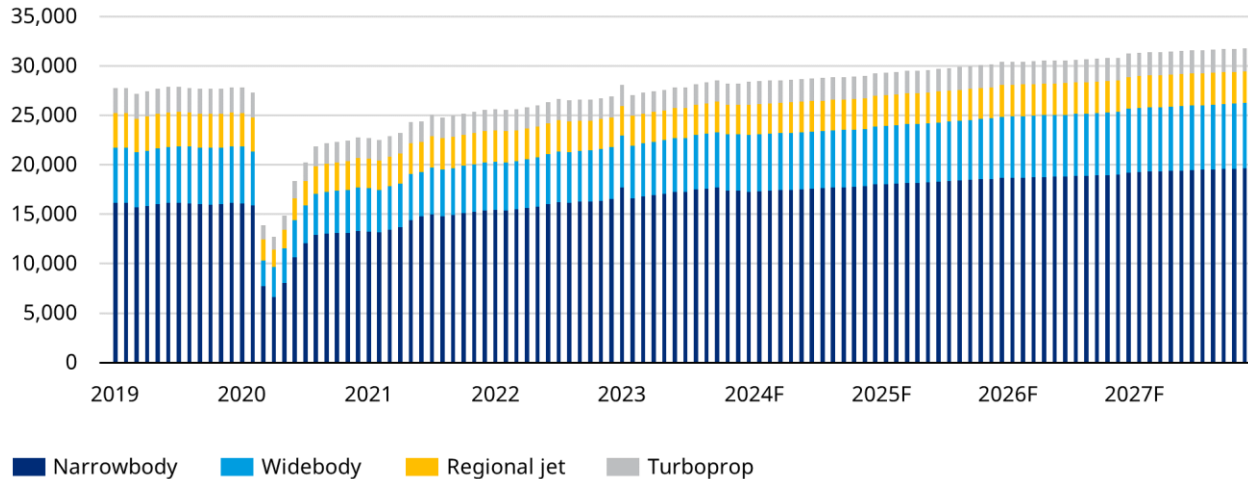
Additionally, a general upgauging trend is happening in domestic travel markets, with many commercial carriers replacing regional jets with larger, more cost-effective narrowbodies. Depending on region and fleet composition, the substitution of larger aircraft is expected to expand long-term capacity 1% or more above fleet CAGR, before accounting for potential changes in average utilization and/or higher passenger load factors.

Besides its slower growth, the global fleet will look different in 2034 than it does today. For example, by 2034, China will have surpassed Western Europe's fleet size. At that point, China will represent 18% of the total fleet versus 16% for Western Europe. North America still remains the largest region from a fleet size perspective, with a 27% share in 10 years' time.

By 2034, narrowbody aircraft will make up 63% of the global fleet versus the 61% they represent today. The narrowbody fleet will also be slightly older, with an average age of 12 compared with the current average age of 11.5.

Exhibit 6: Monthly in-service fleet forecast, 2019-2027

Number of aircraft



Note: F stands for forecast

Source: Aviation Week Intelligence Network's Fleet Discovery, Oliver Wyman analysis

REGIONAL GROWTH IN NARROWBODIES

North America and Asia Pacific emerge in the forecast as the leaders in demand for new narrowbodies, each accounting for about 28% of new orders. Within Asia, India and China both have impressive order books of narrowbodies — India with more than 1,800 and China with over 2,000. This represents more than 3,000 narrowbody aircraft designated for the two countries over the next 10 years.

Although relatively small given the size of the nation, India's fleet currently stands at a little over 600 aircraft. By 2034, that number will be 2.5 times larger, as both the Indian economy and population keep rapidly expanding. India's fleet growth is front-loaded, with the region slated to see almost 13% growth between 2024 and 2029 and only 6.9% between 2029 and 2034.

The Chinese economy and fleet, on the other hand, face slowing growth over the next few years. Its fleet is expected to be 56% bigger by 2034 at just over 6,400 aircraft versus growing 65% last year. The number of narrowbodies should be up 42% in absolute numbers by 2034, and widebodies, up 49%. The biggest growth for the Chinese fleet is among smaller regional jets and turboprops: The number of regional jets will triple to 645, and turboprops will go from one to over 200.

NOW ARRIVING, THE C919

China has been trying for years to develop a global aerospace manufacturing sector and is now on the cusp of achieving that. In May, COMAC put into service its first narrowbody, the C919, and although The Chinese manufacturer has limited production capacity at this juncture, Chinese airlines have already placed orders for 1,000.

Given the C919's dependence on Western suppliers for engines, avionics, and components, COMAC will be challenged to ramp up production, especially since suppliers are more likely to service their long-time customers first. And many are already struggling to keep up with that demand.

Boeing is still sitting on an inventory of about 50 narrowbodies, many of which are destined for Chinese airlines. China hadn't been accepting 737 MAX aircraft since the plane was grounded over safety concerns in March 2019. Even though regulators around the world recertified the plane in 2020 and 2021, China was a holdout, becoming the last major market to recertify the MAX for commercial flight and re-start new deliveries. In December 2023, Boeing delivered the first 787 widebody to China since 2019 and two 737s in January of this year.

Meanwhile, in contrast to China and every other region included in the Oliver Wyman forecast, the number of narrowbodies in Russia will plummet 44% over the 10-year forecast period. The overall size of the Russian fleet will also decline 8%, making it the only region followed by the forecast to show a decline through 2034.

The drop has been fueled by a shaky Russian economy and the Russian invasion of Ukraine, which prompted the United States and the North Atlantic Treaty Organization to impose trade sanctions on Russia that prohibited companies in the US or NATO to sell aviation parts and aircraft to Russia. In last year's [2023-2033 forecast](#) and [a Forbes article](#) by our partners, we previewed the likely decline of the Russian market.

WIDEBODIES AND OTHER CLASSES

Over the past year, the order books for widebodies have been growing, prompting subsequent increases in stated production goals to meet burgeoning demand. The North American and Middle East regions have the largest orders, each representing 27% of the order book. But The Indian and Eastern Europe orders for widebodies will see the biggest growth: Both are expected to more than double the size of their current small fleets over the forecast period. In China, the widebody fleet is expected to increase nearly 50%. Based on order books as of Feb.23, Boeing has about a 63% share of widebody orders and Airbus, almost 37%.

Over the next 10 years, the regional jet and turboprop fleets, primarily used for short domestic routes, will face the most challenging outlook. With a substantial shortage of pilots expected to last throughout the forecast, particularly in North America, airlines have reduced service to less densely populated and rural destinations where regional jets typically operate. Additionally, carriers continue to replace regional aircraft with more cost-efficient narrowbodies on many routes whenever practical.

As a result, the regional jet and turboprop order books remain relatively weak (under 500 orders), with demand concentrated among carriers in North America, China, and Western Europe. Following Embraer's decision to postpone re-entry into the turboprop market, ATR is the only remaining aircraft manufacturer of scale in the turboprop market.

AIRBUS TAKES THE LEAD

With 57% of the order book, Airbus is positioned to secure a majority share of future deliveries, effectively reversing Boeing's historical dominance, the fleet forecast indicates.

Narrowbodies are expected to play a pivotal role, with Airbus securing over 8,000 narrowbody orders versus Boeing with about 5,000. The A321neo variants, including the new XL/XLR models, account for more than 65% of Airbus' narrowbody backlog and will become an important driver of the company's profitability.

While impressive, the aircraft order books are not risk-free. Several South and Southeast Asian airlines, for example, are chasing the same passenger growth, which is likely to lead to some level of over-ordering. We estimate 20% to 30% of orders should be considered at risk of being cancelled. Nevertheless, narrowbody production will need to expand significantly over the next five years to support what would still be significant demand growth.

Both manufacturers are aggressively ramping up production on all platforms, although supply chain constraints and production issues will impede the ability of aircraft manufacturers to ramp toward target rates.

PRODUCTION STRAINS

With narrowbodies leading growth, we forecast annual production rates to reach about 1,100 a year in 2024, nearly 1,700 in 2028, and just above 1,800 in 2033. Projections include flagship models from both major manufacturers, including the Boeing 737 MAX and Airbus A320neo, along with Airbus' smaller A220 narrowbody and the Chinese COMAC C919.

Airbus has set an ambitious target of producing 75 A320 aircraft per month by 2026. Previously, the highest production rate achieved for the A320 was 53 per month in 2019. At the end of 2023, Airbus hit monthly production of 45 aircraft for A320s. Reaching the company's target will require significant support from suppliers and the alleviation of current supply chain constraints and labor shortages. Airbus currently holds a backlog of almost 6,000 A320 aircraft across variants. Despite production challenges, Airbus delivered 735 aircraft cross all types in 2023.

Boeing also has set a high goal to increase the monthly production of its flagship 737 aircraft to 57 by 2026, surpassing its previous record of 49 per month in 2018. To support this increased production, the company plans to open a fourth production line at its facility in Everett, Washington, by the end of 2024. But recent intensified FAA scrutiny of Boeing has prompted a mandated pause in plans to increase production and delayed certification of MAX 7 and 10 variants.

It also pushed back implementation of the new Everett final assembly line, which will impede the aircraft manufacturer’s effort to achieve targeted rates.

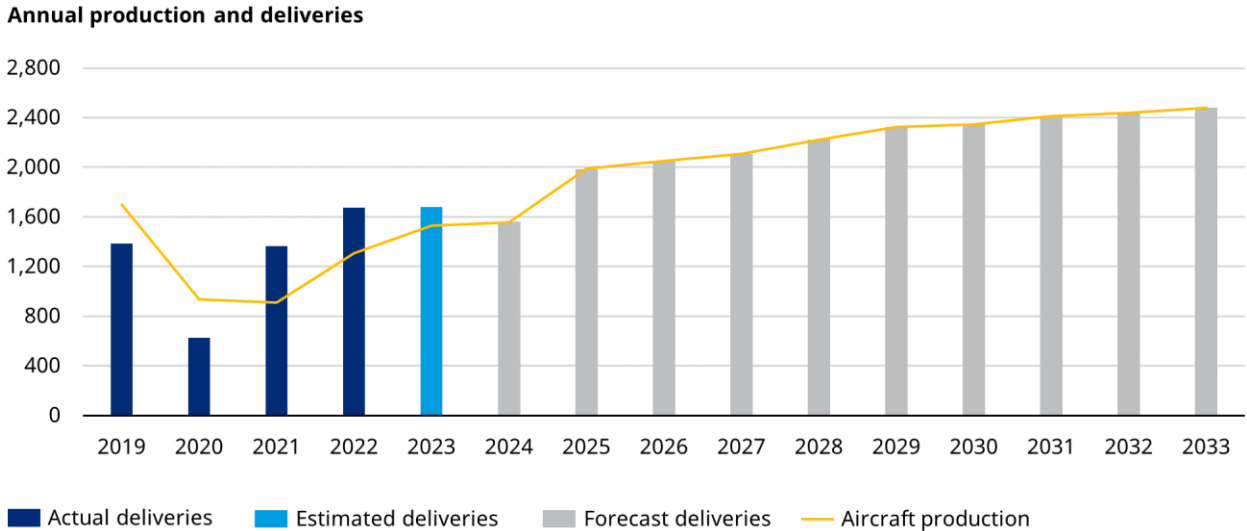
Another reality both Airbus and Boeing must face is the fact that they essentially share many of the same Tier 1 suppliers and those further upstream on the supply chain, including material supply and perennially constrained castings and forgings. Thus, it doesn’t bode well that both aircraft manufacturers setting aggressive production schedules at a time when suppliers are already having trouble keeping up with lower targets. Both Airbus and Boeing were unable to meet targets in 2023, and often by a large margin.

FIXING THE PROBLEMS

To surpass historical production levels, Airbus, Boeing, and their suppliers must undergo a significant upscaling of operations, including substantial growth of capacity at suppliers and assembly lines. Some suppliers have openly challenged the ambitious production targets, given the hurdles facing the industry post-COVID and the continuing shortage of skilled labor.

Airbus has taken a global approach to increasing production by creating more assembly lines in various parts of the world, including France, Germany, the US, and China. This approach may help expedite orders and deliveries. Boeing has plans to expand by adding a production line for the 737 MAX in Renton, Washington, in 2024 and consolidating 787 production in Charleston, South Carolina.

Exhibit 7: Aircraft production and delivery actuals and forecasts, 2019-2033



Note: Aircraft production is based on forecasts beginning in 2024. F stands for forecast.
 Source: Oliver Wyman analysis

QUALITY PROBLEMS EVEN BEFORE RAMP-UP

Both Airbus and Boeing have run into quality problems as well, although Boeing much more so than Airbus in recent years. Those kind of quality problems mean extra scrutiny from regulators, which may also prove an impediment to reaching higher production levels.

In early January, Boeing's 737 MAX 9 fleet was grounded for several weeks after a door plug flew off a new Alaska Airlines MAX 9 mid-flight. The FAA has capped Boeing's production rates while investigations were conducted. For Boeing, it meant a significant drop in deliveries in January. This comes after several pauses in deliveries throughout 2023 attributed to quality issues and necessary rework at Boeing's Tier 1 supplier, Spirit AeroSystems.

Airlines also had to inspect hundreds of Airbus' A320neo aircraft because of a quality problem involving aircraft's new geared turbofan (GTF) engine produced by Pratt & Whitney, which is one of the two options available on the aircraft. The other is CFM International's LEAP engine. It was found that high-pressure turbine discs of the GTF, produced using a powder metallurgy process, could fail prematurely. Through 2026, this will force over 3,000 engines to be removed to check for these potentially flawed components. As many as 350 aircraft a year are expected to be parked annually over the next three years because of the additional engine work.

Another notable change in production involves Boeing's 767 and 777 lines, which are expected to cease production after 2027 due to new noise and emission limits set by the International Civil Aviation Organization (ICAO) and adopted by the FAA. The 777 line will be replaced by the 777X line, which has encountered significant delays and unexpected costs during its certification process. The aircraft has faced meticulous scrutiny because of lessons learned from the 737 MAX incidents. These factors have contributed to delays in the 777X timeline, with Boeing now pushing deliveries to 2025 at the earliest.

The quality issues that both airframe manufacturers are encountering, along with engine manufacturers and other Tier 1 suppliers, raise concerns about how accelerated production schedules will be handled.

WHICH REGION WILL DOMINATE?

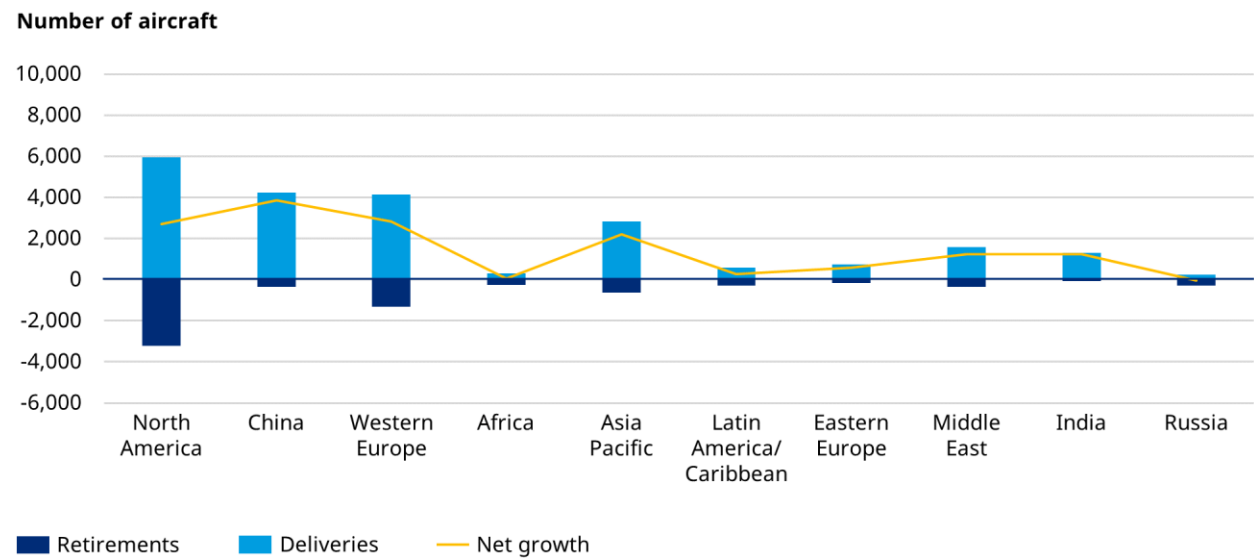
Over the next 10 years, there will be shifts in the regional composition of the global fleet, with China and the Middle East gaining a larger share. Although the global fleet is projected to grow at about 2.5% CAGR from 2024 to 2034, that rate will vary dramatically from region to region, based on the maturity of each market.

While North America and Western Europe have older fleets and are expected to maintain a modest CAGR of around 1.4%, emerging markets like India and Eastern Europe will see gains in market share as they are among the fastest-growing regions, with 9.7% and 6.9% CAGR, respectively.

In North America, the fleet has already surpassed its pre-pandemic size by about 0.6%. The region is expected to add almost 6,000 new aircraft throughout the forecast period. Despite those increases, North America’s market share is expected to drop from 29% of the global fleet in 2024 to 27% in 2034. Part of the explanation for slow growth is the anticipated 13% decline in the regional jet fleet, driven in large part by a shortage of pilots. Narrowbody aircraft will drive fleet growth in the region, accounting for 78% of the increase in fleet size over the 10-year forecast period.

In Western Europe, the fleet is nearing full recovery, with modest growth anticipated in the narrowbody fleet. The region is unique in that it faces more regulations around sustainability and climate change than other regions, which impacts fleet growth and dynamics. Despite facing a pilot shortage, Western Europe will see a slight increase in the regional jet fleet from the addition of 195-E2, 175-E2, and 190-E2 aircraft over the forecast period.

Exhibit 8: Projected fleet growth by region, 2024-2034



Note: Asia Pacific excludes China and India
 Source: Oliver Wyman analysis

Eastern Europe, with a fleet size slightly smaller than India’s today, has surpassed its pre-pandemic levels. The region has an order book for over 400 aircraft, with nearly 80% consisting of the A321. Almost three-quarters of the orders are from Hungary’s Wizz Air. Over the next 10 years, Eastern Europe is expected to receive nearly 800 aircraft deliveries, made up primarily of narrowbodies.

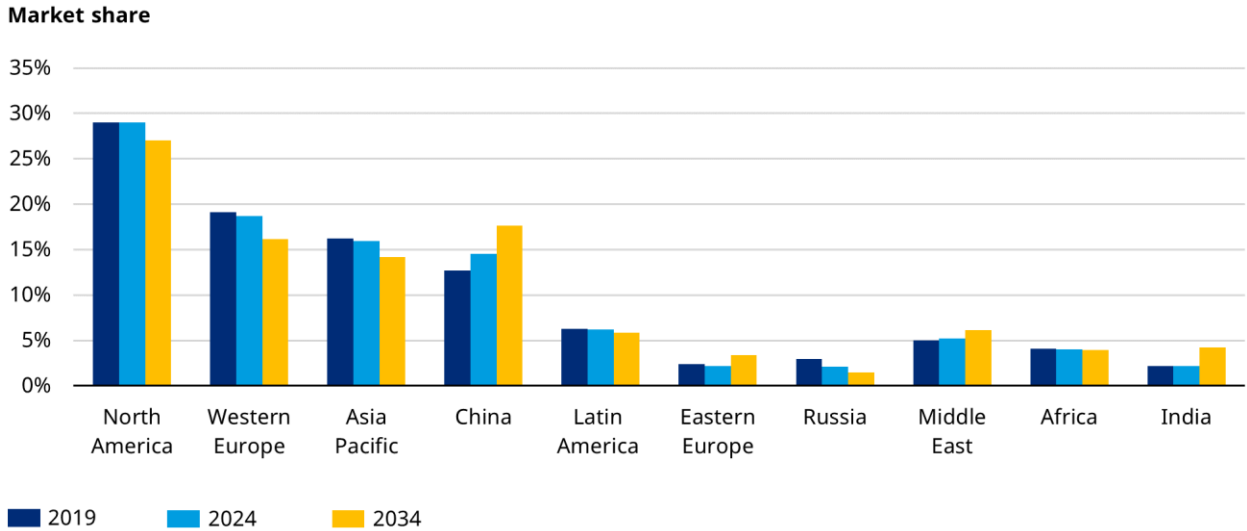
A slowing economy in China, largely the result of an implosion of real estate values, ended up cutting into initial rosier forecasts for fleet growth. The anticipated growth rate is still a respectable 4.5% with a significant order book. In the 2023-2033 forecast, the Chinese fleet was slated to grow at 5.2%. China is expected to receive over 4,200 deliveries throughout the forecast period.

The Middle East fleet is projected to grow at an annual 4.2%, driven primarily by narrowbodies. In a region where widebodies have long dominated, narrowbodies will climb from 40% to 47% of the fleet over the decade. Widebodies will decrease from 56% to 50%.

Latin America experienced a faster-than-expected recovery in domestic travel, considering the economic conditions before and after the pandemic. However, the number of widebodies is still lagging behind pre-pandemic levels. We do not anticipate a full recovery of regional jet fleets in Latin America because of too few replacement aircraft and the pilot shortage. The total fleet in Latin America is expected to grow 1.4% annually, with regional jets remaining relatively stable and turboprops declining 2.9% annually. Narrowbodies and widebodies will drive most of the growth at an average CAGR of 2.1% each.

Africa has historically received significant aircraft migrations from other regions. This trend should be a factor throughout the forecast period, given the region's small order book of new aircraft. We anticipate over 300 aircraft joining the continent's fleet from other regions, accounting for the majority of its 2.3% annual growth over the decade. The narrowbody fleet will fully recover in 2024 to 2019 levels.

Exhibit 9: Fleet market share by region, 2019-2034



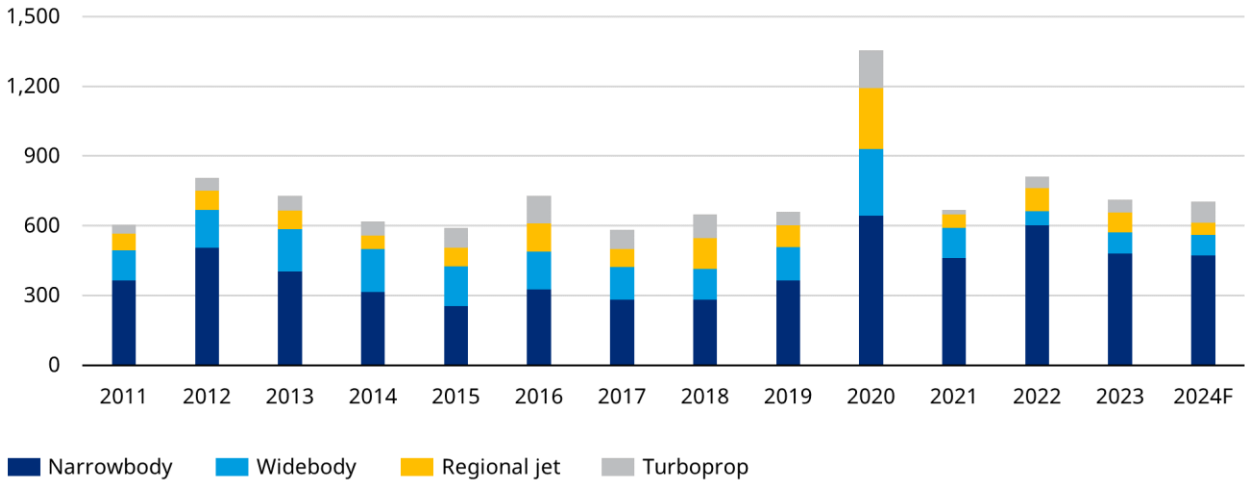
Note: F stands for forecast
 Source: Oliver Wyman analysis

TRENDS IN AIRCRAFT RETIREMENT

Capturing retirements in real time is challenging as aircraft can remain in storage for extended periods before being officially retired. We anticipate an average of about 700 aircraft retirements annually over the forecast period compared with the pre-2020 average of 650. The majority of these retirements will be narrowbodies, followed by regional jets, as older fleets are replaced by new, more fuel-efficient aircraft. Over the near-term, production constraints and lower availability of new aircraft due to engine “teething” issues is expected to lead to increased fleet utilization and delayed retirements.

Given the massive order book for the narrowbody fleet, the average retirement age for that class is expected to slip slightly to 21.2 years old in 2034. The widebody fleet retirement age, on the other hand, will increase over the decade to 24.4 years. Widebodies are typically kept in service longer, but in this case the slight increase is connected to production delays.

Exhibit 10: Annual retirements, 2011-2024



Source: Oliver Wyman analysis

In recent years, the global share of fleet retirements for North America and Western Europe has been higher at 57% than its historical average of 51%. Despite challenges posed by the pandemic, North America and Western Europe will continue to have the highest proportion of retirements, given their older fleets that need to be modernized with more fuel-efficient aircraft. Aging regional jets and turboprops will also contribute to the older fleet trend, as limited replacement options force carriers to extend the use of these aircraft.

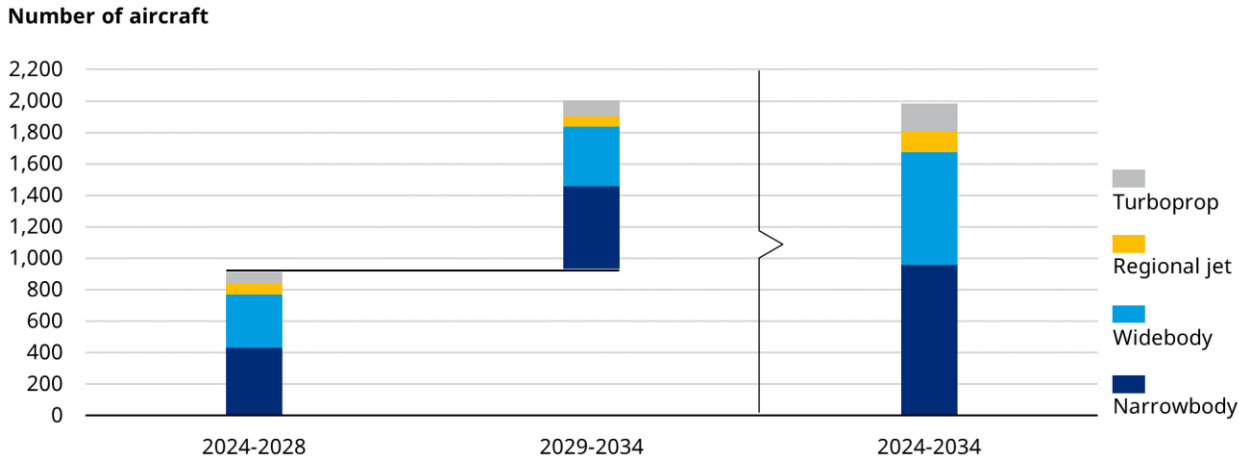
THE OUTLOOK FOR CARGO

The International Air Transport Association released 2023 data showing air cargo demand surpassing pre-pandemic levels. Capacity (measured in available cargo tonne kilometers, or ACTK) rose 13% in 2023, while cargo tonne kilometers (CTK) rose nearly 4%, thanks to a return of belly capacity as more passenger flights took to the air to meet the rebounding travel demand.

With belly capacity returning to the cargo market, we predict softening demand in the passenger-to-freighter (P2F) conversion market. However, belly capacity is insufficient to support the strong cargo volume growth of recent years, and that expected over the longer-term. Passenger aircraft can be converted into freighters and, in some cases are converted into “combi” aircraft that serve both passenger and cargo demand. These conversions offer airlines greater flexibility in adapting to changing market conditions but are rapidly becoming less relevant as pandemic-related jitters subside.

Counting all aircraft types, we forecast nearly 2,000 passenger-to-freighter conversions by 2034, with an average year-over-year increase of almost 6%.

Exhibit 11: Passenger-to-freighter conversions 2024-2034



Source: Oliver Wyman analysis

MRO MARKET FORECAST



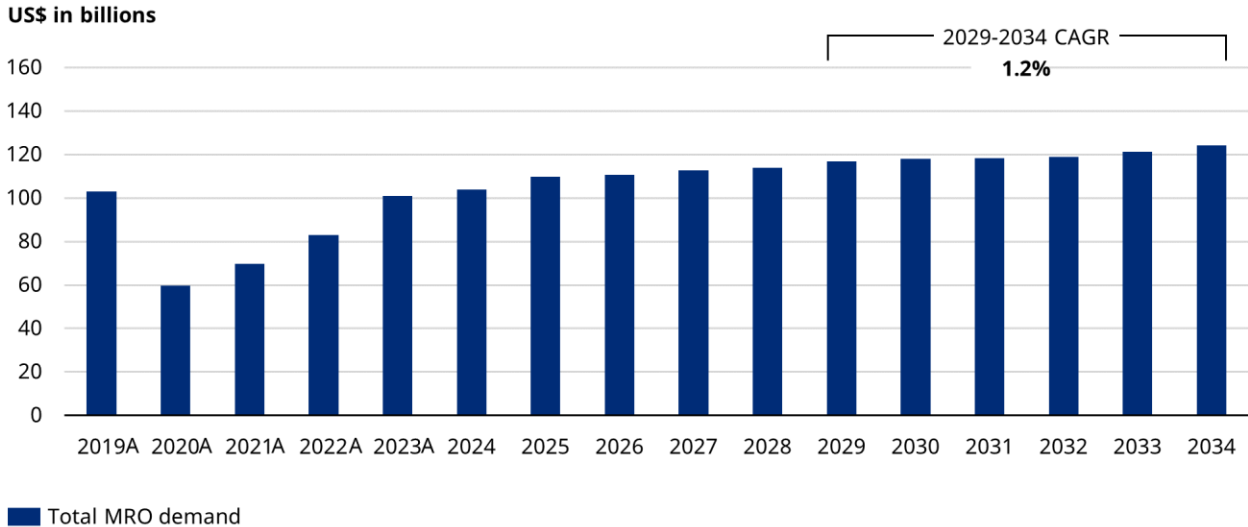
MOVING PAST \$100 BILLION

The recovery of global maintenance, repair, and overhaul (MRO) from the turmoil the COVID pandemic wrought was essentially complete when the 2023 market reached \$101 billion, 98% of the 2019 pre-COVID peak in real dollars. This year, MRO spending will set a record of \$104 billion, 2.8% above 2023 and 1% higher than 2019, driven by large cost escalations resulting from material and supply chain challenges. Between 2024 and the beginning of 2034, driven by passenger demand and growth in the size of the fleet and utilization, it will expand at an annual rate of 1.8% in real terms. By the end of the forecast period, it will reach \$124 billion.

That’s a slower compound annual growth rate (CAGR) than we had projected in last year’s forecast (2.9%), and even that will not come without challenges. The supply chain disruptions and labor shortages that accompanied the pandemic will continue, exacerbated by a new set of pressures from rising costs from higher wages and raw materials. The engine segment, in particular, will be pressed to its limits by maturity and durability challenges from a new generation of fuel-efficient engines.

The smaller CAGR reflects slower growth in the fleet because of ongoing production challenges.

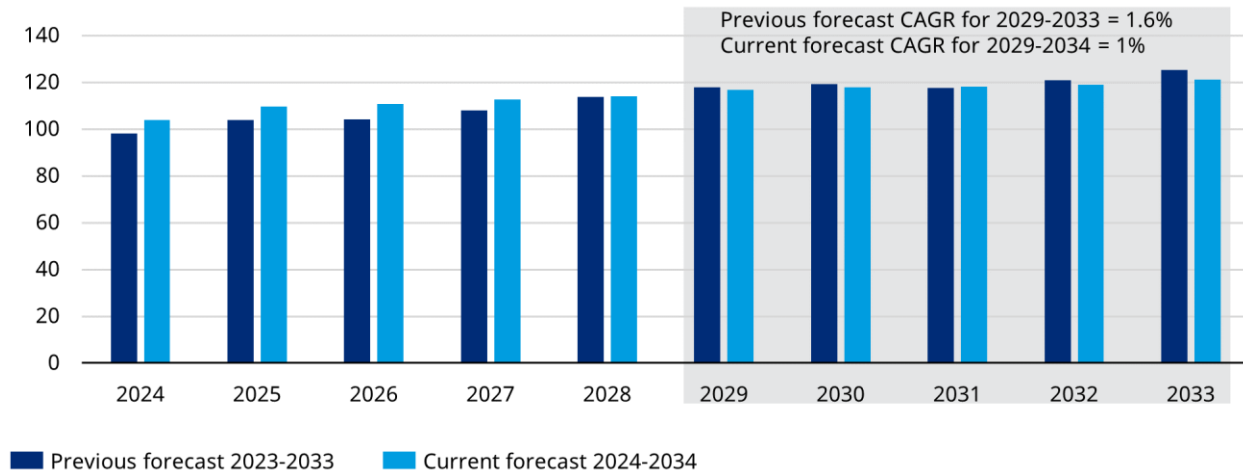
Exhibit 12: MRO demand forecast, 2019-2034



Note: The forecast runs through Jan. 1, 2034. CAGR stands for compound annual growth rate. A stands for actual demand numbers; the rest are forecasts
 Source: Oliver Wyman analysis

Exhibit 13: Changes in MRO market outlook, 2024-2033

US\$ in billions



Note: CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

ENGINE PRESSURES

The market has seen a historically unprecedented number of next-generation engines enter the market, offering airlines improved fuel-efficiency and the promise of lower fuel costs and greenhouse gas emissions. But the benefits anticipated from improved reliability and operational costs from these new engines have yet to be fully realized.

All the new engines coming to market in recent months, from CFM International's LEAP to Pratt & Whitney's GTF to Rolls-Royce's Trent XWB, have experienced their fair share of operational issues. For some, these problems have resulted in arduous on-wing inspections and airworthiness directives. For others, it has meant many more unplanned MRO visits. The result has been a system strained to its limits at times.

The unexpected servicing has prompted both aerospace manufacturers and maintenance providers to hurriedly add capacity to handle these visits and invest in additional material supply solutions.

While aerospace manufacturers plan to release hardware upgrades to help the new engines meet on-wing and performance expectations, these are still years away. In the meantime, with unpredictable costs, the business models for these engines have been challenged, making engine makers reticent to offer power-by-the-hour contracts where they bear the financial burden associated with earlier than anticipated shop visits. Power-by-the-hour contracts allow airlines to pay MRO providers a fixed per-hour rate based on utilization.

GTF COMPLICATIONS

In 2023, Pratt & Whitney's challenges with its geared turbofan (GTF) platform grew even more considerable after the discovery that contaminated powdered metal had been used in the manufacture of certain GTF engine parts. The finding prompted regulators to issue airworthiness directives that called for in-shop inspections across all three variants of the engine type.

Inspections mandated by the Federal Aviation Administration can only take place during a shop visit as disassembly of the engine is required to access and test the parts. These inspections further clogged an already stressed network, which has been dealing with ongoing GTF durability issues since the engines entered service in 2016.

Given capacity issues, coupled with short supplies of replacement parts, some aircraft are expected to be grounded for up to 300 days while awaiting replacement engines per Pratt & Whitney's Fleet Management Program released to address the issue. Initially, as many as 650 aircraft were expected to be parked because of the GTF problems, but that number has since been reduced to 350.

In late February, between 250 and 300 were parked, so that engines could be inspected and parts or the entire engine replaced. The ongoing inspection program is likely to ground aircraft through 2026 as they individually reach the airworthiness directive's limits.

GTF IMPACT

The GTF engine issues will also significantly impact utilization. In 2024, component, and line maintenance markets will be more than \$500 million smaller due to parked aircraft. By 2026, with most affected aircraft already returning to service, the annual impact will drop to around \$250 million.

For engines, this impact comes in the form of limited capacity and material challenges. Airlines may opt to expand the workscopes of GTF inspection visits and capitalize on the opportunity to have heavier maintenance performed. Regardless, annually from 2024 through 2026 these shop visits will total between 250 and 350 globally across the PW1100, PW1500 and PW1900 fleets combined. North America and Europe are the regions most affected.

We expect airframe maintenance to be less impacted, as those intervals are primarily calendar driven and operators may utilize the opportunity of aircraft being out of service to complete larger checks so that once they return to service the aircraft won't require significant maintenance. For the other segments, this impact means a reduction of markets as those aircraft will not receive line, component maintenance as otherwise expected.

REGIONS

With changing market dynamics comes a reshuffling of the regions contributing to the growth of the market. India, will lead growth globally during this forecast period, given its burgeoning order books and planned expansions of MRO facilities. India, currently the second smallest market behind Eastern Europe (excluding Russia), will expand rapidly at a rate of 12.1% annually to become the sixth-largest out of 10 markets, by 2034.

Other emerging markets, especially Eastern Europe, the Middle East and Africa, are also demonstrating strong MRO growth over the forecast. While Eastern Europe's recovery to 2019 levels won't occur until 2025, the region shows strong growth after that through 2034, with a 10-year annual growth rate of 7%. Its MRO sector will double in size to nearly \$3.5 billion over the forecast period. The Middle East follows as the growing 2.3% to just over \$15 billion by 2034, also driven by order book growth and investment in MRO facilities.

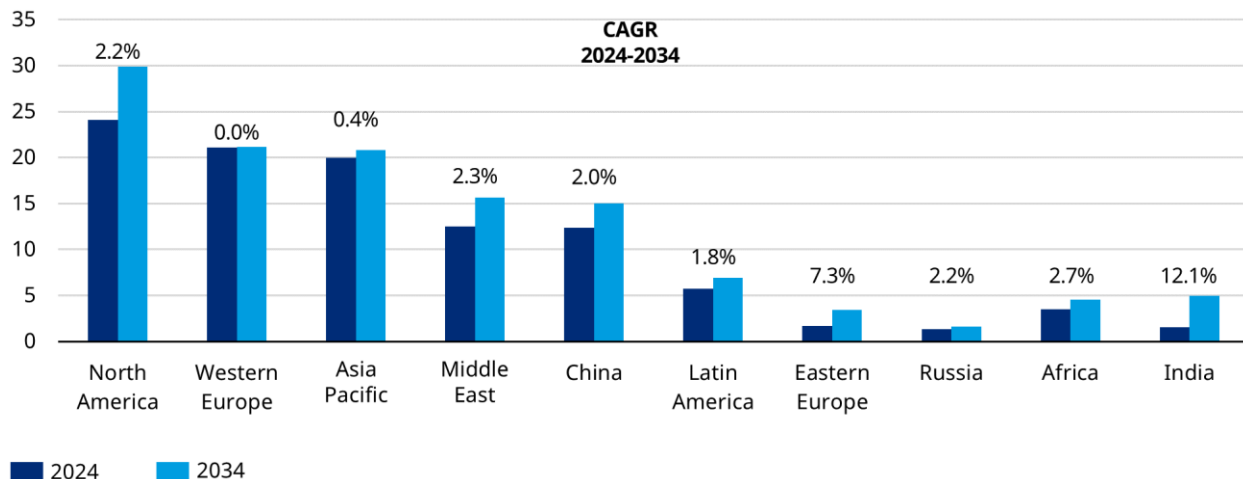
Meanwhile, Africa is benefiting from MRO spending associated with the more than 300 aircraft that will migrate there over the forecast period. Its MRO market will grow by more than \$1 billion in size over the next 10 years to over \$4.5 billion, representing an annual growth rate of 2.7%.

North America and Western Europe will remain the largest regions of the market, although growth in both will be slower than it has been. In 2023, the North American market surpassed its 2019 high of \$25 billion, approaching nearly \$26 billion, just as its fleet did. Western Europe, not having yet quite recovered its fleet, slightly lags its 2019 regional peak by about \$1 billion and experiences growth in 2025 as its fleet grows beyond 2019 size. Both regions feature aging fleets, with re-fleeting leading to maintenance holidays that will suppress market growth throughout the forecast period. Through 2034, North America will see a 2.2% annual growth rate, while Western Europe's market will essentially stay flat.

Latin America and the Caribbean will grow beyond its 2019 high in 2024 and then experience an annual growth rate of 1.8% through 2034. This modest growth rate is driven by the slow recovery of the region's widebody fleet, along with the looming retirements of the regions regional jet fleet.

Exhibit 14: MRO Market Forecast, 2024–2034

US\$ in billions



Note: CAGR stands for compound annual growth rate
Source: Oliver Wyman analysis

UTILIZATION

Market size is determined not only by the number of aircraft flying, but also on how long they are being operated. This makes utilization — the hours and cycles an aircraft is flown — a primary driver of the demand for MRO services. This is the case for engine, component and line maintenance, which are closely tied to utilization. This leaves airframe maintenance — which tends to be driven by calendar limits — and modifications, aligned with fleet management practices.

As fleets recovered beyond 2019 levels, daily utilization of aircraft increased as operators tried to capture the rise in air travel demand. In 2023, total global utilization was more than 7.6 million flight hours, almost 400,000 flights hours from its 2019 total.

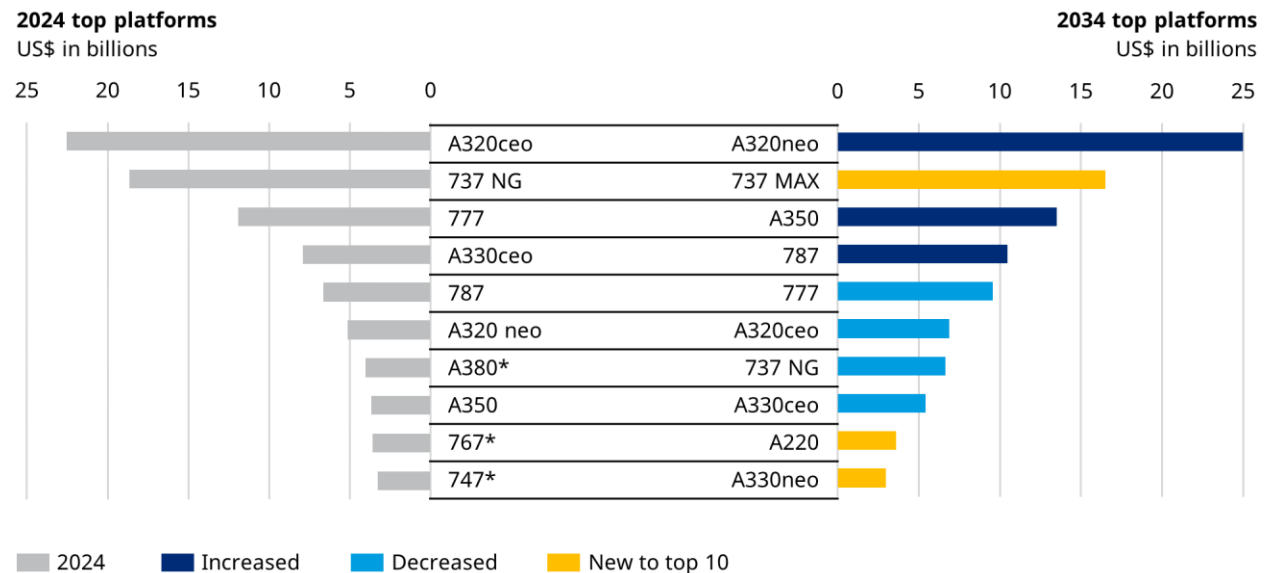
Across all regions, except Asia Pacific, domestic travel utilization is now higher than it was in 2019. The same cannot be said for international travel, with utilization not beyond 90% of 2019 levels in early 2024. Looking forward, utilization will grow at an annual rate of 2.5% and exceed 2019 levels.

PLATFORMS

Over the next 10 years, the MRO market will experience significant shifts in which fleets dominate market share. The workhorses of today, 737NGs and A320neos, will cede the way to the next generation of more fuel efficient 737 MAXs and A320neos. Similarly, for widebodies, next generation technology like the 777, 787, and A350neo will replace the established 767 and A330ceo fleets.

By the end of the forecast period, these fleets will represent over \$65 billion of MRO market spending, or more than half. By 2034, GTF and LEAP engines will grow from just 3.7% of engine demand to nearly 33%. By 2034, the ubiquitous CFM and V2500 engines that power the 737 NG and A320ceo fleets of today will decline from 37% of engine spend to about 9%, as the aircraft they power exit the fleet.

Exhibit 15: Top aircraft platforms by total MRO spend, 2024 actual and 2034 forecast



Note: * Not in 2034 top 10
 Source: Oliver Wyman analysis

OVERVIEWS BY SEGMENT

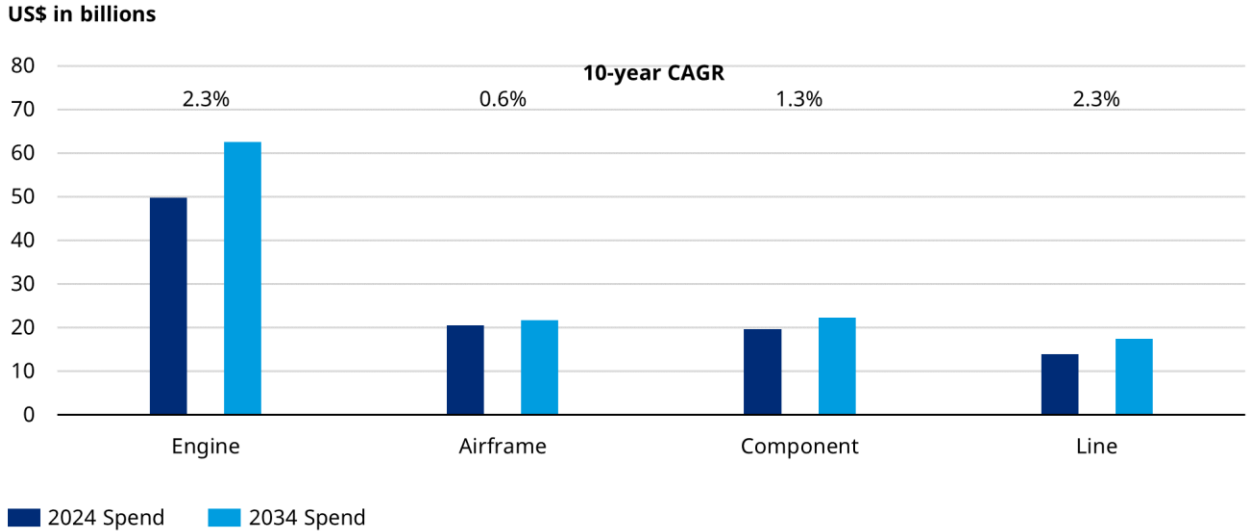
The largest segment of the market, engines, continues its dominance throughout the forecast period with a CAGR of 2.3%. As next-generation engines begin their maintenance cycles, the cost per visit will increase because of the new advanced materials they require. Costs will also be higher while repairs are developed for these engines. Next-generation engines also have yet to match the on-wing performance of their predecessors. They currently experience shorter cycles between shop visits, which make them more expensive to service over the forecast period.

Conversely, airframe MRO represents the slowest growing segment with an annual growth rate of just 0.6%. Airframe maintenance is calendar driven, meaning airlines with new entries into service or newer fleets benefit from maintenance holidays before their aircraft are due for regularly scheduled airframe checks. With so many new entries into service over the forecast, coupled with retiring older fleets that once required larger work packages at each visit, base maintenance will essentially be flat over the forecast period, with many checks on newer entries into service occurring outside the forecast period.

Line maintenance, unlike airframe maintenance, does not benefit from maintenance holidays on new entries into the fleet. This means the line maintenance segment will grow at a similarly strong rate as the engine maintenance market, at a rate of 2.3%. Line maintenance growth, heavily dependent on utilization, closely follows fleet growth.

Component maintenance can be considered a hybrid of maintenance philosophies — with some components, like auxiliary power units, thrust reversers, and landing gear managed like engines, while other parts are highly utilization based and treated more like line maintenance. This results in component maintenance exhibiting slightly smaller growth than engine maintenance, at a CAGR of 1.3%. Component maintenance will reach \$22 billion in 2034.

Exhibit 16: Total MRO demand forecast by segment, 2024 and 2034



Note: CAGR stands for compound annual growth rate
 Source: Oliver Wyman analysis

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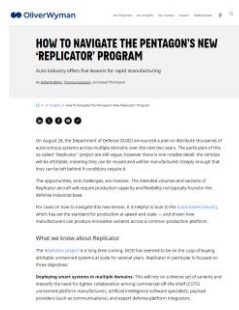
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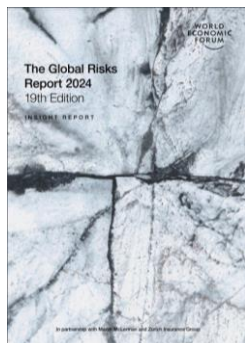
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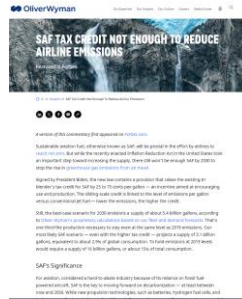
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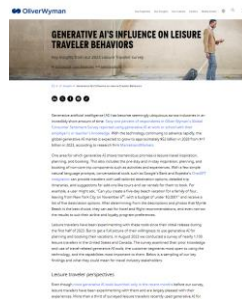
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