Maintenance Cost data eXchange (MCX) - Executive Report

FY2024 Data

FY2024 Data Highlight – 28 Airlines – 2,703 Aircraft

Maintenance Cost ($/FH)	$1,522	Average Fleet Age	10.6
Maintenance Cost ($/FC)	$3,758	Aircraft Utilization (hrs/day)	9.06
Maintenance Cost ($/AC)	$5.05M	Dispatch Reliability (%)	98.86

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Foreword

Dear MCX Member Airlines,

On behalf of IATA, I extend our great appreciation for your continued participation in the IATA Maintenance Cost Data Exchange (MCX) Program. This report represents the second edition since MCX became part of the Global Aviation Data Management (GADM) suite, and it reflects our shared commitment to advancing maintenance cost management across the industry.

Data quality remains our highest priority. Accurate, reliable data is the foundation of meaningful analysis and benchmarking, and we greatly appreciate the diligence of our member airlines in submitting complete and validated information. Your efforts enable MCX to deliver insights that drive operational efficiency and cost optimization.

As we look to the future, **growing the MCX community is essential**. Expanding membership will enhance the depth and diversity of our dataset, making the program even more valuable for all participants. We encourage every member airline to actively engage in this journey by promoting MCX within the industry and inviting peers to join.

Equally important is your participation in the **Maintenance Cost Technical Group (MCTG)**. This forum is where collaboration happens—where members share best practices, influence program development, and help shape the future of MCX. By being fully involved, you not only gain access to richer insights but also benefit from **networking opportunities** that foster partnerships and innovation.

Together, we can ensure MCX continues to evolve as the industry benchmark for maintenance cost management. Thank you for your trust, your partnership, and your commitment to excellence. We look forward to working with you to drive progress and deliver greater value for all.

Chantal Berthiaume

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Introduction

Dear MCX Member Airlines,

The MCX Team is pleased to share the **MCX Executive Report**, providing an in-depth analysis of the maintenance cost data submitted for 2024. This report offers valuable insights into key trends, cost drivers, and benchmarks across regions, aircraft types, and airline groups.

In addition to this report, you can access the **MCX Industry Overview (IO)** and **Operator Benchmark (OB)** dashboards through the GADM Hub on the IATA Customer Portal, enabling deeper exploration and comparison.

We sincerely thank you for your continued participation and support in this initiative. Your contributions are essential to advancing efficiency and competitiveness within the airline industry. We trust that this report will serve as a useful resource to inform your business decisions and strategic planning.

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Disclaimer

This study provides high level benchmarks and does not provide direct cost comparisons. Every Airline operates in a unique environment, e.g., in terms of geographic location, network schedule, fleet type, aircraft age, fleet size, proximity to major OEMs, currency exchange rates, etc. Cost Benchmark is not a science, and no existing normalization is available that allows any form of direct comparisons. In addition, our sample includes Airlines of different size, aircraft size, and operational profile.

Every effort has been made to ensure this report, including the collection of data and publication of the results, complies strictly with all relevant competition laws. This report is only available to the Airlines which participated in the data collection Any use of this report by third parties must first be cleared with IATA.

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Preliminary Remarks

As part of the Aircraft Maintenance Cost Data eXchange (MCX) program, we collect annual maintenance cost data from participating airlines worldwide. The objective of MCX is to provide standardized tools, methodologies, and definitions that enable airlines to accurately assess the cost of maintaining their fleets. This data supports informed decision-making in areas such as new fleet introductions, fleet expansion, "make vs. buy" evaluations, and year-over-year trend analysis.

This report is exclusively distributed to airlines that submitted 2024 data. The MCX program is committed to delivering meaningful insights and encourages your feedback to help enhance future editions. Participation in MCX is open to all commercial airlines seeking to benchmark their fleet maintenance costs – regardless of IATA membership status, size, or business model (full-service/legacy, regional, low-cost, domestic, or international, etc.).

The importance of data quality

Collecting and submitting data requires significant time and effort from MCX airlines, and validating this data is equally demanding on our end to ensure accurate and meaningful benchmarking analysis. When data fails to meet established quality checks, we often need to reach out to airlines for clarification. To keep this initiative viable and trustworthy, maintaining the highest possible data quality is essential.

We kindly remind you to verify the accuracy of your data before submission. To assist you, the MCX Toolset includes built-in validation checks, along with three dedicated tabs – **Summary Tables**, **Summary Graphs**, and **P&O Graphs** – that provide an overview of key metrics (e.g., maintenance cost per flight hour, per flight cycle, or per aircraft). Please note that unscheduled events can significantly impact maintenance costs; therefore, we require comments to explain any unusually high or low figures.

The importance of reporting operational data

While MCX primarily focuses on maintenance costs, operational data – such as flight hours, cycles, ASK, fleet size, and fleet age—as well as personnel and overhead information (e.g., number of mechanics and support staff, time allocation, overhead costs) are equally critical. These data points are essential for calculating unit costs and key performance indicators (KPIs).

We want to emphasize the importance of submitting accurate costs and operational data to ensure precise benchmarking and analysis. High-quality data benefits not only the airline industry as a whole but also your own organization by enabling more informed decision-making.

The importance of data treatment

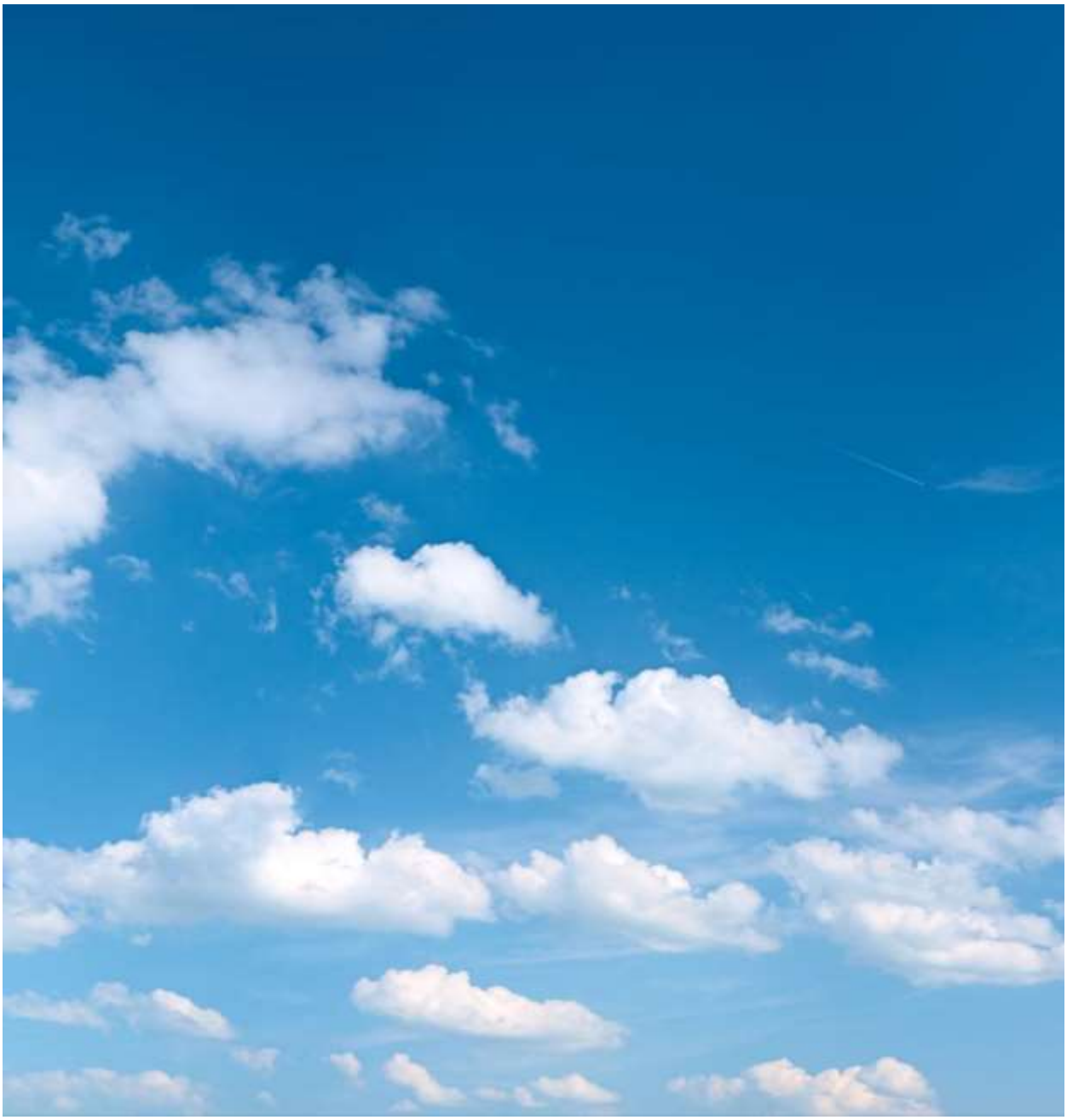
All MCX analyses in this report are based on maintenance cost data provided by airlines through the standardized MCX toolset. No normalization has been applied for factors such as operational severity (e.g., hours-to-cycle ratio, utilization, harsh environments), aircraft age, fleet size and commonality, labor rates, or similar parameters.

Please note that all figures are presented in **USD (U.S. Dollars)**, as most aircraft parts are marketed in this currency. Consequently, exchange rate fluctuations can significantly affect benchmarking results, particularly in cases of major foreign exchange fluctuations or currency devaluation.

Finally, aircraft delivery schedules and the timing of maintenance programs can strongly influence costs – especially when multiple aircraft are delivered within a short timeframe.

Data acceptance

A total of **29 airlines** submitted data for FY2024. However, one airline was excluded from this report because they were unable to finalize their dataset before the report's completion deadline.



Data and Analysis Methodology

IATA's Aircraft Maintenance Cost Data eXchange (MCX) program collects maintenance cost data from participating airlines worldwide on an annual basis. The data presented in this report has been **de-identified** (airline operators are anonymized) and used as reported – without **normalization** – to produce benchmarking insights.

All submitted data was consolidated and analyzed considering multiple factors, including aircraft type, fleet and engine size and models, fleet age, maintenance market segments (line, components, engines, heavy checks, and modifications), cost elements (labor, material, subcontracted work), flight hours, cycles, and geographic region.

For confidentiality, the two-digit airline codes shown in this report are unique identifiers assigned for de-identification purposes. Any resemblance to actual IATA airline codes is purely coincidental. If you do not know your airline's code, please contact us at **mcx@iata.org.**

Typical metrics used in the analysis include **cost per flight hour**, **cost per flight cycle**, and **cost per aircraft**. All cost data is expressed in **USD**, and distance measurements are in **kilometers**.

Definitions & Acronyms

Term or Acronym	Definition
AC	Aircraft
AFI	Africa
Aircraft Category	NB, WB, RJ, TP (defined below)
Aircraft Family	Aircraft communalities (e.g. A320 Family includes A318, A319, A320, A321; 737 NG includes 737-600/700/800/900)
Aircraft Sub-Category	NB, WB2, WB3+, RJ, TP (defined below)
AL	Airline
AME	Africa & Middle East
APU	Auxiliary Power Unit
ASK	Available-Seat Kilometers
ASPAC	Asia Pacific
Cost Elements	Material, labor, engine life limited parts and outside repairs (or outsourced, used interchangeably)
Cost Segments	Line, base, component and engine maintenance
Currency	All amounts in this report are in US$, unless specified otherwise.
DMC	Direct Maintenance Costs
ESV	Engine Shop Visit
EUR	Europe
FC	Flight Cycle
FH	Flight Hour
FTK	Freight Ton Kilometers
IFE	In-Flight Entertainment
LG	Landing Gear
LLP	Life Limited Part
MCTF	Maintenance Cost Task Force (predecessor of MCTG)
MCTG	Maintenance Cost Technical Group
MCX	Maintenance Cost data eXchange program
MR	Maintenance Reserves
MRO	Maintenance, Repair and Overhaul
MTBR	Mean Time Between Removals
NAM	North America
NB	Narrow-body single aisle aircraft with more than 100 seats (excludes Embraer 190/195)
PLF	Passenger Load Factor
PTF	Passenger-to-Freighter
Regions	AME (Africa & Middle East) ASPAC (Asia Pacific) Americas (North & South America) Europe (includes CIS) N. Asia (China, Hong Kong, Macao, Taiwan, Mongolia)
RJ	Regional jets up to 100 seats (includes Embraer 190/195)

RPK	Revenue-Passenger Kilometers
RTS	Return to Service
Supply Chain	Includes all maintenance activities performed by third party (also called "contract maintenance" or "outsourcing") and the cost of material purchased to do work in-house
Total Maintenance Costs	DMC plus overhead costs
TP	Turboprops
TR	Thrust Reversers
Units	K ($#,000) Thousand Mill. ($#,000,000) Million Bill. ($#,000,000,000) Billion
USM	Used Serviceable Material
Utilization	Number of flight hours per aircraft per day (= FH / AC / 365 days)
WB	Wide-body aircraft with more than one aisle or equivalent freighter, combination of WB2 and WB3+
WB2	Wide body aircraft equipped with two engines
WB3+	Wide body aircraft equipped with three or more engines

1. Global Aviation Overview

This chapter provides some context to the MCX analysis by presenting an overview of the airline industry, the global fleet count and MRO spend for 2024.

In 2024, the global fleet count was **33,271** aircraft[1], 85% of which were in service. Globally, airlines spent **$103.9 Billion**[2] on MRO, representing around 11.5% of total airline operational costs and 10.8% of their total revenue.

1.1. Airline Industry Landscape in 2024

In 2024, the aviation industry experienced a robust recovery, driven by strong demand for air travel. Q4 2024 was strong with industry-wide Revenue Passenger-Kilometer (RPK) increasing by 8.0% YoY, outpacing the growth seen in Q3 (Fig. 1). Total passenger traffic reached a record 2.2 trillion RPK in Q4, the highest for any fourth quarter. Seasonally adjusted global RPK rose 2.2% from Q3 2024 to an all-time high.

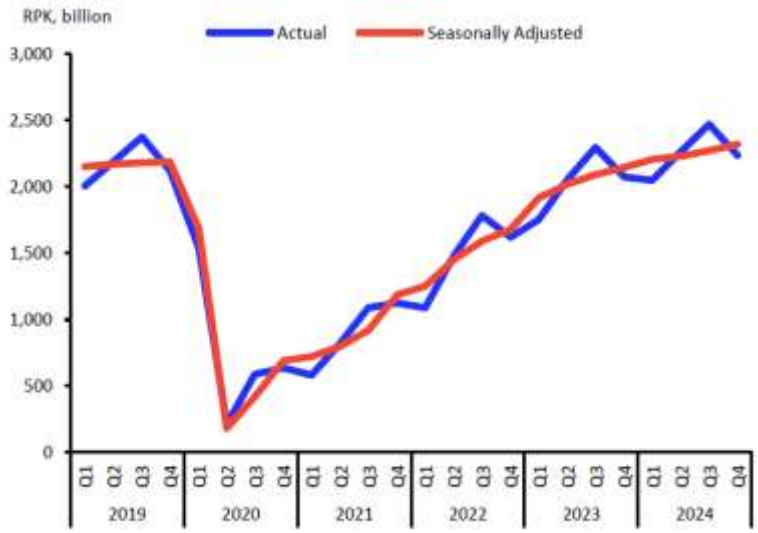


Figure 1 - Industry total RPK, billion (2019-2024)
Source: IATA Sustainability & Economics

[1] **Source: Cirium**
[2] **Source: Oliver Wyman**

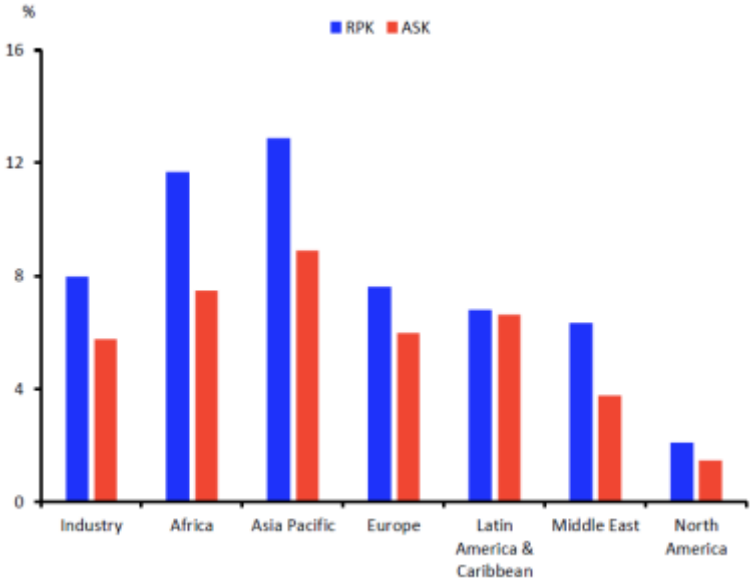


Figure 2 - Total RPK and ASK by airline region of registration, % YoY
Source: IATA Sustainability & Economics

The Passenger Load Factor (PLF), a crucial indicator of air travel demand, reached a new high in Q4 at 83.8%, an increase of 1.7 percentage points over the year. The relatively slower YoY increase in Available Seat-Kilometers (ASK) of 5.8%, coupled with strong demand for air travel, helped push the load factor higher (Fig. 2 & 3). Persistent supply chain issues faced by aircraft manufacturers are curtailing the industry's ability to increase capacity to meet the higher demand. Similar patterns were observed across multiple regions, as growth in RPK outpaced that in ASK, and load factors exceeded those of the previous years.

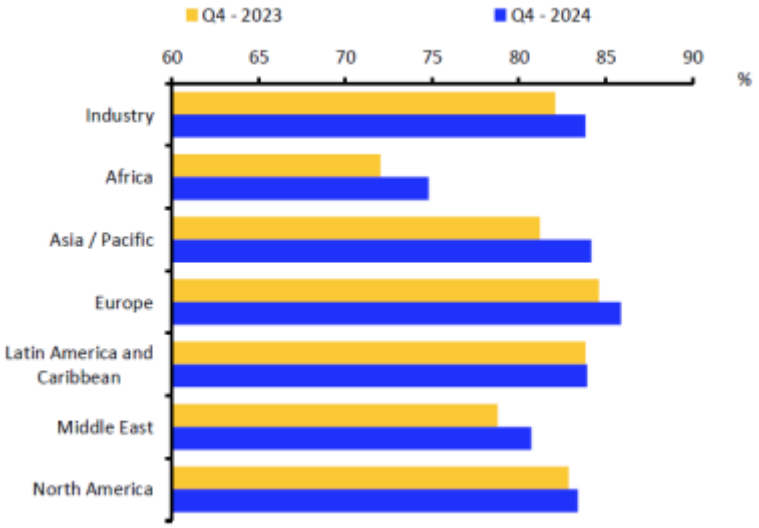


Figure 3 - Passenger load factor by airline region of registration, % of ASK (Q4 2023 vs Q4 2024)
Source: IATA Sustainability & Economics

Global oil demand softened in 2024 due to electrification trends in China and a weaker global economic cycle, while supply remained ample, putting downward pressure on prices. Crude oil averaged USD 81 per barrel (2% lower YoY) and closed the year at USD 75, while jet fuel prices fell 12% YoY to USD 99 per barrel, ending at USD 93.

Average salaries in the airline industry rose by 8% YoY in 2024, marking the fourth consecutive year of growth above 5%, and were 26% higher than in 2019 – nearly catching up with global inflation of 32% over the same period. Despite these trends, the industry continues to struggle with labor shortages, especially among pilots, mechanics, and aircraft maintenance workers. The workforce is aging substantially, and there is a lack of younger workers to replace those who are retiring.

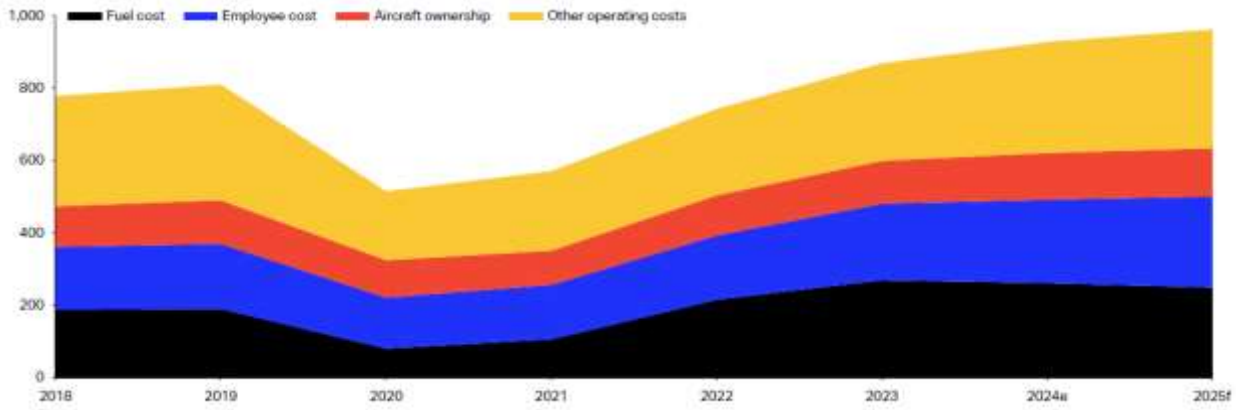


Figure 4 - Breakdown of costs, pre-tax level, USD billion -
Source: IATA Sustainability and Economics using data from Airfinance Global

The global airline industry in 2024 marked a transition from the rapid post-pandemic recovery of previous years to a more stable growth environment. Revenue reached USD 966 billion, up 6.2% from 2023, while expenses grew slightly faster at 6.8%, totaling USD 904 billion. This cost pressure led to a marginal decline in operating margin from 6.9% to 6.4%, and net profit fell to USD 32.4 billion from USD 37.3 billion. Return on invested capital eased to 6.6%, signaling stabilization rather than expansion.

Passenger traffic growth slowed significantly, with RPKs increasing by 10.6% compared to 36.8% in 2023, reflecting the normalization of demand after the pandemic-driven surge. Load factors remained strong, with passenger load factor improving slightly to 83.5%, while cargo volumes rebounded by 11.3% after a decline in 2023. Fuel prices provided some relief, dropping from USD 112 to USD 99 per barrel, though overall cost inflation persisted.

The moderation in growth was influenced by slower global economic expansion (3.3% vs. 3.5%), the fading of pent-up travel demand, and ongoing geopolitical and supply chain challenges. Despite these headwinds, the industry maintained profitability and operational resilience. (Table 1)

	2019	2020	2021	2022	2023	2024
World Economic Growth, % YoY	2.9%	-2.7%	6.6%	3.6%	3.5%	3.3%
REVENUES, USB bn	**838**	**384**	**513**	**738**	**909**	**966**
% Change year-on-year	3.2%	-54.1%	33.4%	44.1%	23.1%	6.2%
EXPENSES, USD bn	**795**	**495**	**556**	**727**	**846**	**904**
% Change year-on-year	3.7%	-37.7%	12.3%	30.8%	16.4%	6.8%
OPERATING PROFIT, USD bn	**43.2**	**-110.8**	**-43.5**	**11.3**	**62.9**	**61.9**
Operating margin, % revenue	5.2%	-28.8%	-8.5%	1.5%	6.9%	6.4%
NET PROFIT, USD bn	**26.4**	**-137.7**	**-40.4**	**-3.5**	**37.3**	**32.4**
Return on Invested Capital, %	5.8%	-19.3%	-8.0%	2.0%	6.9%	6.6%
RPKs, billion	8,688	2,974	3,623	5,974	8,172	9,038
% change year-on-year	4.1%	-65.8%	21.8%	64.9%	36.8%	10.6%
CTKs, billion	254	229	272	250	241	268
% change over year	-3.2%	-9.9%	18.8%	-8.1%	-1.7%	11.3%
Passenger load factor, % ASK	**82.6%**	**65.2%**	**66.9%**	**78.7%**	**82.2%**	**83.5%**
Cargo load factor, % AFTK	46.8%	53.8%	56.1%	49.9%	43.2%	45.9%
Weight load factor, % ATK	70.4%	70.0%	59.5%	61.7%	66.9%	70.2%
Breakeven load factor, % ATK	66.4%	66.4%	76.7%	67.0%	65.8%	65.7%
Jet kerosene price, USD/barrel	80	47	78	139	112	99

Table 1 - Airline Industry Performance (2019-2024) - Source: IATA Sustainability & Economics

1.2. Global Fleet

At the end of 2024, the global fleet[3] reached **33,271 aircraft**, up +1.9% YoY and +8.9% vs. pre-COVID level. Aircraft in service rose to 28,221 (+2.1% YoY) and +3.7% vs. 2019, while the number of aircraft in storage was roughly flat YoY at 5,050, but +51% vs. 2019. (Fig 5)

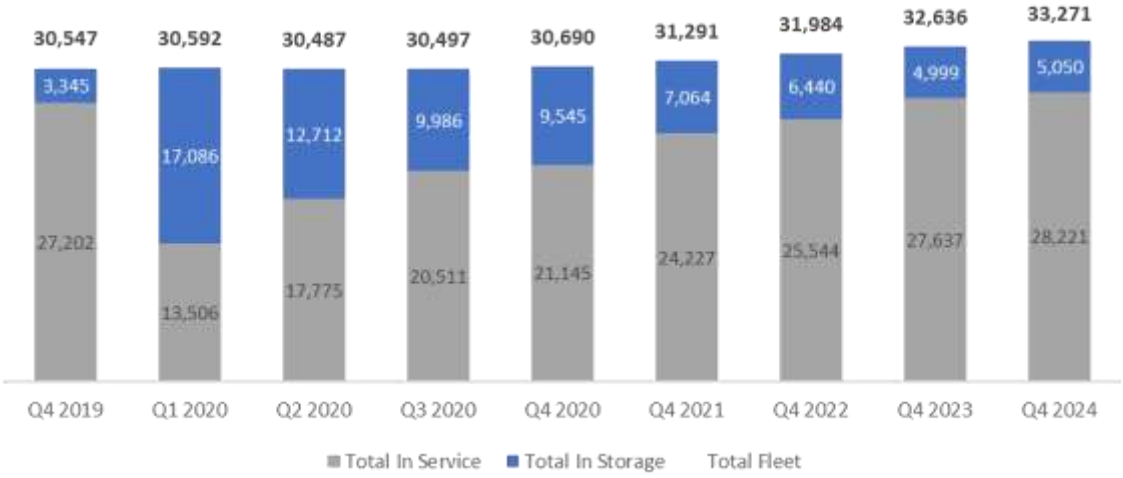
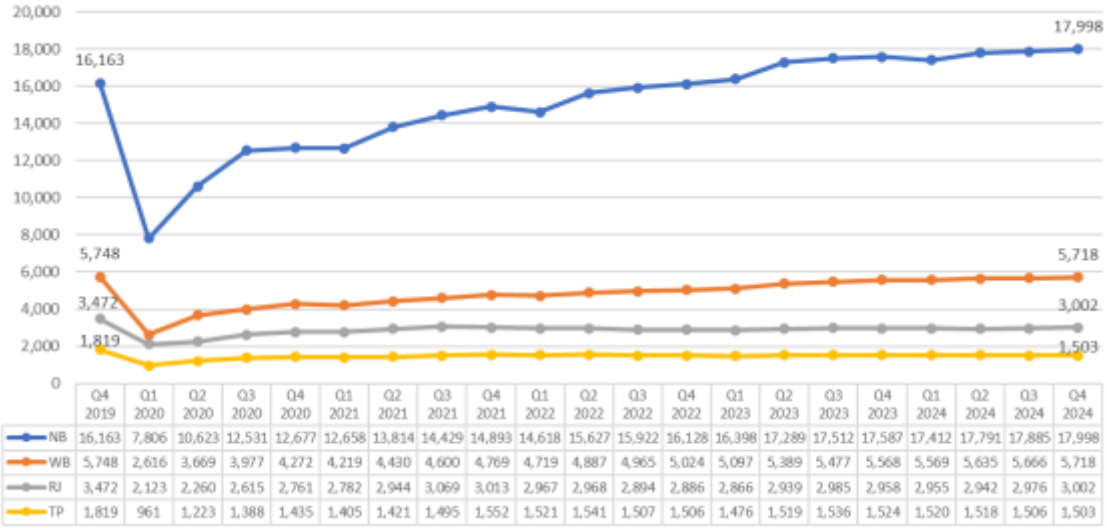


Figure 5 - Global Fleet (Q4 2019-Q4 2024) - Source: Cirium

The share of active aircraft remains steady at 85% in 2024 – unchanged from 2023, yet 4 points below the 89% pre-COVID level – indicating that growth is coming from fleet additions rather than higher activation rates. (Fig. 6)



	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024	Q4 2024
NB	16,163	7,806	10,623	12,531	12,677	12,658	13,814	14,429	14,893	14,618	15,627	15,922	16,128	16,398	17,289	17,512	17,587	17,412	17,791	17,885	17,998
WB	5,748	2,616	3,669	3,977	4,272	4,219	4,430	4,600	4,769	4,719	4,887	4,965	5,024	5,097	5,389	5,477	5,568	5,569	5,635	5,666	5,718
RJ	3,472	2,123	2,260	2,615	2,761	2,782	2,944	3,069	3,013	2,967	2,968	2,894	2,886	2,866	2,939	2,985	2,958	2,955	2,942	2,976	3,002
TP	1,819	961	1,223	1,388	1,435	1,405	1,421	1,495	1,552	1,521	1,541	1,507	1,506	1,476	1,519	1,536	1,524	1,520	1,518	1,506	1,503

Figure 6 - Number of Active Aircraft by Category (Q4 2019-Q4 2024) – Source: Cirium

[3] **Includes western built aircraft in commercial operations (Passenger, Cargo, Combi), consisting of narrowbody, widebody, regional jets and turboprops (ATR42/72 and Q300/400 only).**

Overall, the global fleet is larger and more active than before the pandemic, but with notable differences by aircraft category. Narrowbodies and widebodies have largely recovered, with NB active units well above pre-COVID and WB utilization near 2019 levels, while parked rates remain low at 12% and 13%, respectively. In contrast, regional jets and turboprops continue to lag, with parked ratios of 28% and 27% and active fleets still below pre-pandemic levels despite slight year-over-year improvement. (Fig. 6 & 7)

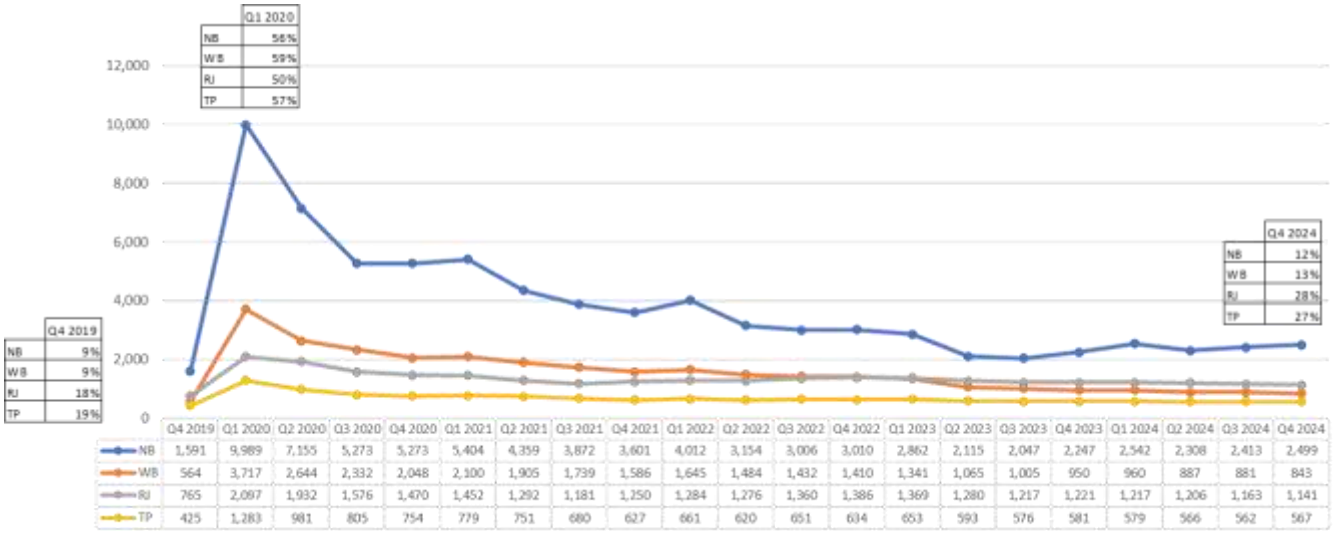


Figure 7 – Number and Percentage of Parked Aircraft by Category (Q4 2019-Q4 2024) – Source: Cirium

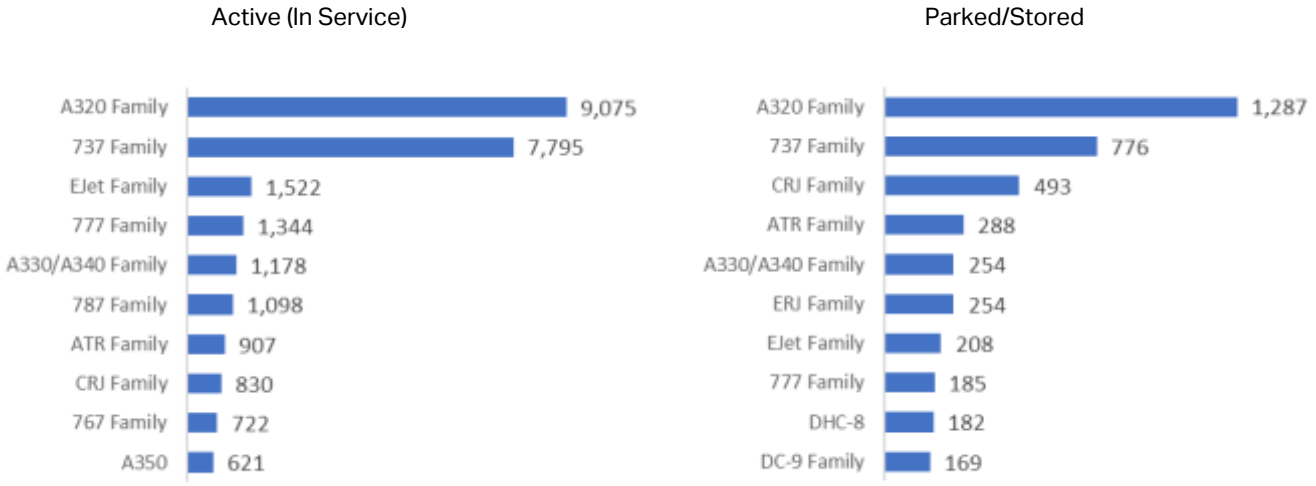


Figure 8 - Top 10 Aircraft Families (2024) - Source: Cirium

In 2024, operational performance continued to strengthen, surpassing both 2023 and pre-COVID levels. Flight Hours per Aircraft (FH/AC) rose to 2,853, up +4.8% from 2023 and slightly above 2019. Flight Cycles per Aircraft (FC/AC)

reached 1,284, a modest +2.6% increase over 2023 but still –4.4% below 2019. Daily utilization also improved, reaching 7.82 hours, up +4.8% from 2023 (7.46) and above the 2019 level of 7.76 hours. (Fig. 8)

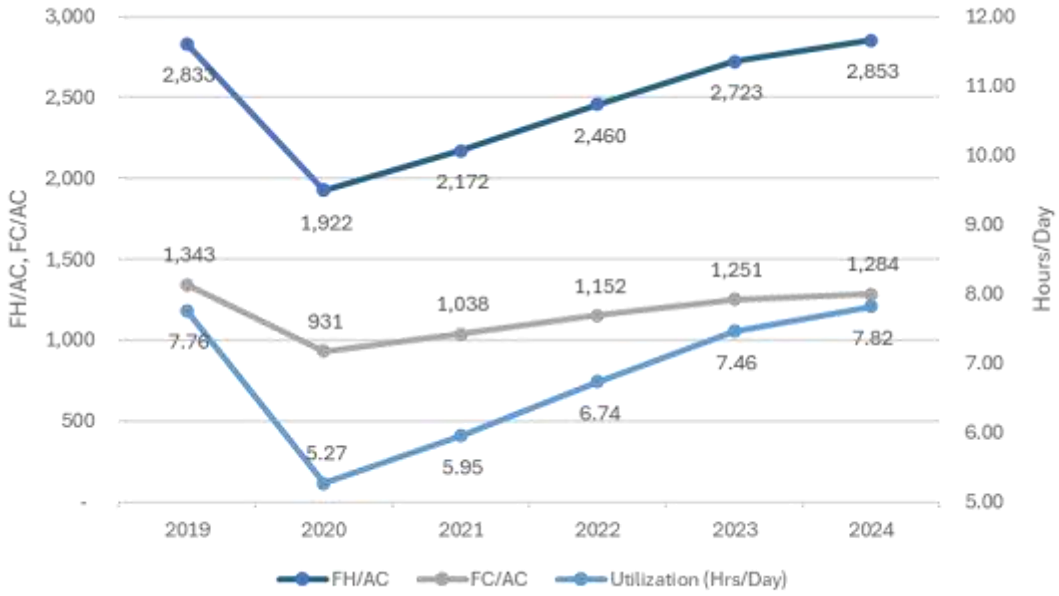


Figure 9 - Global Fleet Statistics (2013 - 2024) - Source: Cirium

Aircraft availability remains severely constrained due to persistent supply chain disruptions and production challenges, with manufacturers still struggling to return to pre-pandemic output levels. Despite global air traffic surpassing 2019 levels, deliveries in 2024 were 30% below their peak, and lead times for new aircraft have stretched to a record 5.3 years, meaning airlines are only now receiving orders placed before 2019. This shortage has driven carriers to rely on the secondary market, where lease rates have surged, and to maximize fleet utilization, achieving record daily usage and passenger load factors. Meanwhile, the global order backlog reached an unprecedented 17,000 aircraft – nearly 50% of the current fleet – requiring 13.5 years to clear at current production rates, pushing new deliveries into the late 2030s and creating significant challenges for short-term capacity planning and cost management.

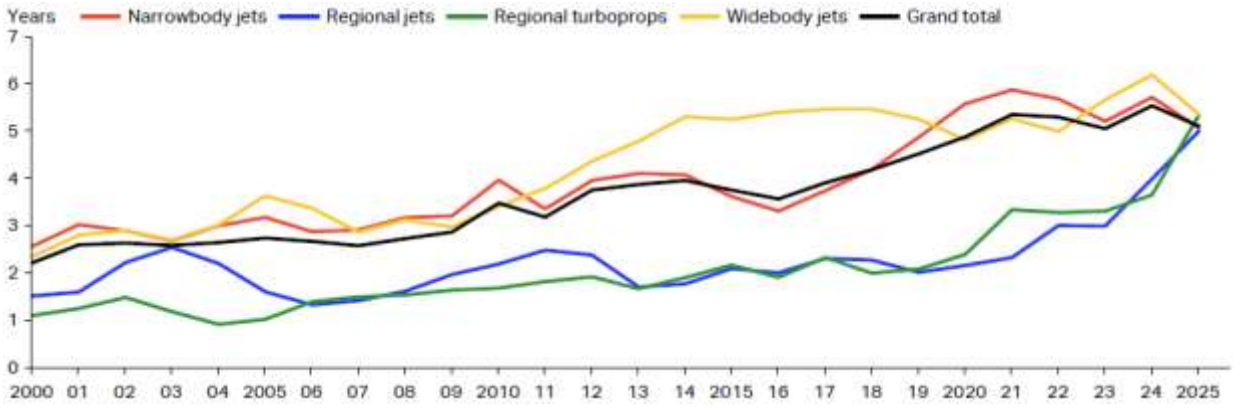


Figure 10 - Aircraft average delivery times in years, by the year of delivery
Source: IATA Sustainability and Economics, Cirium

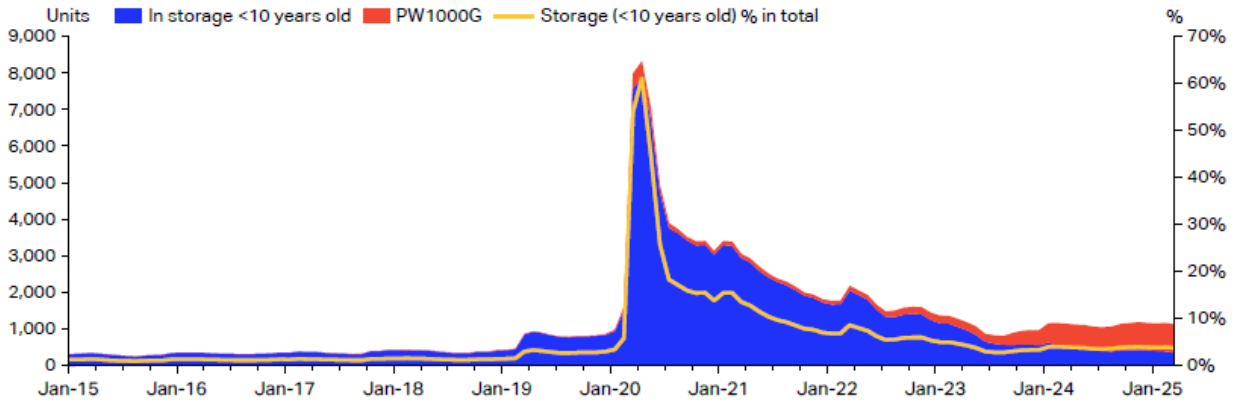


Figure 11 - Number of Aircraft (< 10 years old) in Storage -
Source: IATA Sustainability and Economics using data from Cirium

In addition to the delivery delays, engine problems and a shortage of spare parts exacerbate the situation and have caused record-high groundings of certain aircraft types. The number of aircraft younger than 10 years in storage is currently at more than 1,100, constituting 3.8% of the total fleet compared to 1.3% between 2015 and 2018. A significant portion of these grounded aircraft (69%) are equipped with PW1000G engines. (Fig. 11)

1.3. Global Maintenance, Repair & Overhaul (MRO) Market

Global MRO spend has rebounded strongly, surpassing pre-COVID levels in 2024 ($104B, +11.7% vs 2019) with consistent YoY growth since 2021. The 2034 forecast at $124B (+33.4% vs 2019) points to a steady expansion and durable demand for maintenance as fleets grow and age (Fig. 12). MRO spend represents an increasing share of airline expenses (11.5% in 2024 vs 10% in 2019). (Table 2)

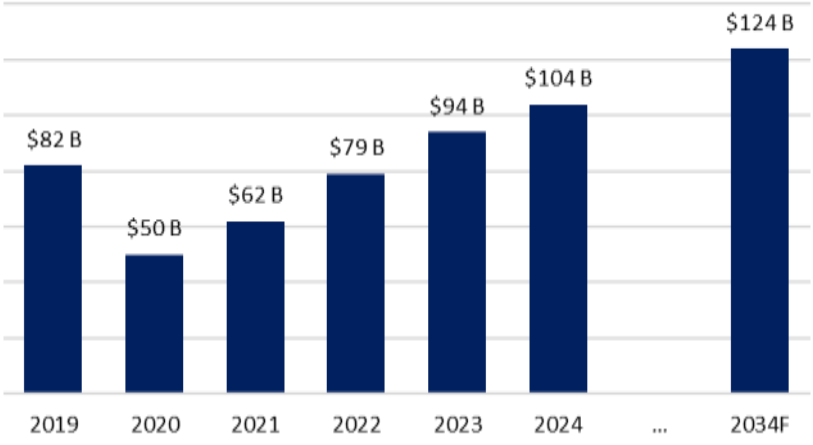


Figure 12 - Global MRO Spend Forecast (2019-2034F) - Source: Oliver Wyman

	2019	2020	2021	2022	2023	2024
Global MRO Spend (US$ Bill.)	82	50	62	79	94	104
% of Global Expenses	10%	10%	11%	11%	11.1%	11.5%
% of Global Revenues	10%	13%	12%	11%	10.3%	10.8%

Table 2 - Global MRO Spend vs Total Expenses and Revenues (2019-2024)
Source: IATA Sustainability & Economics, Oliver Wyman

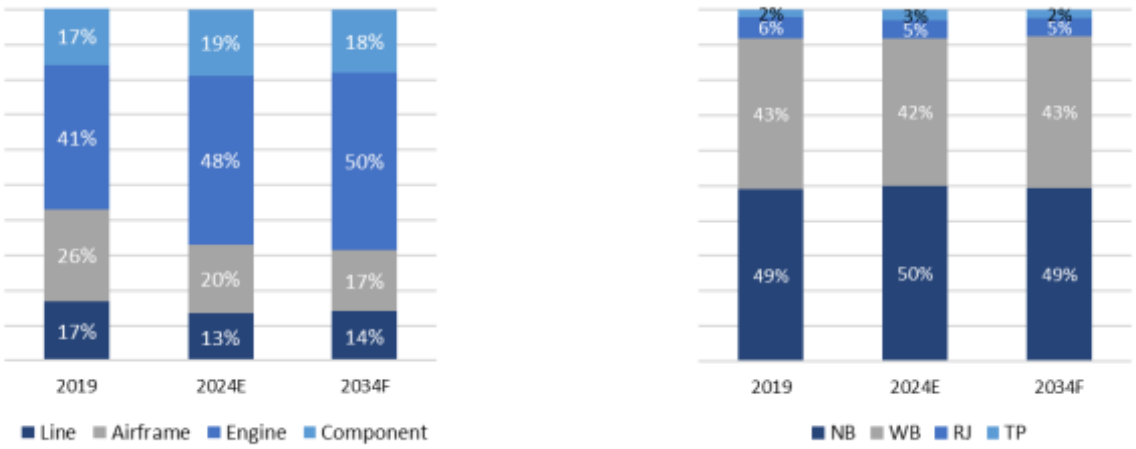


Figure 13– Global MRO Spend by Segment and by Aircraft Category (2019-2024E-2034F) - Source: Oliver Wyman

The global MRO market is driven by both the size of the aircraft fleet and its utilization, measured in flight hours, cycles, and daily activity. Higher utilization translates into increased demand for engine and component maintenance, which rose from 41% and 17% of total MRO spend in 2019 to 50% and 18% in 2024. In contrast, airframe maintenance—more influenced by calendar intervals, aircraft age, and fleet management practices—declined from 26% in 2019 to 17% in 2024. MRO expenditures remain heavily concentrated on widebody aircraft, which represent only 20.3% of the active fleet but account for 42% of total MRO costs, while narrowbody, regional jets, and turboprops drive volume but incur significantly lower spend per unit. (Fig. 13)

2. 2024 MXC Snapshot

Twenty-eight (28) airlines contributed data to the FY2024 cycle. Their fleet comprised a total of **2,703 aircraft** for a total spend[4] of **$13.19 Billion**.

In the following sections, we detail the fleet structure, the direct maintenance costs, personnel and overhead costs, spares and inventory levels as well as the leased fleet and related maintenance reserves.

2.1. Fleet Overview

In this section, we differentiate the total fleet *(i.e. all the aircraft in the airlines' fleets)* from the active fleet *(i.e. the aircraft in operations)*.

2.1.1 Total Fleet

In 2024, the MCX fleet had a total of 2,703 aircraft, which represented 8% of the global fleet. The fleet size of MCX airlines ranged from 1 to over 400+ aircraft.

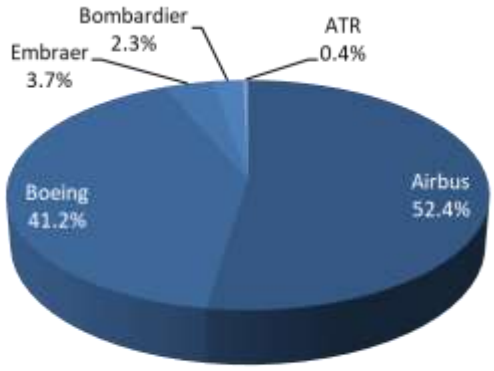


Figure 14 – Total Fleet Distribution by Manufacturer
(2024 – 28 Airlines; 2,703 Aircraft)

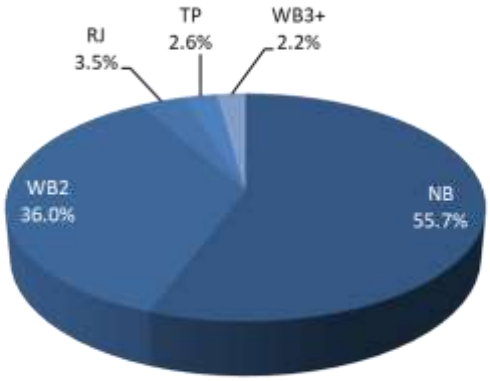


Figure 15 – Total Fleet Distribution by Aircraft Category
(2024 – 28 Airlines; 2,703 Aircraft)

Twelve (12) airlines out of 28 reported both passenger and freighter aircraft. The ratio of passenger and freighter aircraft was 96% and 4% respectively.

The rest of this report is only available to participating airlines.

If your airline is interested in joining the MCX program, please contact us at mcx@iata.org.

[4] Direct maintenance costs + overhead costs

International Air Transport Association
Maintenance Cost data eXchange (MCX) program
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