Airline Maintenance Cost Executive Commentary

FY2023 Data

FY2023 Data Highlight – 27 Airlines – 2,241 Active Aircraft

Maintenance Cost ($/FH)	$1,499	Average Fleet Age	10.6
Maintenance Cost ($/FC)	$3,445	Aircraft Utilization (hrs/day)	8.38
Maintenance Cost ($/AC)	$4.59M	Dispatch Reliability (%)	98.75

JANUARY 2025

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Foreword

Dear MCX Member Airlines,

IATA and I are sincerely thankful for your participation in the IATA Maintenance Cost Data Exchange (MCX) Program. This report marks the second installment since the integration of MCX into the Global Aviation Data Management (GADM) programs suite.

Every year we stride to make improvements to the program and provide additional value to you and your airline. Data quality remains an important focus and we have worked diligently to review all data that has been submitted. We are also committed to improving our toolset to make the data submission process more user-friendly and efficient for you.

As you delve into this report, you will observe that we have meticulously addressed all potential areas of interest. We have gone to great lengths to segment the data into the most detailed levels, ensuring that you have access to comprehensive insights. With the introduction of the new Industry Overview (IO) dashboard last year and the upcoming Operator Benchmark (OB) dashboard set to be available later in 2025, we are confident these tools will provide you with actionable insights, empowering you to make data-driven decisions that optimize maintenance strategies and reduce costs.

IATA, along with the GADM team, remains steadfast in our commitment to establishing the MCX program as an industry beacon for maintenance cost management. We are actively seeking additional participants to ensure comprehensive coverage across all aircraft types and configurations. Your involvement is crucial to our success. If you are interested in supporting us in promoting the MCX program, please do not hesitate to reach out. Together, we can drive significant advancements in maintenance cost optimization for the entire industry.

In closing, I would like to extend my heartfelt gratitude for selecting MCX as your trusted partner and custodian for your maintenance cost data. Your confidence in our program is invaluable, and we are committed to upholding the highest standards of data management and support.

We eagerly anticipate your continued collaboration and support as we work together to drive innovation and excellence in maintenance cost management.

Thank you once again for your trust and partnership.

Chantal Berthiaume

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Introduction

Dear MCX Member Airlines,

The MCX Team is pleased to present the Airline Maintenance Cost Executive Commentary, offering a detailed analysis of the maintenance cost data you submitted for 2023. This report delivers valuable insights into the trends, drivers, and benchmarks of airline maintenance costs across various regions, aircraft types, and airline groups.

In addition to this report, airlines members can access the MCX Industry Overview (IO) Dashboard on the GADM Hub via the IATA Customer Portal.

We would like to thank you for your continued participation and support in this initiative, which is essential for enhancing the efficiency and competitiveness of the airline industry. We hope that you will find this report useful and informative for your business decisions and strategies.

Geraldine Cros

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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.

Although every effort has been made to ensure accuracy, IATA shall not be held responsible for any loss or damage caused by errors, omissions, misprints or misinterpretations of the contents herein. Furthermore, IATA disclaims all warranties of any kind, either expressed or implied, including, but not limited to, implied warranties of satisfactory quality, fitness for a particular purpose, or non-infringement. IATA shall not be liable for any loss which may arise from the use of the information contained in this report.

Preliminary Remarks

As part of the Aircraft Maintenance Cost Data eXchange (MCX) program, we collect data from participating airlines worldwide on an annual basis. The goals of MCX are to provide the tools, methodology and definitions to be able to determine how much it costs an airline to maintain its fleet and be able to use this data in cases of new fleet introduction or expansion, "make vs. buy" decisions, year-over-year trends, etc.

This report is exclusively distributed to airlines that provided data for 2023 as of 31st December 2024. IATA MCX continually endeavors to present meaningful analysis and we encourage you to provide feedback to this report so we can enrich it further in the coming years. MCX data collection is open to all commercial airlines worldwide that would like to benchmark their fleet maintenance costs. MCX membership is not restricted to IATA or non-IATA member airlines or major, domestic, international, low-cost, regional airlines, etc.

The importance of data quality

It takes a fair amount of time for MCX airlines to gather and submit their data, and it takes equally a lot of effort to validate this data in order to deliver the most relevant benchmarking analysis. We often need to contact airlines and ask for clarifications when numbers do not meet the quality checks set. For this initiative to remain viable and reliable, it is critical to focus on the best possible data quality.

We would like to remind you of the importance of ensuring your data is accurate before submitting it. For that purpose, built-in checks are included in the data collection form *(on three tabs: Summary Tables, Summary Graphs and P&O Graphs)* in order to help you get an idea of the main *metrics (e.g. maintenance cost per flight hour, per flight cycle or per aircraft)*. Unscheduled events can cause dramatic impact on maintenance spending; thus we require comments to explain unusually high or low costs.

The importance of reporting operational data

The focus of MCX is on maintenance costs, however operational data *(e.g. flight hours, cycles, ASK, fleet size and fleet age)*, personnel and overheads data *(e.g. number of mechanics and overhead staff, time breakdown, overhead costs, etc.)* are very important to calculate unit costs and KPIs. We would like to draw your attention on the importance of reporting accurate cost data and operational data in order to get accurate benchmarking and analysis for the benefit of the airline industry and your own airline.

The importance of data treatment

All the MCX analyses presented in this report use maintenance cost data as they were provided by the airlines through the standardized IATA toolset. No attempt has been made to normalize the data based on any parameters such as operational severity *(hours to cycle ratio, utilization, harsh environment, etc.)*, aircraft ageing, fleet size and commonality, labor rate, etc.

Additionally, it should be noted that the analysis is done in USD (US Dollars) as most of the aircraft parts are marketed in USD; therefore, currency exchange rates may play a significant role in benchmarking maintenance costs, especially when substantial foreign exchange fluctuations and/or currency devaluation take place.

Finally, the aircraft delivery schedule and the periodicity of the maintenance program can strongly influence costs, especially when many aircraft were delivered within a short timeframe.

The acceptance of data

Twenty-nine (29) airlines reported data for FY2023, however two (2) airlines were excluded from this report, as they were not able to finalize their datasets at the closing time for completion of this report.

Data and Analysis Methodology

IATA's Aircraft Maintenance Cost Data eXchange (MCX) program collects maintenance cost data from airlines worldwide on an annual basis. MCX Airlines are the carriers who participate in the annual data collection.

The data contained herein has been coded (operators are deidentified) and used as reported (i.e. without any normalization) to create this benchmark report.

All airline data have been consolidated then analyzed while considering the aircraft type, fleet and engine size and models, fleet age, maintenance market segments *(line, components, engines, heavy checks and MOD)* and elements *(labor, material, subcontracted work)*, flight hours, cycles and geography.

All data presented in this report is de-identified. The two-digit airline codes shown in this report are unique codes given to the participating airlines for de-identification purposes. Although some of these codes may match real IATA airline codes, this is merely a coincidence. If you do not know your airline's code, please contact us at mcx@iata.org.

Typical metrics used include cost per flight hour, cost per departure, cost per aircraft. The cost data unit is USD and the length unit is Kilometer.

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 Picture

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 2023.

In 2023, the world fleet count was **32,654** aircraft[1], 85% of which were in service. Globally, airlines spent **$93.9 Billion**[2] on MRO, representing around 11% of total airline operational costs and 10% of their total revenue.

1.1. Airline Industry Landscape in 2023

In 2023, the aviation industry experienced a robust recovery, driven by strong demand for air travel. Passenger markets saw significant growth, with the industry achieving a **36.9%** year-on-year (YoY) increase. Traffic, measured in revenue passenger-kilometers (RPKs), reached **94.1%** of 2019 levels, a significant increase from **68.7%** in 2022. (Fig. 1).

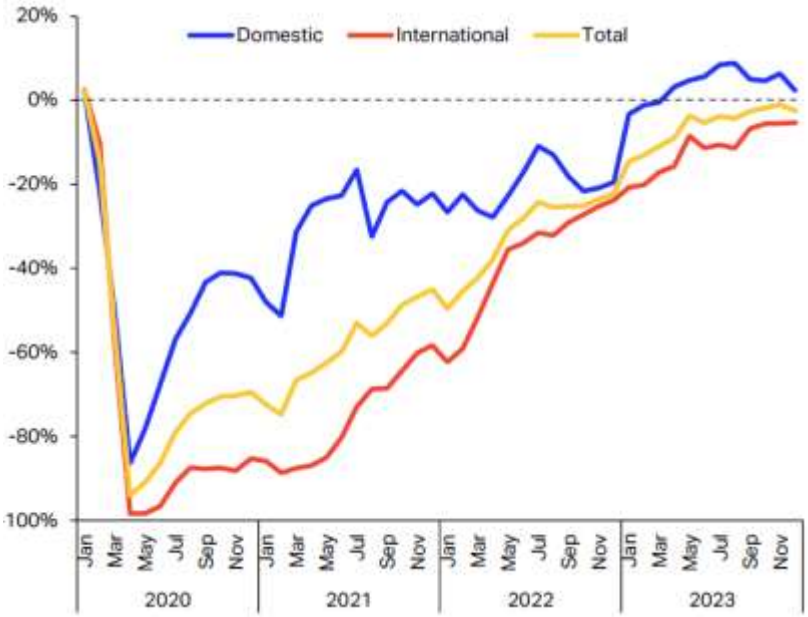


Figure 1 - Global domestic and international RPKs, YoY% change vs.2019
Source: IATA Sustainability & Economics

Seat supply slightly outpaced travel demand compared to pre-pandemic 2019, resulting in an industry-wide load factor of **82.3%**, just 0.3 percentage points lower than in 2019. Industry seat capacity, measured in available seat kilometers (ASKs), grew by **24.1%** from December 2022, reaching 97.5% of pre-pandemic levels. Passenger load factors (PLF) remained close to 2019 levels, with industry-wide seat occupation 0.8 percentage points higher than the previous year and consistent with December 2019 figures. (Fig. 2)

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

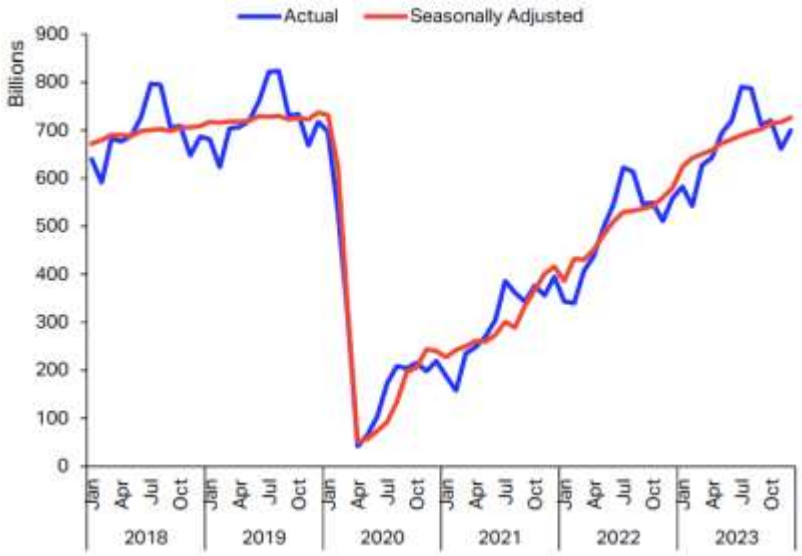


Figure 2 - Global ASKs in billion per month (2018-2023)
Source: IATA Sustainability & Economics

This trend was observed across most regions, indicating a global alignment between air travel demand and airline seat capacity. However, Asia Pacific and North American carriers experienced slightly lower load factors compared to December 2019, due to seat supply outpacing passenger numbers in China and US domestic markets. Europe led the regions, surpassing December 2019 PLF by 2.1 percentage points as RPKs exceeded pre-pandemic levels by 2.0% for the first time since 2020. (Fig.)

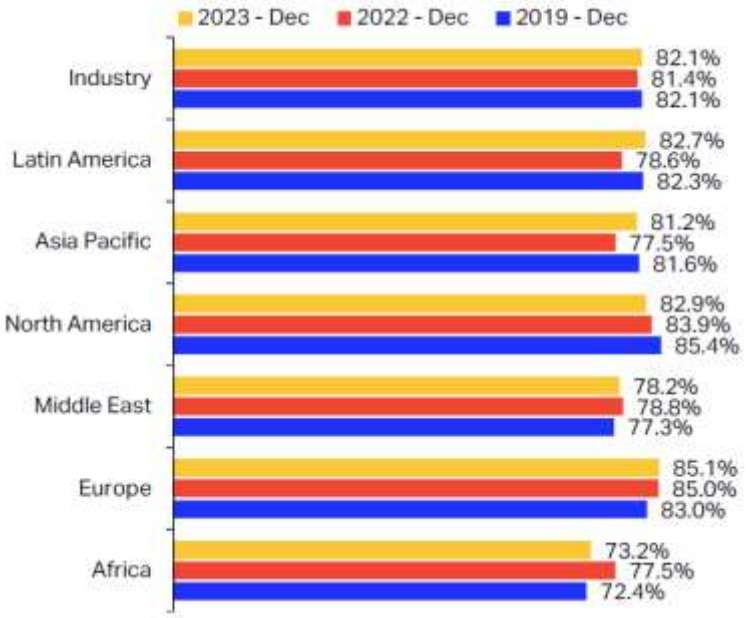


Figure 3 - Passenger load factors, by airline region of registration % share of ASKs (Dec 2019 – Dec 2023)

The industry bounced back to profitability, just three years after experiencing a historic loss of nearly USD 140 billion in 2020. This remarkable turnaround highlights the industry's resilience, adaptability, and dedication. Total airline revenue has reached 108% of 2019 levels, with operating profits amounting to **USD 52 billion** in 2023. (Table 1)

	2019	2020	2021	2022	2023E
REVENUES, USB bn	**838**	**384**	**513**	**738**	**908**
% Change year-on-year	3.2%	-54.1%	33.4%	44.1%	23.0%
EXPENSES, USD bn	**795**	**495**	**556**	**727**	**856**
% Change year-on-year	3.7%	-37.7%	12.3%	30.8%	17.7%
OPERATING PROFIT, USD bn	**43.2**	**-110.8**	**-43.5**	**11.2**	**52.2**
Operating margin, % revenue	5.2%	-28.8%	-8.5%	1.5%	5.7%
NET PROFIT, USD bn	**26.4**	**-137.7**	**-40.4**	**-3.5**	**27.4**
Return on Invested Capital, %	5.8%	-19.3%	-8.0%	2.0%	5.7%
RPKs, billion	8,688	2,974	3,623	5,974	8,271
% change year-on-year	4.1%	-65.8%	21.8%	64.9%	36.6%
CTKs, billion	254	229	272	250	241
% change over year	-3.2%	-9.9%	18.8%	-8.1%	-3.7%
Passenger load factor, % ASK	**82.6%**	**65.2%**	**66.9%**	**78.7%**	**82.0%**
Cargo load factor, % AFTK	46.8%	53.8%	56.1%	49.9%	43.2%
Weight load factor, % ATK	70.4%	70.0%	59.5%	61.7%	66.9%
Breakeven load factor, % ATK	66.4%	66.4%	76.7%	67.0%	65.8%
Jet kerosene price, USD/barrel	79.7	46.6	77.8	135.6	112.2

Table 1 - Airline Industry Performance (2019-2023) - Source: IATA Sustainability & Economics

1.2. Global Fleet

In 2023, the world fleet consisted of a total of **32,654** aircraft (active and parked). This includes western built aircraft in commercial operations (Passenger, Cargo, Combi), consisting of narrowbody, widebody, regional jets and turboprops (ATR42/72 and Q300/400 only). Eighty five percent (85%) of the fleet was active compared to 44% in Q1 2020 and 89% in Q4 2019. (Fig. 4)

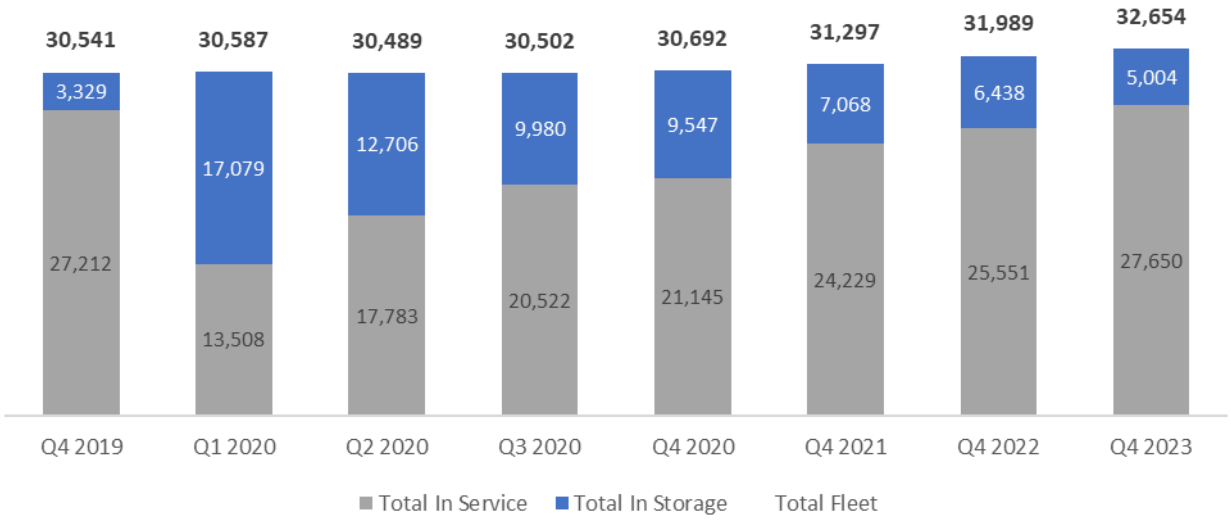
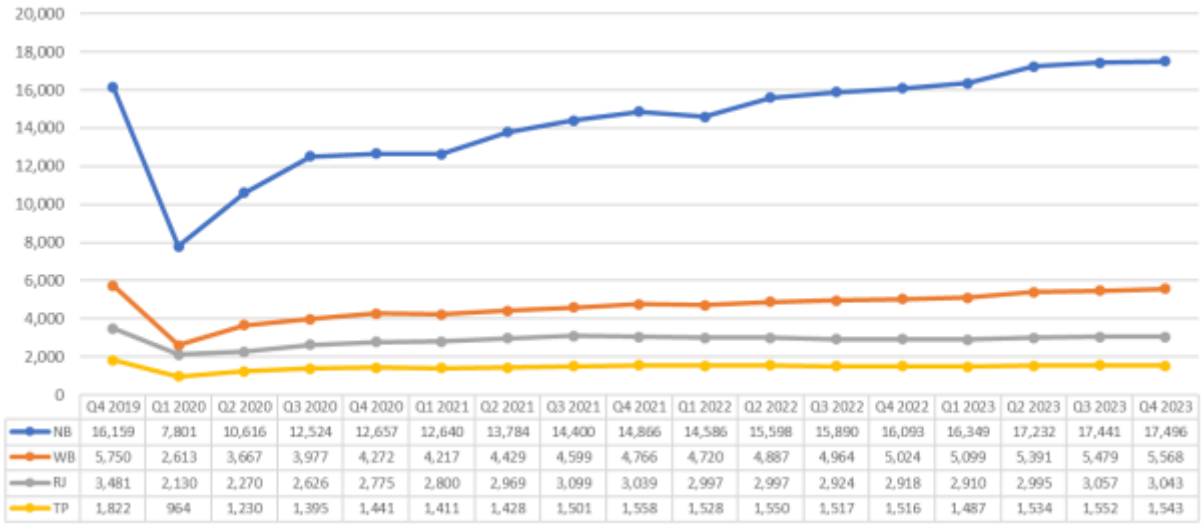


Figure 4 - Global Fleet (Q4 2019-Q4 2023) - Source: Cirium

Despite a significant reduction in the number of parked aircraft since 2020, the figures are still elevated compared to pre-COVID levels. The in-service fleet is primarily composed of narrowbody aircraft, with widebody aircraft also making a comeback. However, the demand for regional jets and turboprops remains low, with 29% and 27% of these fleets parked at the end of 2023, compared to 18% and 19% before the pandemic.



	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
NB	16,159	7,801	10,616	12,524	12,657	12,640	13,784	14,400	14,866	14,586	15,598	15,890	16,093	16,349	17,232	17,441	17,496
WB	5,750	2,613	3,667	3,977	4,272	4,217	4,429	4,599	4,766	4,720	4,887	4,964	5,024	5,099	5,391	5,479	5,568
RJ	3,481	2,130	2,270	2,626	2,775	2,800	2,969	3,099	3,039	2,997	2,997	2,924	2,918	2,910	2,995	3,057	3,043
TP	1,822	964	1,230	1,395	1,441	1,411	1,428	1,501	1,558	1,528	1,550	1,517	1,516	1,487	1,534	1,552	1,543

Figure 5 - Number of Active Aircraft by Category (Q4 2019-Q4 2023) – Source: Cirium

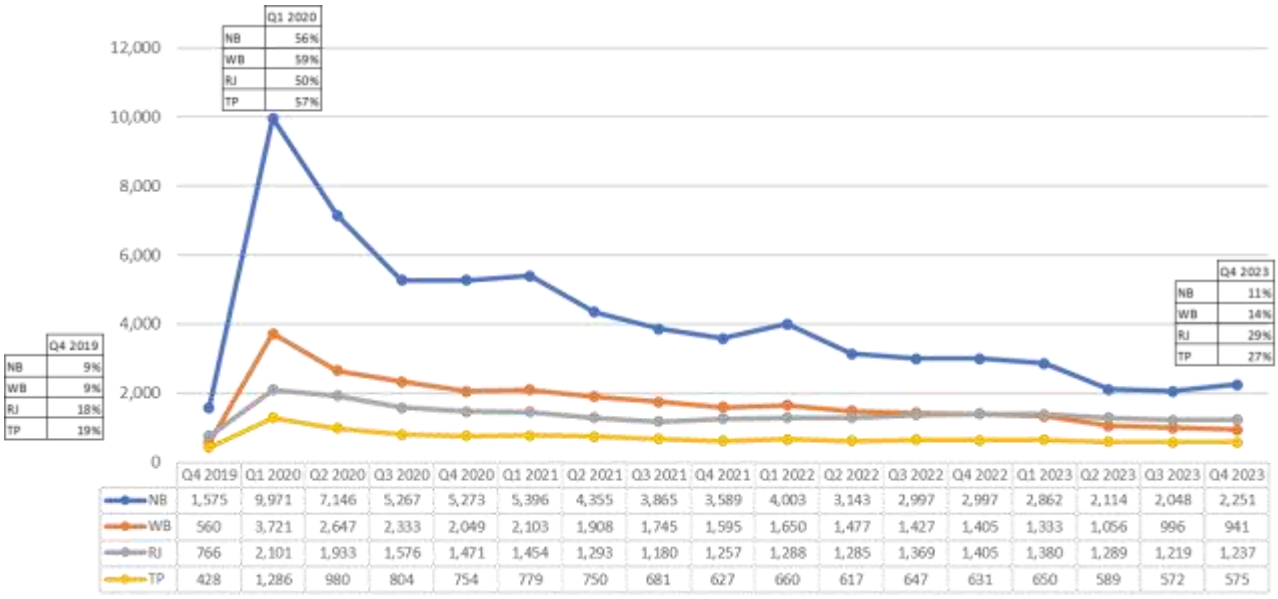


Figure 6 – Number and Percentage of Parked Aircraft by Category (Q4 2019-Q4 2023) – Source: Cirium

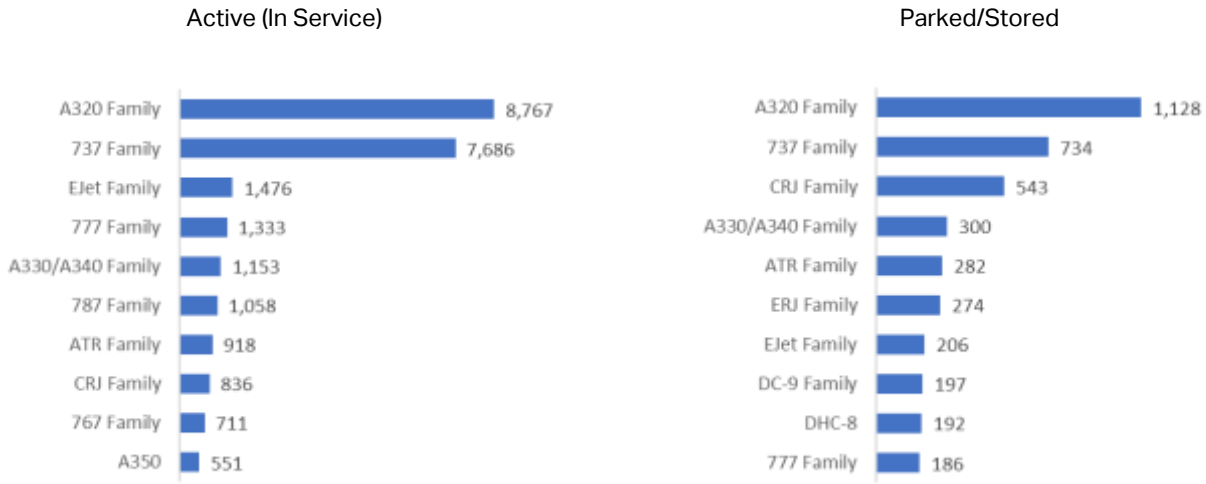


Figure 7 - Top 10 Aircraft Families (2023) - Source: Cirium

The fleet statistics *(flight hours per aircraft, flight cycles per aircraft and aircraft utilization)* continued to increase in 2023. Aircraft utilization notably reached **7.6 hours per day**, achieving 98% of the 2019 level. (Fig. 8)

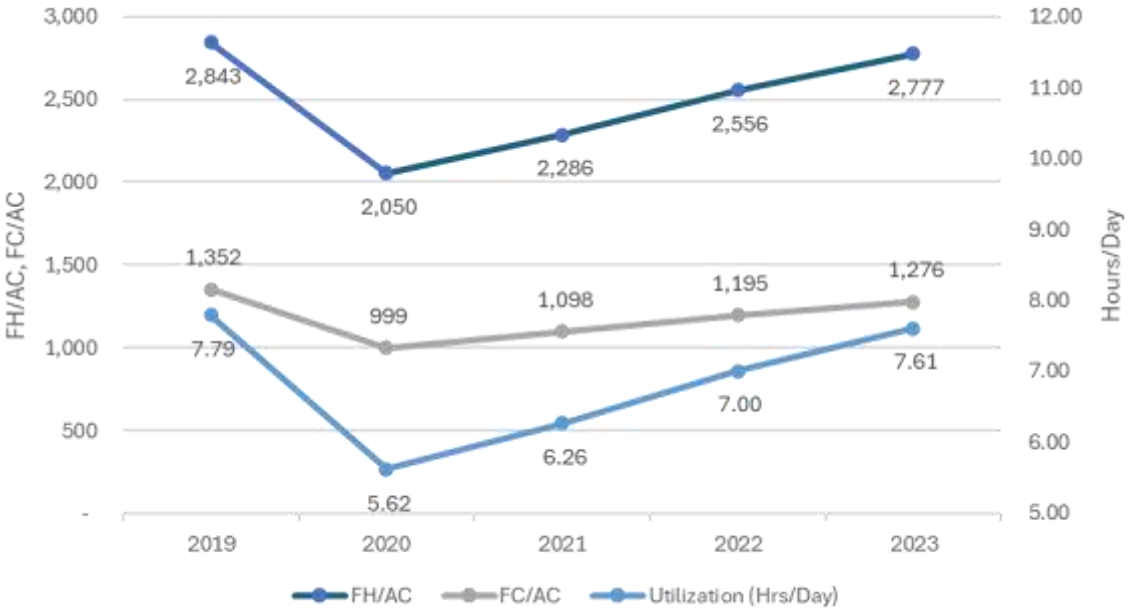


Figure 8 - Global Fleet Statistics (2013 - 2023) - Source: Cirium

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

In 2023, the global MRO market reached $94 billion, just 2% shy of the 2019 peak of $95 billion. The MRO sector still faces significant challenges after three difficult years marked by the pandemic, an overwhelmed supply chain, inflation, and the ongoing conflict in Ukraine. Similar to the broader global economy, the MRO sector is grappling with labor shortages and supply chain disruptions, which are major constraints as deferred maintenance on fleets comes due.

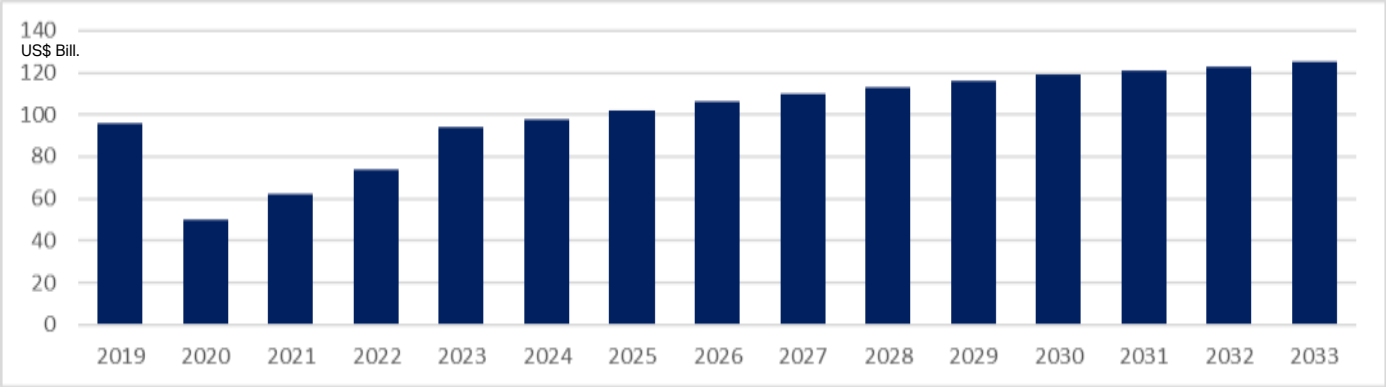


Figure 9 - Global MRO Spend Forecast (2019-2033) - Source: Oliver Wyman

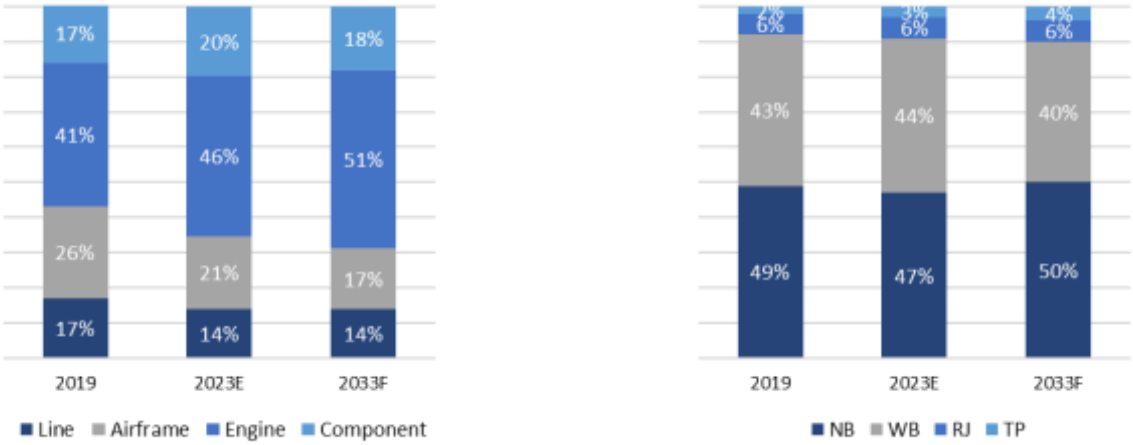


Figure 10– Global MRO Spend by Segment and by Aircraft Category (2019-2023E-2033F) - Source: Oliver Wyman

	2019	2020	2021	2022	2023
Global MRO Spend (US$ Bill.)	95	56	66	79	94
% of Global Expenses	12%	11%	12%	11%	11%
% of Global Revenues	11%	15%	13%	11%	10%

Table 2 - Global MRO Spend vs Total Expenses and Revenues (2019-2023)
Source: IATA Sustainability & Economics, Oliver Wyman

2. 2023 Snapshot

Twenty-seven (27) airlines contributed data to the FY2023 cycle. Their fleet comprised a total of **2,307 aircraft** for a total spend[3] of **$11.67 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 2023, the MCX fleet had a total of 2,307 aircraft, which represented 7% of the global fleet. The fleet size of MCX airlines ranged from 1 to over 300+ aircraft.

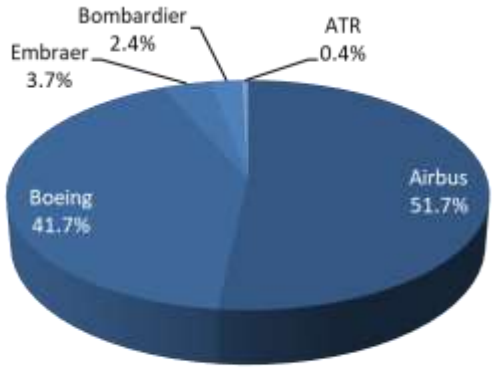


Figure 11 – Total Fleet Distribution by Manufacturer
(2023 – 27 Airlines; 2,307 Aircraft)

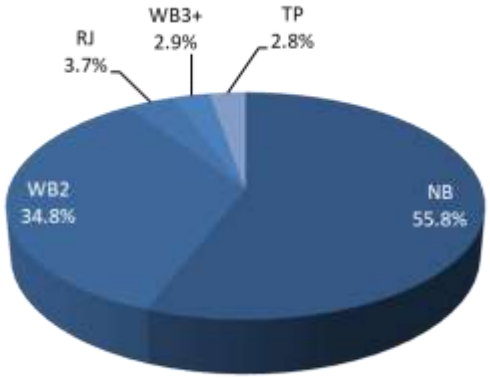


Figure 12 – Total Fleet Distribution by Aircraft Category
(2023 – 27 Airlines; 2,307 Aircraft)

Eight (8) airlines out of 27 reported both passenger and freighter aircraft. The ratio of passenger and freighter aircraft was 94% and 6% respectively

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

If your airline would like to join the MCX program, please contact us at mcx@iata.org.

[3] Direct maintenance costs + overhead costs

International Air Transport Association
Maintenance Cost data eXchange (MCX) program
mcx@iata.org
www.iata.org/mcx