AIRLINE MAINTENANCE COST
EXECUTIVE COMMENTARY

An Exclusive Benchmark Analysis (FY2014 data)
by IATA’s Maintenance Cost Task Force
This report contains data and information that is available only to airlines that provided data and, as such, has been removed from this "public" version.

To participate in the next Maintenance Cost Task Force (MCTF) data collection, please contact us at mctf@iata.org.
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Preliminary remarks

Maintenance Cost Task Force (MCTF) collects maintenance cost data from airlines worldwide on an annual basis. The goals of MCTF 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 the data in cases of new fleet introduction or expansion, “make vs. buy” decisions, year-over-year trends, etc.

This report contains data and information that is available only to airlines that provided data and, as such, has been removed from this “public” version.

We are doing our maximum to present meaningful analysis and we encourage you to provide feedback on this report so we can improve it again next year.

THE IMPORTANCE OF DATA QUALITY

It takes a fair amount of time for MCTF airlines to gather and submit data, and it takes a lot of effort to validate this data in order to deliver the most relevant benchmark 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 deal with the best possible data quality. That’s why we would like to remind you of the importance of making sure your data are accurate before submitting it. For that purpose, built-in checks are included in the data collection form (on two tabs: Summary Tables and Summary 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 spend, that is why we need also as many comments to explain unusually high or low costs.

THE IMPORTANCE OF REPORTING OPERATIONAL DATA

The focus of MCTF is clearly on maintenance costs but operational data (e.g. flight hours, cycles, ASK, fleet size and fleet age) are very important to calculate unit costs and KPIs. For example, only 25% of MCTF airlines reported ASK in the past four years, preventing us from having a sample statistically large enough to calculate one of the most basic KPIs of the airline industry: CASK (cost per ASK).

We would like to draw your attention on the importance of reporting accurate cost data and operational data in order to get the best benchmark data and analysis possible for the benefit of the airline industry and your own airline.

THE IMPORTANCE OF DATA TREATMENT

All the MCTF analyses presented in this report use maintenance cost data as they were provided by the airlines through the standardized IATA toolset. No attempt was used 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 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 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 period of time.

THE ACCEPTANCE OF DATA

This report analyzes and comments data from 51 airlines. Due to late submission, insufficient data and poor data quality, a few other airlines’ data was excluded from the analysis and report.

MCTF data collection is open to all commercial airlines worldwide that would like to benchmark their cost to maintain their fleet. MCTF does not discriminate between IATA and non-IATA member airlines. MCTF does not discriminate between major, domestic, international, low-cost, regional airlines, etc.
IATA’s Maintenance Cost Task Force (MCTF) collects maintenance cost data from airlines worldwide on an annual basis.

MCTF Airlines are the carriers which participate in the annual data collection. 51 airlines reported data for FY2014, and 23 airlines provided data consistently over the past five years (FY2010-2014). Airline maintenance cost submitted past the deadline and data that did not pass the quality checks and subsequent questions were excluded from this report. If needed, contributing airlines are contacted to clarify the reported data. The data are then coded (operators are de-identified) and used as reported (i.e. without any normalization) to create this benchmark report.

All airline data are consolidated and then analyzed considering 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 are 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 mctf@iata.org.

Typical metrics include: cost per flight hour, cost per departure, cost per aircraft. Next year, we plan to expand the benchmark using cost per ASK (metric that relates closer to the financial performance of the airline than the above listed).

All cost data unit is US dollar, and length unit is kilometer.

The goals of MCTF 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 the data in cases of new fleet introduction or expansion, “make vs. buy” decisions, year-over-year trends, etc.
<table>
<thead>
<tr>
<th>Definitions &amp; Acronyms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC</strong>                  Aircraft</td>
</tr>
<tr>
<td><strong>AFTK</strong>                Available Freight Tonne Kilometers</td>
</tr>
<tr>
<td><strong>Aircraft Category</strong>   NB, WB, RJ, TP (defined below)</td>
</tr>
<tr>
<td><strong>Aircraft Sub-Category</strong> NB, WB2, WB3+, RJ, TP (defined below)</td>
</tr>
<tr>
<td><strong>Aircraft Family</strong>     Aircraft communalities (e.g. A320 Family includes A318, A319, A320, A321; 737 NG includes 737-600/700/800/900)</td>
</tr>
<tr>
<td><strong>AL</strong>                  Airline</td>
</tr>
<tr>
<td><strong>APU</strong>                 Auxiliary Power Unit</td>
</tr>
<tr>
<td><strong>ASK</strong>                 Available-Seat Kilometers</td>
</tr>
<tr>
<td><strong>Cost Elements</strong>       Material, labor and outside repairs (or outsourced or subcontracted, used interchangeably)</td>
</tr>
<tr>
<td><strong>Cost Segments</strong>       Line, base, component and engine maintenance</td>
</tr>
<tr>
<td><strong>Currency</strong>            All amounts in this report are in US$, unless specified otherwise.</td>
</tr>
<tr>
<td><strong>Utilization</strong>         Number of flight hours per aircraft per day (= FH/AC/365 days)</td>
</tr>
<tr>
<td><strong>DMC</strong>                 Direct Maintenance Costs</td>
</tr>
<tr>
<td><strong>ESV</strong>                 Engine Shop Visit</td>
</tr>
<tr>
<td><strong>FLF</strong>                 Freight Load Factor</td>
</tr>
<tr>
<td><strong>FTK</strong>                 Freight Tonne Kilometers</td>
</tr>
<tr>
<td><strong>LG</strong>                  Landing Gear</td>
</tr>
<tr>
<td><strong>LLP</strong>                 Life Limited Part</td>
</tr>
<tr>
<td><strong>MCTF</strong>                Maintenance Cost Task Force</td>
</tr>
<tr>
<td><strong>MENA</strong>                Middle East &amp; North Africa</td>
</tr>
<tr>
<td><strong>MR</strong>                  Maintenance Reserves</td>
</tr>
<tr>
<td><strong>MTBR</strong>                Mean Time Between Removals</td>
</tr>
<tr>
<td><strong>NB</strong>                  Narrow-body single aisle aircraft with more than 100 seats (excludes Embraer 190/195)</td>
</tr>
<tr>
<td><strong>PLF</strong>                 Passenger Load Factor</td>
</tr>
<tr>
<td><strong>Regions</strong>             Africa (Sub-Saharan Africa), ASPAC (Asia Pacific), MENA (Middle East &amp; North Africa), Americas (North &amp; South America), Europe (includes CIS), N. Asia (China, Hong Kong, Macao, Taiwan, Mongolia)</td>
</tr>
<tr>
<td><strong>RPK</strong>                 Revenue-Passenger Kilometers</td>
</tr>
<tr>
<td><strong>TR</strong>                  Thrust Reversers</td>
</tr>
<tr>
<td><strong>Units</strong>               K ($#,000) Thousand M ($#,000,000) Million B ($#,000,000,000) Billion</td>
</tr>
<tr>
<td><strong>WB</strong>                  Widebody aircraft with more than one aisle or equivalent freighter, combination of WB2 and WB3+</td>
</tr>
<tr>
<td><strong>WB2</strong>                 Widebody aircraft equipped with two engines</td>
</tr>
<tr>
<td><strong>WB3+</strong>                Widebody aircraft equipped with three or more engines</td>
</tr>
</tbody>
</table>

**Total Maintenance Costs**: DMC plus overhead costs

**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.
Global Picture

This section provides some context to the MCTF analyses in other sections by presenting an overview of the airline industry, the world fleet count and the Maintenance, Repair and Overhaul (MRO) market for 2014. The industry performed better in 2014, with a net post-tax profit of $19.9 billion, compared to $10.6 billion in 2013.

In 2014, the world fleet count was 24,597 aircraft, with 76% of the fleet manufactured by Boeing or Airbus. Globally, airlines spent $62.1 billion on MRO, representing around 9% of total operational costs.
1.1. Airline Industry Landscape in 2014

Aviation has an immeasurable impact on the world we live in, connecting people and cultures, creating opportunities and facilitating economic progress. 2014 was a relatively strong year for the airline industry.

Collectively, the airlines had a net post-tax profit of $19.9 billion (Fig. 1), a 2.7% margin on revenues. This improves on the 2013 results of $10.6 billion profit (1.6% margin). The improvement was achieved through a combination of improving global economic conditions, which supported stronger growth in passenger and air freight demand. Lower fuel costs also helped, but due to hedging, some airlines have experienced a delay in seeing the benefits of the fall in fuel prices. Jet fuel prices fell significantly during 2014, starting the year at $130 per barrel and finishing it at $75 per barrel.

The average for the year was $114.8 / bbl, 6% lower than the 2013 average price of $124.5 / bbl (Fig. 2). However, the strengthening of the US$ over other world currencies does not allow all airlines to benefit from the lower fuel prices (or other costs, e.g. aircraft leasing, maintenance) denominated in US$.

Passenger ancillary revenues continued to play an increasing role in the industry. Revenues from added-value services improved from $42.6 billion in 2013 to $49.9 billion in 2014, or more than $15 per passenger.

RPKs between regions of the world grew at an accelerated rate in 2014, expanding by 6% compared to 5.4% in 2013. The pick-up in the growth trend reflects increasing demand through improvements in the global economic backdrop.

Fig. 1: Industry Net Profits
Source: IATA WATS 2015

Fig. 2: Jet Fuel Price per Barrel
Annual average
Source: IATA WATS 2015
Even so, airlines have continued with disciplined capacity management. The growth in available seat kilometers (ASK) has been 6.4%, only slightly stronger than the expansion in RPKs (Fig. 3).

More than 32.5 million scheduled flight services were provided in 2014, a 2.2% increase on the previous year. Correspondingly, the number of seats rose 4.7% to 4.4 million.

Passenger load factors remained close to 2013’s record high at 80%. This is the result of an increase in passenger volumes, coupled with disciplined capacity management, particularly in mature markets like the US domestic and the North Atlantic.

Break-even load factors came down even further in 2014 (63.7% vs 64.5% in 2013) because of lower fuel prices and the positive impact of increasing ancillary revenues on yields. In addition, consolidation and capacity management boosted load factors achieved.

Cargo markets showed solid improvement in 2014. The cyclical upturn in the global economy helped boost confidence and international trade, and support stronger demand in air freight.

Sources:
IATA WATS (2015)
Fig. 3: RPK Growth by Route Area
Source: IATA WATS 2015
1.2. World Fleet

In FY2014, the world fleet count was 24,597 aircraft*. 76% of this fleet was manufactured by Boeing or Airbus. In the last decade, airlines introduced 6,665 aircraft to their fleet, broken down as follows: 56% NB, 18% RJ, 16% WB and 11% TP. TPs include only ATR42/72 and Q300/400.

---

* Excludes all non-western built aircraft
Most popular aircraft are the Airbus A320s. However, if 737 Classics and NGs are combined, the Boeing 737s have a very narrow lead.

<table>
<thead>
<tr>
<th>Aircraft Family</th>
<th>Utilization (Hours/Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A320 Family</td>
<td>5,880</td>
</tr>
<tr>
<td>737 NG</td>
<td>5,054</td>
</tr>
<tr>
<td>777</td>
<td>1,234</td>
</tr>
<tr>
<td>A330</td>
<td>1,092</td>
</tr>
<tr>
<td>737 Classic</td>
<td>982</td>
</tr>
<tr>
<td>767</td>
<td>808</td>
</tr>
<tr>
<td>757</td>
<td>781</td>
</tr>
</tbody>
</table>

Fig. 7: Popular Aircraft Families (2014)
Source: ACAS3 (July 2015)

Fig. 8: World Fleet Statistics (2004-2014)
Source: ACAS3 (July 2015)
**T. 1: Jan 2015 vs Jan 2014**

<table>
<thead>
<tr>
<th>Region</th>
<th>RPK</th>
<th>ASK</th>
<th>PLF</th>
<th>FTK</th>
<th>AFTK</th>
<th>FLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRICA</td>
<td>-0.9%</td>
<td>0.4%</td>
<td>68.1%</td>
<td>5.2%</td>
<td>2.4%</td>
<td>27.8%</td>
</tr>
<tr>
<td>ASIA/PACIFIC</td>
<td>4.2%</td>
<td>5%</td>
<td>76.8%</td>
<td>6.9%</td>
<td>5.4%</td>
<td>51.7%</td>
</tr>
<tr>
<td>EUROPE</td>
<td>4.9%</td>
<td>4.3%</td>
<td>76.6%</td>
<td>-1.2%</td>
<td>3.6%</td>
<td>43.4%</td>
</tr>
<tr>
<td>LATIN AMERICA</td>
<td>5.6%</td>
<td>4%</td>
<td>81.9%</td>
<td>-6.4%</td>
<td>-2%</td>
<td>36.5%</td>
</tr>
<tr>
<td>MIDDLE EAST</td>
<td>10.8%</td>
<td>12.8%</td>
<td>80%</td>
<td>9.2%</td>
<td>18.1%</td>
<td>38.6%</td>
</tr>
<tr>
<td>NORTH AMERICA</td>
<td>2.6%</td>
<td>4.4%</td>
<td>79.4%</td>
<td>-1%</td>
<td>-2.6%</td>
<td>35%</td>
</tr>
<tr>
<td>TOTAL MARKET</td>
<td>4.6%</td>
<td>5.2%</td>
<td>77.7%</td>
<td>3.2%</td>
<td>4.1%</td>
<td>42.8%</td>
</tr>
</tbody>
</table>

**T. 1b: 2014 vs 2013:**

<table>
<thead>
<tr>
<th>Region</th>
<th>RPK</th>
<th>ASK</th>
<th>PLF</th>
<th>FTK</th>
<th>AFTK</th>
<th>FLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRICA</td>
<td>0.3%</td>
<td>2.5%</td>
<td>68.4%</td>
<td>6.7%</td>
<td>0.9%</td>
<td>30.7%</td>
</tr>
<tr>
<td>ASIA/PACIFIC</td>
<td>7.1%</td>
<td>7.5%</td>
<td>77.2%</td>
<td>5.4%</td>
<td>5.7%</td>
<td>55.4%</td>
</tr>
<tr>
<td>EUROPE</td>
<td>5.6%</td>
<td>5.2%</td>
<td>80.8%</td>
<td>2%</td>
<td>3%</td>
<td>46.9%</td>
</tr>
<tr>
<td>LATIN AMERICA</td>
<td>6.4%</td>
<td>4.1%</td>
<td>79.8%</td>
<td>0.1%</td>
<td>0.3%</td>
<td>41.8%</td>
</tr>
<tr>
<td>MIDDLE EAST</td>
<td>12.6%</td>
<td>11.5%</td>
<td>78.4%</td>
<td>11%</td>
<td>11.1%</td>
<td>44.5%</td>
</tr>
<tr>
<td>NORTH AMERICA</td>
<td>2.7%</td>
<td>2.4%</td>
<td>83.6%</td>
<td>2.4%</td>
<td>-0.5%</td>
<td>35.3%</td>
</tr>
<tr>
<td>TOTAL MARKET</td>
<td>5.5%</td>
<td>5.6%</td>
<td>79.7%</td>
<td>4.9%</td>
<td>3.7%</td>
<td>45.7%</td>
</tr>
</tbody>
</table>

PLF increased from 79.5% in 2013 to 79.7% in 2014. The average utilization in 2014 was 7.79 hours per day, a 0.3% decrease vs 2013, and an 8.3% increase vs 2004. All figures in the tables are expressed in % change year on year, except for PLF and FLF which are the load factors for the specific month.
1.3. Maintenance, Repair and Overhaul (MRO) Market

Global MRO spend in 2014 was valued at $62.1 billion, excluding overhead. This represented around 9% of total operational costs.

With a 3.8% increase per annum, the market size is estimated to reach $90 billion in 2024.
DEVELOPING TRENDS AND TECHNOLOGIES IN MAINTENANCE

- Aircraft health monitoring systems and big data: e-aircraft are constantly monitoring and transmitting faults and warnings for a more dynamic planning and check scheduling

- New technologies: mobile devices, wearables (e.g. Google Glass) and real-time video transmission for front-line support, e-logbooks for paperless operations, drones and/or sensors for remote inspections

- Predictive maintenance is estimated to increase aircraft availability by up to 35%

- Composite repair capabilities

- Additive manufacturing (3-D printing) is continuously growing, reducing lead times, increasing part availability, optimizing parts and saving weight.

These innovations are estimated to decrease MRO spending by 15 to 20% but first, the market needs to innovate with a clear vision and strategy.

It is critical to identify opportunities and isolate the most promising ones, then develop an innovation process to transform these opportunities into pilot projects and market roll-outs.

Sources:
IATA Economics (June 2015)
IATA Airline Cost Management Group (August 2015)
ICF International Global MRO Forecast (Jan 2015)
FY2014 Snapshot — 51 Airlines

This section provides the overview of FY2014 data reported by 51 airlines worldwide. The MCTF airlines operated 4,216 aircraft in 2014, of which more than 85% were Boeing and Airbus aircraft. Technical Division spend totaled $17.6 billion of which $15 billion was Direct Maintenance Cost and $2.5 billion for Overhead.
2.1. Fleet Overview

In FY2014, the MCTF fleet had 4,216 aircraft, which represented 17% of the world's fleet.

The MCTF airline fleet size ranged from 1 to 630 aircraft with an average fleet age of 9.5 years. They flew a total of 13.5 million flight hours and 5.6 million flight cycles. 13 airlines operated both passenger and freighter aircraft, 1 airline operated freighters only.
Boeing (including McDonnell-Douglas) and Airbus are overrepresented in MCTF fleet. They account for 86% of MCTF fleet vs 76% of worldwide fleet. On the contrary, Bombardier and ATR have a combined share of 4.3% of MCTF fleet vs 13.5% worldwide. (Fig. 12). More details on MCTF fleet vs Worldwide Fleet in Annex I.

As shown in Fig. 13, narrowbody aircraft (NB) were the most popular aircraft (50% of 51 MCTF airlines' fleet) with 3,098 flight hours per aircraft and 1,555 flight cycles per aircraft on average. In 2014, widebody aircraft represented 36% of the fleet with an average age of 10.4 years (vs. 9.8 years for NB). Each widebody aircraft (WB) flew on average 3,867 hours and performed 802 cycles (Table 3). Regional (RJ) and Turboprop (TP) fleets are underrepresented in the MCTF analysis because reporting carriers mostly have larger aircraft.
MCTF airlines operated 26 different aircraft families in 2014. Figure 14 represents only the Top 15 aircraft families with a minimum of 3 operators and 5 aircraft, and a total of 3,856 aircraft (91% of MCTF total fleet). Some populous aircraft types have been removed because they did not meet the ‘3 operators / 5 aircraft’ rule. The rest of the fleet (not shown here) is mostly composed of mature to old fleet types that will be retired in a near future.

Table 3: Operational Data by Aircraft Category (FY2014—51 Airlines)

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Airlines</th>
<th>Avg Age</th>
<th>Utilization</th>
<th>FH / AC</th>
<th>FC / AC</th>
<th>FH / FC</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB</td>
<td>2,110 A / C</td>
<td>44</td>
<td>9.8</td>
<td>8.5</td>
<td>3,098</td>
<td>1,555</td>
</tr>
<tr>
<td>WB2</td>
<td>1,287 A / C</td>
<td>33</td>
<td>10.4</td>
<td>10.6</td>
<td>3,863</td>
<td>837</td>
</tr>
<tr>
<td>RJ</td>
<td>394 A / C</td>
<td>14</td>
<td>6.2</td>
<td>7.1</td>
<td>2,607</td>
<td>1,878</td>
</tr>
<tr>
<td>WB3+</td>
<td>244 A / C</td>
<td>11</td>
<td>10.1</td>
<td>10.7</td>
<td>3,890</td>
<td>620</td>
</tr>
<tr>
<td>TP</td>
<td>182 A / C</td>
<td>14</td>
<td>5.3</td>
<td>5.5</td>
<td>2,015</td>
<td>2,002</td>
</tr>
</tbody>
</table>
2.2. Maintenance Cost Analysis

In FY2014, MCTF airlines reported a total of $17.6 billion for their Technical Division spend: this is $15 billion for Direct Maintenance Cost (reported by 48 airlines) and $2.5 billion for Overhead (reported by 41 airlines). $15 billion represent almost 24% of the world MRO spend for 17% of the world fleet. This may be explained by the fact that MCTF fleet is skewed towards higher gauge aircraft (36% WB in MCTF fleet vs 20% in world fleet).

They employed a total of 30,064 mechanics (reported by 29 airlines) and 18,276 OH staff (reported by 43 airlines). Staffing and overhead (OH) are analyzed separately in Section 2.2.3.

2.2.1. Direct Maintenance Spend

The 51 MCTF airlines reported $15 billion for their direct maintenance costs, the average maintenance cost was $295 million per airline, $1,087 per flight hour, $2,681 per flight cycle and $3.6 million per aircraft.

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost / Airline</td>
<td>$295M</td>
<td>$0.95M</td>
<td>$2.2B</td>
</tr>
<tr>
<td>Cost / Flight Hour</td>
<td>$1,087</td>
<td>$287</td>
<td>$2,841</td>
</tr>
<tr>
<td>Cost / Flight Cycle</td>
<td>$2,681</td>
<td>$465</td>
<td>$11,937</td>
</tr>
<tr>
<td>Cost / Aircraft</td>
<td>$3.6M</td>
<td>$0.67M</td>
<td>$9.3M</td>
</tr>
</tbody>
</table>

Fig. 15: Evolution of Direct Maintenance Cost Structure by Segment (FY2010 & FY2014)

Table 4: Direct Maintenance Cost - Unit Costs (FY2014 — 51 Airlines)
Engine remains the highest cost segment with 39% of maintenance costs (Fig. 15). Over the past five years, base maintenance has decreased from 20% to 15%.

Contract maintenance (indicated as ‘SubC’ for subcontracted) continued to grow and reached a new high with 68% of total direct maintenance spend (Fig. 16); 13 airlines indicated that they subcontracted all their maintenance activities (Fig. 17).

As shown in Figure 18, the majority of airlines continue subcontract the entirety of their engine work as shown. 0% mostly reflects the absence of any engine overhaul for FY2014.
Figure 19 shows that, although most airlines keep line maintenance in-house, an increasing number is contracting out the work.
2.2.2. Direct Maintenance Spend by Aircraft Category

Table 5: Fleet Count vs Maintenance Costs by Aircraft Category (FY2014 — 51 Airlines)

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Table 7:
Operational Data by Aircraft Family (FY2014 — 23 Airlines)

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2.2.3. Personnel & Overhead

For a better understanding of Technical Division’s costs, it is important to consider not only the direct maintenance cost but also the personnel and overhead (P&O) data. For FY2014, 41 airlines provided P&O data, at different levels of completion. This section presents some benchmarks based on the available data.

Fig. 22: Technical Division Cost Breakdown (FY2014 — 41 Airlines)

Fig. 23: Technical Division Staff by categories in 2015 (FY2014)
Fig. 24:
Technical Division
Cost Breakdown
(FY2014 — 41 Airlines)

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Fig. 25:
Number of mechanics per Aircraft vs % DMC SubContracted
(FY2014 — 27 Airlines)

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2.3. Aircraft Leasing & Maintenance Reserves (Supplemental Lease)

Over the years, the share of aircraft under operational lease has stabilized around 40% of the world fleet. (Fig. 28)
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Fig. 30: 
% of Leased Aircraft by Region
(FY2014 — 47 Airlines)

Fig. 31: 
% of Leased Aircraft by Aircraft Category
(FY2014 — 47 Airlines)

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2.4. Spare Parts Inventory

The level of spares and inventory that an airline keeps can have a positive impact on its operations in terms of aircraft availability and on-time performance. However, it is also money that is not invested and cannot be used/accessed by the airline easily.

Fig. 35: Inventory $ vs Direct Maintenance Cost $ (FY2014 — 39 Airlines)

Fig. 36: Number of Airlines reporting Spares & Inventory by Region (FY2014 — 39 Airlines)
Analysis by Airline Group

This section of the report presents a maintenance cost analysis of airlines with similar fleet sizes. Group One consists of airlines with a fleet size of up to 50 aircraft. Group Two airlines have a fleet size between 51 and 100. The airlines with fleet of over 101 aircraft form Group Three. In addition to a fleet analysis and maintenance cost analysis, this section also analyzes aircraft leasing and maintenance reserves.
3.1. Fleet Overview

The 51 participating airlines were grouped by similar fleet sizes. Group One consists of airlines with a fleet size of up to 50 aircraft. Group Two airlines have a fleet size between 51 and 100. The airlines with fleet of over 101 aircraft form Group Three. Table 8 gives an overview of the unit costs and operational data for each Airline Group.

Table 8:
Operational and Unit Cost Data by Airline Group
(FY2014—51 Airlines)

Fig. 39:
Fleet Distribution by Aircraft Category and by Airline Group
(FY2014—51 Airlines)
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3.2 Maintenance Cost Analysis
By Airline Group

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Fig. 41:
Direct Maintenance Cost by Airline Group; cost percent of each group related to total maintenance cost (FY2014—51 Airlines)

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Table 9: Minimum and Maximum Unit Cost by Airline Group (FY2014 — 51 Airlines)

Table 10: Direct Maintenance Cost by Aircraft Category and by Airline Group (FY2014 — 51 Airlines)

Table 11: Direct Maintenance Cost by Market Element and by Airline Group (FY2014 — 51 Airlines)

Table 12: Direct Maintenance Cost by Segment and by Airline Group (FY2014 — 51 Airlines)
3.3. Aircraft Leasing and Maintenance Reserves By Airline Group

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Fig. 45:
Group Two % of Leased Aircraft by Region (FY2014 — 13 Airlines)

Fig. 46:
Group Three % of Leased Aircraft by A/C Category (FY2014 — 14 Airlines)

Fig. 47:
Group Three % of Leased Aircraft by Region (FY2014 — 14 Airlines)
Trend Analysis (FY2010 - 2014), 23 MCTF Airlines

This section presents a 5-year trend analysis for airlines that have been consistently submitting data to MCTF. Out of 51 airlines, we have data from 23 airlines and we hope to continue progressing to be able to perform a trend analysis over a period of six years (one full maintenance cycle). From 2010 to 2014, the fleet size grew 21% and direct maintenance costs increased 42%. Cost per flight hour increased 12%, cost per cycle increased 21% and cost per aircraft increased 17% over the last five years.
4.1. Fleet Overview

The 23 airlines that consistently participated in MCTF reported a total of 1,914 active aircraft (8% of world fleet). Their fleet grew 21% in five years; some of the increase is due to airline mergers. The average fleet size per airline went from 69 aircraft in 2010 to 83 in 2014 (20.2% increase).

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Fig. 50: Fleet Distribution by Manufacturer (23 Airlines)

Fig. 51: Evolution of Fleet Size by Category (23 Airlines)

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Fig. 52: Evolution of Fleet Size by Manufacturer (23 Airlines)

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4.2. Maintenance Cost Overview

In FY2014, direct maintenance costs for the 23 airlines reached $8.18 billion, this was 55% of the total amount reported by the MCTF airline pool. Over the past five years, there was a 42% increase (Fig. 53). The large increase between 2010 and 2011 is attributed to airline mergers.

![DMC Costs Chart]

Along with the growing fleet size, the average total DMC per airline grew from $247 million to $350 million in 5 years.

![Direct Maintenance Unit Costs Chart]

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4.3. General Trends

The graphs below present general trends in terms of operational data (fleet size, average age, flight hours and cycles, etc.) and unit costs (maintenance cost per FH, per FC and per AC) for FY2010 to 2014.
4.4. Trend Analysis By Airline Group

In total, 23 airlines have submitted their data consistently for the past 5 years, allowing us to perform trend analysis for each group between 2010 and 2014. During this period, the number of Group One airlines decreased from 13 in 2010 to 10 in 2014. Conversely, the number of Group Two and Group Three airlines increased, from 5 to 6 and from 5 to 7 respectively. This trend is also reflected in the fleet size between 2010 and 2014 (Fig. 63). The increase in fleet size could be due to mergers and acquisitions or more aircraft entering than leaving airline fleets.

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Fig. 65: Direct Maintenance Unit Cost for Group Two Airlines (FY2010 - FY2014)

$, / FH
$, / FC
$, / AC

Table 14: Operational Data Group Two Airlines (FY2010 - FY2014)

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Maintenance Costs Trend Analysis by Aircraft Category (FY2010 - 2014 — 23 Airlines)

This section presents a trend analysis of maintenance costs by aircraft category for the 23 consistent airlines in MCTF. Over the last five years, these airlines had increases in all aircraft categories with the exception of turboprops, which declined 23%. Maintenance unit costs display an increasing trend for most aircraft categories.
5.1. Overview by Aircraft Category

This section gives an overview of all the aircraft categories.

Over the last five years, NB and WB2 fleets had the strongest increases, respectively +30% and +25% WB3+ and RJ were on a steady but slower progression with +12% and +15%. On the contrary, TPs have been less and less popular (-23%) among the MCTF airlines that contributed data on a consistent basis (Fig. 67).

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Fig. 69: Evolution of Direct Maintenance Cost / FC by AC Category (23 Airlines)

Fig. 70: Evolution of Direct Maintenance Cost / AC by AC Category (23 Airlines)
5.2. Narrowbody Aircraft

Fig. 71:
NB Fleet Mix
(FY2010 - 2014 — 23 Airlines)

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Fig. 72:
NB Unit Costs
(FY2010 - 2014 — 23 Airlines)

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5.3. Widebody Aircraft

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Fig. 75: WB Fleet Mix (FY2010 - 2014 — 23 Airlines)

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Fig. 76: WB Unit Costs (FY2010 - 2014 — 23 Airlines)
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Fig. 77: WB Maintenance Cost/FH by Segment (FY2010-2014 — 23 Airlines)

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Fig. 78: WB Maintenance Cost/FH by Element (FY2010-2014 — 23 Airlines)
5.4. Regional Jets

Fig. 79: RJ Fleet Mix (FY2010 - 2014 — 23 Airlines)

Fig. 80: RB Unit Costs (FY2010 - 2014 — 23 Airlines)

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5.5. Turboprops

Fig. 83:  
TP Fleet Mix  
(FY2010 - 2014 — 23 Airlines)

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Fig. 84:  
TP Unit Costs  
(FY2010 - 2014 — 23 Airlines)

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### Annex I: MCTF Fleet vs World Fleet (2014)

#### Table 17:
**Fleet Composition by Category**
Sources: MCTF (51 Airlines) World (ACAS)

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<thead>
<tr>
<th></th>
<th>MCTF</th>
<th>WORLD</th>
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<tr>
<td>NB</td>
<td>2,110</td>
<td>13,792</td>
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<td>WB</td>
<td>1,530</td>
<td>4,968</td>
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<tr>
<td>RJ</td>
<td>394</td>
<td>3,935</td>
</tr>
<tr>
<td>TP</td>
<td>182</td>
<td>1,902</td>
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<tr>
<td></td>
<td>4,216</td>
<td>24,597</td>
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</tbody>
</table>

#### Table 18:
**Fleet Composition by Region**
Sources: MCTF (51 Airlines) World (ACAS)

<table>
<thead>
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<th>MCTF</th>
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<td>Americas</td>
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<td>ASPAC</td>
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<td>Middle East</td>
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<td>N. Asia</td>
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<tr>
<td></td>
<td>4,216</td>
<td>24,597</td>
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</tbody>
</table>

#### Table 19:
**Fleet Composition by Manufacturer**
Sources: MCTF (51 Airlines) World (ACAS)

<table>
<thead>
<tr>
<th></th>
<th>MCTF</th>
<th>WORLD</th>
</tr>
</thead>
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<td>Boeing</td>
<td>2,223</td>
<td>11,055</td>
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<td>Airbus</td>
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<td>Embraer</td>
<td>372</td>
<td>2,407</td>
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<td>Bombardier</td>
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<td>2,007</td>
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<td>ATR</td>
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<td>906</td>
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<tr>
<td>BAE</td>
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<td>199</td>
</tr>
<tr>
<td>Fokker</td>
<td>2</td>
<td>192</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>4,216</td>
<td>24,597</td>
</tr>
</tbody>
</table>


Annex II: Staff (2014)

Table 20: Direct Labor Staff (29 Airlines)

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Table 21: Overhead Staff (43 Airlines)

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Table 22: Overhead Staff by Category (43 Airlines)

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Annex III: Time Breakdown (2014)

Table 23: Time Breakdown for One Mechanic (28 Airlines)

Breakdown of hours per year for one employee of the direct maintenance staff (i.e. mechanic)

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ANNEX IV: Fleet Distribution by Aircraft Family and by Group (51 Airlines, FY2014)

Fig. 87: Fleet Distribution by Aircraft Family for Group One (up to 50 aircraft) 24 Airlines

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Fig. 88: Fleet Distribution by Aircraft Family for Group Two (51 – 100 aircraft) 13 Airlines

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Fig. 89: Fleet Distribution by Aircraft Family for Group Three (+101 aircraft) 14 Airlines

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Annex V: Operational Data by Aircraft Category

Table 24:
Operational Data
by Aircraft Category
(23 Airlines)

This part of the report is only available to participating airlines.
ANNEX VI: Unit Costs by Airline

Fig. 90: Direct Maintenance Cost per FH (FY2014 — 51 Airlines)

Fig. 91: Direct Maintenance Cost per FC (FY2014 — 51 Airlines)

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