Airline Maintenance Cost Executive Commentary

An Exclusive Benchmark Analysis (FY2011 data) by IATA's Maintenance Cost Task Force

EXECUTIVE SUMMARY

This report is the annual MCTF report discussing airline maintenance costs. We analyzed airline operational data and maintenance cost data from airlines worldwide. 40 airlines participated in the 2011 data collection.

In 2011, world fleet consisted in 22,488 aircraft (including large turboprops), most of it being narrowbody aircraft. Airlines worldwide spent $583 Bill. (+11% vs. 2010) to operate, and the Maintenance, Repairs and Overhaul (MRO) market reached $46.9 Bill. (+11% vs. 2010).

The 40 MCTF participating airlines reported a total fleet of 3,989 aircraft (18% of the world fleet) for 2011. Boeing aircraft represented the majority (64%), followed by Airbus with 29%. Narrowbody aircraft represented over 57% of the fleet, while widebody aircraft accounted for 36% of the fleet; the remaining being regional jets and turboprops.

Direct maintenance cost was $13.1 Bill.; range per airline went from $19.5 Mill. to $1.5 Bill. The average maintenance cost was $1,024 per flight hour, $2,579 per flight cycle and $ 3.3 Mill. per aircraft. Engine maintenance remained the highest cost segment.

Out of 40 airlines, 23 have been reporting data consistently for the past four years, allowing MCTF to conduct trend analysis. In FY2011, they operated 2,812 aircraft. Direct maintenance cost for this group of airlines reached $9.1Bill. (+15% increase since 2008). The average maintenance cost was $1,033 per flight hour, $2,608 per flight cycle and $ 3.2 Mill. per aircraft. This group of airlines has been more successful at containing cost for Line and Base maintenance rather than for Engine and Component which are outsourced for the majority.
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DATA & ANALYSIS METHODOLOGY

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. 40 airlines reported data for FY2011, and 23 airlines provided data consistently over the past four years (FY2008-2011).

If needed, contributing airlines are contacted to clarify the reported data. The data is then coded (operators are de-identified) and used to create this benchmark report.

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

PRELIMINARY REMARKS

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 for MCTF 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 are not consistent with previous years and/or out of range. 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 the importance of making sure your data is 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 KPIs (e.g. maintenance $ per flight hour, per flight cycle or per aircraft). Unplanned events can cause dramatic impact on maintenance spend, that is why we need also as many comments to explain unusual 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) is 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 big enough to calculate one of the most basic KPI 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.
DEFINITIONS & ACRONYMS

A/C: Aircraft

Aircraft family: Aircraft communalities (e.g. A320 Family includes A318, A319, A320, A321)

AL: Airline

APU: Auxiliary Power Unit

ASPAC: Asia South Pacific

Cost elements: Material, labor and outside repairs (or outsourced, used interchangeably)

Cost segments: Line, base, component and engine maintenance

DMC: Direct Maintenance Cost

ESV: Engine Shop Visit

FC: Flight Cycle

FH: Flight Hour

LG: Landing Gear

LLP: Life Limited Part

MCTF: Maintenance Cost Task Force

MENA: Middle East—North Africa

MR: Maintenance Reserves

MTBR: Mean Time Between Removals

NB: Narrow-body single aisle aircraft with more than 100 seats (excludes Embraer 190/195)

RJ: Regional-jets up to 100 seats (includes Embraer 190/195)

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 Cost: DMC plus overhead

TP: Turbo-props

TR: Thrust Reverser

Units:

ŭ K ($#,000) Thousand

ŭ Mill. ($#,000,000) Million

ŭ Bill. ($#,000,000,000) Billion

WB: Wide-body aircraft with more than one aisle or equivalent freighter

WB2: Wide body aircraft equipped with two engines

WB3+: Wide body aircraft equipped with 3 or more engines
1. GLOBAL PICTURE

1.1. World Fleet

In FY2011, the world fleet count was 22,448 aircraft. Airlines added 5780 aircraft to their fleet between 2002 and 2011: 48% of NB, 28% of RJ, 14% of WB, 10% of TP.

Asia (including Pacific Rim), Europe and North America were the most dynamic regions in terms of fleet size development. In most regions, NB was still the most popular aircraft category. North America is the only region which has reduced the number of NB aircraft in their fleet over the past decade but this trend is slowing down. TP remain the most popular addition to the fleet. On Pacific Rim, airlines favor both extremes of the range (RJ and WB).

In 2011, the average aircraft utilization has maintained the upward trend observed in 2010, reaching the same level as in 2007 (7.6 hrs/day).

Note: TP include only ATR42/72 and Q300/400

The average passenger load factor went down from 74.4% to 78.1% in 2011 due to an increased capacity (+6.3% vs. 2010) that wasn’t met by demand.
FOCUS ON WORLDWIDE BUSINESS & ECONOMIC HIGHLIGHTS

At the IATA Annual General Meeting in Beijing 2012 it was revealed that in 2011 aviation safely transported 2.8 billion passengers and 48 million tons of cargo. The value of goods transported by air was estimated at $5.3 trillion, which equals to 35% of the value of all goods traded internationally. A recent study of Oxford Economics has confirmed that aviation’s contribution to the global economy supports 57 million jobs and some $2.2 trillion in economic activity. Oxford Economics projected that aviation will grow about 5% annually to 2030 which means the passenger traffic will double.

Aviation is a true catalyst to tourism and business development. Moreover, aviation enables globalization and “brings together the peoples of the world”.

Despite all of the benefits aviation brings to the table, airlines which are the direct link to passengers and cargo are struggling. Average profits are razor thin and every increase in fuel prices slashes them even more if not completely. Investors are not motivated to invest when airlines are not even able to recover their cost of capital. Given the growth forecasts the lack of investors interests could severely endanger sustainable growth of airlines and consequently the whole aviation industry.

The structure of airline industry is extremely complex. As the purpose of this analysis is to tackle operational cost which could consequently increase profitability we will highlight only 3 main factors which can make it or brake it for airlines’ bottom lines.

Jet Fuel prices, Passenger & Cargo demand, and Passenger & Freight capacity perfectly explain the results we obtained in this analysis. Or the other way around, the results confirm aviation industry highlights in 2009-2011.

*Chicago Convention, ICAO
1.2. Maintenance, Repair and Overhaul (MRO) Market

In FY2011, Total Operational Costs reported by airlines increased by 11%, mostly due to the on-going high fuel prices. Consequently, the weight of fuel in the airline costs also went up from 26 to 31% (Fig. 5). The share of maintenance spends (including 20% overhead costs) remained at 12%.

In 2010, the global MRO market logged the first decline in seven years (-7.4% vs. 2009) but it immediately went back up in 2011 (+10.9% vs. 2010) at $46.9Bill, excluding overhead costs. (Fig. 6)

Over the past ten years, the structure of global maintenance spends evolved dramatically. In 2002, base maintenance was the main driver, at about a third of the total maintenance expenses. Nowadays, engine cost lead the maintenance spends with 43 to 46%.

**Total Ops Cost: US$ 524 Bill. (2010)**

- Pax Services, 7%
- Charges, 8%
- Distribution, 8%
- A/C Ownership, 11%
- Maintenance, 12%
- Cost of Operations, 26%
- Fuel, 26%
- Others, 2%


- Pax Services, 6.5%
- Charges, 7.5%
- Distribution, 7.5%
- A/C Ownership, 16.5%
- Maintenance, 12.0%
- Cost of Operations, 24.6%
- Fuel, 30.3%
- Others, 1.5%

**Cost Breakdown**

- Cost of Operations: flight deck crew, station and ground, general & administration
- Maintenance: aircraft maintenance (labor, material, outsourcing and overhead)
- A/C Ownership: rentals and depreciation
- Distribution: ticketing, sales and promotion
- Charges: navigation and landing fees
- Pax Services: passenger services (check-in counter and gate agents), cabin crew
- Others: IT and communications, flight equipment insurance, load insurance

**Fig. 6: Estimated Global MRO Spends FY2001-2022**
(Source: Aviation Week “10-year global MRO forecast” April 2012)
2. FY2011 SNAPSHOT

This section provides an overview of FY2011 data reported by 40 airlines worldwide. The year-on-year and 4-year trend analysis will be presented further in this report.

2.1. Fleet Overview

In FY2011, the reporting airlines operated 3,989 aircraft, which represents 18% of the world fleet. Their fleet size ranged from 12 to 700+ A/C with an average fleet age of 11.0 years. They flew a total of 12.9 million flight hours, and 5.1 million flight cycles.

Boeing/MD and Airbus represented more than 93% of the reported fleet. Embraer was the third player with 4%.

Narrowbody aircraft were the most popular aircraft (57% of 40 MCTF airlines’ fleet) with 2,936 flight hours per aircraft and 1,484 flight cycles per aircraft on average. In 2011, widebody aircraft represented 36% of the fleet with an average age of 11.1 years (vs. 11.5 years for NB). Each WB aircraft flew on average 3,932 hours and performed 767 cycles.

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Fleetsize</th>
<th>Airlines</th>
<th>Avg Age</th>
<th>FH/AC</th>
<th>FC/AC</th>
<th>Daily Utilization</th>
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<td>2,936</td>
<td>1,484</td>
<td>8.0</td>
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<td>1,445</td>
<td>27</td>
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<td>3,932</td>
<td>767</td>
<td>10.5</td>
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<tr>
<td>RJ</td>
<td>164</td>
<td>10</td>
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<td>2,525</td>
<td>1,809</td>
<td>6.9</td>
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<td>2,037</td>
<td>2,160</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Table 1: Operational Data by Aircraft Category - 40 Airlines - FY2011

2.2. Maintenance Cost Analysis

In FY2011, the 40 MCTF airlines reported $15.4Bill. for their Technical Division spend, including $2.4Bill. for Overhead. Among the 26 airlines that reported Overhead data, it represented on average 20% of their Technical Division, with a maximum of 55% (Fig. 9).
2.2.1. Direct Maintenance Spend

In FY2011, the 40 MCTF airlines reported $13.1B for their direct maintenance costs, ranging from $19.5M to $1.5B per airline.

The average maintenance cost was $1,024 per flight hour (Min: $242; Max: $3,463) and $2,579 per flight cycle (Min: $355; Max: $11,980) and $3.3M per aircraft (Min: $0.6M; Max: $10.3M).

The weight of outsourced maintenance was very pronounced in 2011 reaching 62% of direct maintenance costs in average (Fig. 11). This can be explained by the fact that engine maintenance has also reached a high: 41% of direct maintenance cost on average (Fig. 12).

Among the 40 MCTF airlines, 58% outsourced all their engine maintenance, and it represented up to 59% of direct maintenance costs (Fig. 13).
2.2.2. Direct Maintenance Spend by Aircraft Category

The distribution of fleet count vs. maintenance costs (Table 2) can be explained by the size of the airframe and the number of engines. Aircraft with small size airframe and two engines (NB, RJ, TP) have fleet count share that is 1.5 to 3 times higher than their maintenance costs share whereas the Widebody aircraft’s maintenance cost share follows the opposite trend.

For narrowbody aircraft, the average cost per flight hour was $624, the average cost per cycle was $1,270, and the average cost per aircraft was $2.1Mill.

The average unit costs for widebody aircraft were $1,447/FH, $7,252/FC and $5.4Mill./AC.

This analysis includes only aircraft types that were operated by more than 3 operators: A320 Family, B737 Classic, B737 NG and B757 for narrowbodies; A330, A340, B747-400, B767 and B777 for widebodies.

Data is presented as reported, not normalized.
3. COST TREND ANALYSIS (FY2008-2011) – 23 MCTF AIRLINES

Out of 40 airlines, 23 MCTF have been reporting data consistently for the past four years, allowing to conduct trend analysis.

3.1. Fleet Overview

Their FY2011 fleet comprised 2,812 active aircraft with 2.6% progression vs. FY2010. This fleet represented 12.5% of world fleet with a fleet mix by manufacturer that was slightly different from worldwide level. The two leading manufacturers Boeing and Airbus were represented with a respective market share of 71% and 26% (vs. 48% vs. 28% of world fleet), leaving Embraer, Bombardier, Fokker and ATR further than they were in reality, respectively (1.5% of MCTF fleet vs. 8% of world fleet; 0.9% vs. 11%; 0.4% vs. 1.1%; 0.3% vs. 4%).
3.2. Maintenance Cost Overview

In FY 2011, direct maintenance costs for the 23 MCTF airlines went down 4.5% at $9.1Bil. This is 69.5% of the amount reported by the 40 MCTF airlines, and 19.4% of worldwide MRO spend. Despite ups and downs, the direct maintenance cost for this group of airlines increased by 15% from 2008 to 2011 (Fig. 19).

At first glance, Engine Maintenance seems to be the main cost segment (Fig. 21) but if we consider the fact that Airframe Maintenance is comprised of Line and Base Maintenance, the cost are comparable at around $400/FH (Fig. 23).

Outsourcing also appears as the main cost element (Fig. 22). In reality though, not all segments are heavily outsourced. In terms of Airframe Maintenance (Line + Base), outsourcing only accounts for 20% to 50% of the cost (Fig 25-26). For Component and Engine Maintenance, the outsourced share range from 50 to 80% (Fig. 27.28). This can be explained by the need for a specialized workforce and the aftermarket that is mainly controlled by OEMs.

Although the majority of airlines fit into the model that was just described, there are some airlines that choose to outsource all their maintenance activities. Among these airlines, some consider they should focus on their core competence (flying the aircraft) and leave maintenance to specialized companies. Others choose to outsource all their maintenance due to their geographic location and the difficulties they encounter in hiring specialized workforce combined with the high cost of shipping material to remote locations.
3.3. Focus on Engine Maintenance Costs

The MCTF airlines have reported $3.73 Bill. for engine maintenance in 2011 (Fig. 30). This segment increased by 20% in value but the share of total maintenance costs slightly went down.

On average, the 23 MCTF airlines have spent $26 Mill. per year for their engine maintenance, which was an average $ 1.5 Mill. per aircraft (Fig. 31).

Figure 32 shows the average annual cost to maintain one single engine for each aircraft category. Over the past four years, engines for WB2 were the most expensive to maintain ($1.02 Mill./engine). This is mostly due to the massive size of these engines capable of lifting twin-aisle aircraft.
3.4. General Trends

The graphs below present general trends in terms of operational data (fleet and age size, flight hours and cycles, etc.) and unit costs (maintenance cost per FH, per FC, per A/C) for FY2008-2011.

Fig. 33: General Trends - 23 MCTF Airlines - FY2008-2011
4. MAINTENANCE COST ANALYSIS BY AIRCRAFT CATEGORY (23 MCTF AIRLINES)

This section presents an analysis of maintenance costs by aircraft category with a focus on narrowbody and widebody aircraft as they represent 97% of the fleet of the 23 MCTF airlines that reported data consistently between 2008 and 2011. For the time being, the fleet size of the aircraft category is too limited to perform meaningful statistical analyses (see Appendix 2 for operational data by aircraft category).

Figures 34 and 35 give an overview of maintenance costs per flight hour and per flight cycle for all the aircraft categories considered by MCTF.

All unit costs are on an upward trend, except for NB. Being the biggest and fastest growing category, narrowbody aircraft benefit from economies of scale and fleet renewal for some carriers included in the MCTF airlines.

RJs and TPs costs rose dramatically over the last two years (respectively x2.5 and x2). As mentioned above, the limited numbers of operators and aircraft cause isolated events or extraordinary conditions of operations to have major impact of these categories’ averages. For example, the main operator for RJs reported high maintenance cost due to operations in harsh environment.
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Fig. 36: NB Fleet Mix - 23 Airlines

Fig. 37: WB Fleet Mix - 23 Airlines

Fig. 38: NB Maintenance Costs per AC Type - 23 Airlines

Fig. 39: WB Maintenance Costs per AC Type - 23 Airlines

Fig. 40: NB Unit Costs - 23 Airlines

Fig. 41: WB Unit Costs - 23 Airlines
Appendix 1: Maintenance Cost Breakdown
48 Airlines - FY2011

In the graphs below, airlines are ranked in alphabetical order. The same graphs are available on page 9, respectively ranked from largest to smallest Engine% and Outsourced%.
## Appendix 2: Operational Data by Aircraft Category
### 23 Airlines - FY2008-2011

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<th>Aircraft Category</th>
<th>Fiscal Year</th>
<th>Fleetsize</th>
<th>Airlines</th>
<th>Avg Age</th>
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IATA's Maintenance Cost Task Force (MCTF)

WHY PARTICIPATE IN MCTF?

- MCTF is the industry focal point on commercial airline maintenance costs, including MRO (Maintenance, Repair and Overhaul) cost strategies.
- By joining MCTF, airlines benefit from access to unique tools which permit benchmarking against industry performance covering 47 aircraft versions / 24 aircraft families, and providing for 36 airframe/engine combinations.
- Participation to MCTF is free of charge and open to any interested airline. More than 45 airlines are already members.
- MCTF offers the opportunity to discuss and benchmark key maintenance cost issues facing the airline industry and provides an effective platform for networking and sharing experiences.

COST VS. BENEFITS

- The data required for participation to MCTF’s data collection is already available at your maintenance and finance departments respectively. You just need to populate the input toolset with the relevant information.
- The input toolset is a user-friendly Excel form, developed in collaboration with Airbus. The output software designed with Boeing allows for customized analysis based on the specificities of each airline. Airline fleet performance can be benchmarked based on cost per flight hour, cost per aircraft, and cost per cycle (departure).

TIMELINE FOR AIRLINE PARTICIPATION IN MCTF 2012 EDITION

- June 30, 2013: Deadline for MCTF data collection
- July - August: Data analysis
- September - October:
  - 9th Maintenance Cost Conference (MCC)
  - e-MCTF toolset
  - Airline Maintenance Cost Executive Commentary (AMCEC)

MCTF’S ACTIVITIES

- Aircraft Leasing & Maintenance Reserves Methodology
- Aircraft Delivery/Redelivery Guidelines
- Aircraft Leasing Life Cycle
- Maintenance Cost per Aircraft Tail Number

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