Study into the impact of the global economic crisis on airframe utilisation

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FOREWORD

EUROCONTROL has a unique archive of detailed airline operational data in Europe; including scheduled and actual times, covering some 6 million flights per year (or 60% of all yearly filed flight plans) sent direct by airlines to the Central Office for Delay Analysis (CODA).

This report, prepared by Milena Studic during her traineeship at CODA, looks at one particular aspect of the impact of the economic crisis as it is reflected in these data: changes in aircraft utilisation. Although we are aware that the data are not perfect (because CODA only receives data on operated flights, not on planned nor cancelled flights) for this kind of analysis we are convinced that it will bring added value to the airline community.

Increasingly, EUROCONTROL is making traffic and punctuality statistics available on the web through the CODA portal and STATFOR interactive dashboard, but that has not taken away the value in having reference documents presenting the key figures such as these, to help aircraft operators benchmark their own performance and hence improve the performance of the network for everyone.

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Abstract

This study looks at the possible influence of the global economic crisis on airframe utilisation. Airlines operational plan aim to maximise profitability. Airframe utilisation is a key indicator which can be used to optimise planning of airline schedules and thus increasing profitability.

Based on data provided by 62 airlines, a comparison of airframe utilisation for 2008 and 2009 was conducted. Better understanding of changes in airframe utilisation was conducted by dividing the analysis into 4 groups: range, aircraft type, business model and market segment.

The elasticity of demand for long-haul flights brought a decrease in the number of flights operated on long-haul routes. Ticket prices for long-haul flights are very high and subsequently during the economic downturn those flights suffered the most. The number of airframes was reduced drastically but still the drop in airframe utilisation was evident. The number of medium-haul flights increased forcing airlines to shift airframes from long-haul to medium-haul routes causing no significant drop in airframe utilisation. Airframe utilisation had a highest fall on short-haul routes because carriers didn't manage to reduce adequately the number of airframes in order to cope with a decrease of traffic demand.

One of the major factors of airframe utilisaton is the number of operating airframes. It has been shown that airframe utilisation rises when the number of airframes decreases. Analysis by aircraft type has shown that the biggest drop of airframe utilisation was recorded for narrow body airframes. On the other hand, turboprop airframes managed to increase their utilisation by 5.8% in comparison to 2008 by increasing the number of flights grace to lower operating costs of turboprops. Airframes from the Boeing fleet recorded bigger drop than the ones from Airbus.

Hub-and-spoke carriers try to maximise load factors; on the other hand point-to-point carriers tend to maximise numbers of hours flown this is the reason why point-to-point carriers achieve higher values of airframe utilisation. The financial crisis had worse impact on point-to-point carriers mostly due to new airframe deliveries.

Economic crisis affected air passengers because of decreased financial solvency. That manifested in a decrease in air traffic demand, especially for charter flights which had the biggest drop in traffic in 2009 .This affected not just purely charter airlines but also those traditional scheduled carriers who used to lease additional airframes during the periods with higher demand. Several big traditional scheduled companies completely stopped operating charter flights in 2009. By reducing the number of airframes in use, charters managed to achieve higher values of airframe utilisation in 2009. The worst consequences on airframe utilisation were for LCC because of new airframe deliveries which prevented them from reducing the number of airframes adequately.

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INTRODUCTION

Facing worsening economic conditions airlines had to plan their operations in a way to minimise losses. They had to reduce capacity in order to cope with the reduction in air traffic demand but also to maximise efficiency (by maximising the number of flights and hours flown, etc.). This study investigates the possible influence of decrease of total traffic volumes in 2009 on airframe utilisation, and give some suggestions how to maximise it.

Airlines worldwide aim to maximise profitability. Being the least profitable player in the transport chain and on the operating margin, airlines aim to take all the possible measure in order to stay "in the game". To achieve this goal, 'airlines must maximise resource utilisation (subject to the constraints of each carrier's particular strategic and product positioning) in order to produce as much output as possible over which to spread fixed costs and so average unit cost, it is also vital to be sure that the incremental output can be sold – and can be sold at profit'[1]. In 2009, when air transport demand decreased, airlines tried to optimise their yields combining two strategies: decrease of capacity and prices.

The airlines best interest is to plan their schedules in the way which would allow them to maximise time spent airborne (block-to-block time) in comparison to the time they spend on the ground (turnaround phase of flight, technical checks, overnight stays etc.). The term airframe utilisation is used to show the relation between time aircraft spends in the air to the time it spends on the ground. By maximising airframe utilisation, with the same fleet airlines can achieve higher values of ASK[2] and ATK[3] and improve their available capacity with no additional fixed costs (i.e. cost of buying a new aircraft). But one have to bare in mind that 'higher utilisation does not control costs, but can reduce their wastage'[1] meaning that with higher utilisation more ASK or ATK will be available within the predetermined capacity and less of it will be wasted on overcapacity. On the other hand, with more ASK, airlines will be able to reduce unit cost and fares, thus attract new customers and consequently have an increase in yields.

Efficient scheduling can have a significant influence on airframe utilisation. The process of airline scheduling is a very complex task which requires optimisation of available resources, schedule buffers and costs and at the same time try to minimise the impact of disruptions on the day of operations. Predictability of disruptions is of great importance for incorporation of buffer minutes into the schedules which should help overcoming the gap between strategy and reality. The process of creating an airline schedule requires lot of knowledge but also experience.

On the day of operation scheduled times may differ from the actual ones due to uncertainty and lack of predictability (mostly due to external factors like wind, routings, etc.). This forces airlines to compromise when creating their schedules.

During an operational day, airlines tend to maximise block-to-block time and minimising turnaround times. When constructing flight schedules very tightly, airlines have to handle the problem of delays due to very rigid planning they cannot absorb any disruption (missed slots, awaiting passengers, crew or cargo). Airlines may face delays during each operational day. The cost of delay is very high and varies depending of the length of a delay and whether it occurred on the ground or in the air. According to Performance Review Commission [4] Report, ''Average costs of "tactical" delay on the ground (engine off) are

[1] Holloway S.(2003), Straight and level: practical airline economics, Ashgate
[2] Available seat-kilometre: the number of passenger - seats available for sale on each flight stage multiplied by the corresponding stage distance in kilometres.
[3] Available tonne-kilometre the number of tonnes available for the carriage of revenue load (passengers, freight and mail) multiplied by the corresponding stage distance in kilometres.
[4] www.eurocontrol.int/prc

approximated to be close to zero for the first 15 minutes and €82 per minute, on average, for ATFM delays longer than 15 minutes (€ 2008 prices)'' [5]. If delay incurred while aircraft is in block-to-block phase of flight, it imposes additional crew and fuel costs, while if delay incurred during a ground phase of flight, it imposes additional ground staff and gate costs. Besides these costs, airlines have costs of meals, drinks, communication facilities and a hotel room for the night stay for passengers but also have an indirect negative effect on airline business (in the way that frequent delays will probably reject some future passengers).

Since the cost of delay is so high, airlines tend to add buffers into their schedules. Buffers may be inserted in block-to-block or turnaround phase. Scheduled buffers during the block-to-block phase are used to in example to absorb delay of an inbound aircraft because of the occupation of taxiways or stand. Airline produces its flight plans based on historical data about. Actual departure times are often different than planned ones. Airlines anticipate this and add buffers during the flight phase (while aircraft is airborne) in order to absorb outbound delay. The higher the number of movements at an airport, the more buffer minutes an airline will add in their schedule for flights operated on a particular airport since the probability of a disruption event is higher. Also the buffer increases if the weather conditions at an airport are bad (a seasonal pattern may exist). If the destination airport is a busy one (for example London Heathrow), aircraft have to wait for permission to land because of the high utilisation of the runway and the occupation of taxiways and aprons. Inbound delays appear often in those cases so airlines based on the analysis of the historical data of their operation may decide to add some buffers during the turnaround phase. Added buffers are supposed to absorb these inbound delays reducing the impact that each flight's actual block time has on the on-time performance of subsequent flight.

Optimisation of the exact number of buffer minutes is complex. Additional buffer minutes take away available capacity of an airline. For an aircraft operating on short routes, 10 minutes added in a turnaround phase on each of it's in example 5 flight legs result in total of 50 minutes during an operational day which is the equivalent to a loss of an additional scheduled short-haul flight.

The concept of adding buffers into airline schedules seems to be logical because it reduces the cost of delay. On the other hand, buffers decrease the aircraft utilisation and results in costs of unused buffer minutes which are estimated at 41€ per minute[5].

Airframe utilisation is a key indicator of the performance of an airline. ICAO is defines it as:'' Aircraft hours flown (block-to-block) divided by aircraft days available''. Taking into account the importance of airframe utilisation optimisation, the goal of this study was to investigate whether the decrease of overall traffic in 2009 had an impact of airframe utilisation. The analysis was conducted per range, aircraft type, business model and market segment in order to investigate variables which can be used to maximise airframe utilisation but also to investigate whether some of the groupings have recorded a decrease in airframe utilisation due to economic crisis.

[5] An assessment of Air Traffic Management in Europe during the Calendar Year 2009, EUROCONTROL Performance Review Report 2009, May 2010.

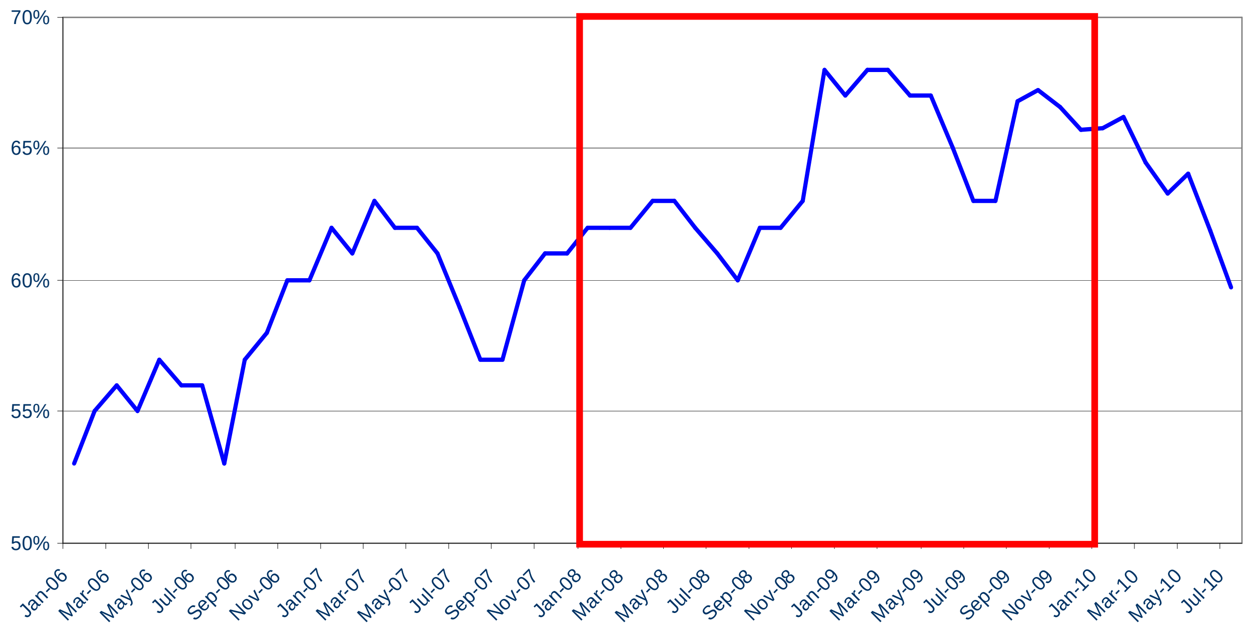
1. STUDY SCOPE

Study scopes include all arrival, departure and internal flights in ECAC for a specified list of 62 airlines which have full CODA coverage[6] for 2008 and 2009.

The objective of the Central Office for Delay Analysis (CODA)[7] within EUROCONTROL is to provide policy makers and managers of the ECAC Air Transport System with timely, consistent and comprehensive information on the air traffic delay situation in Europe, and to make these available to anyone with an interest in delay performance. European Civil Aviation Conference (ECAC) currently consists of 44 Member States comprising almost all European States and deals with many facets of civil aviation matters.

This study was based on CODA database called ACARS which doesn't include all flights conducted in ECAC but only flights from airlines which report to CODA (Figure 1). Airlines are not obliged to report to CODA, the reporting is on voluntary basis and is strictly confidential. CODA now covers more than 100 airlines and about 60 percent of all IFR flights in ECAC area. CODA database covers 3 market segments: Charter, Low-cost and Traditional Scheduled.

Figure 1. Evolution of CODA coverage of total IFR flights



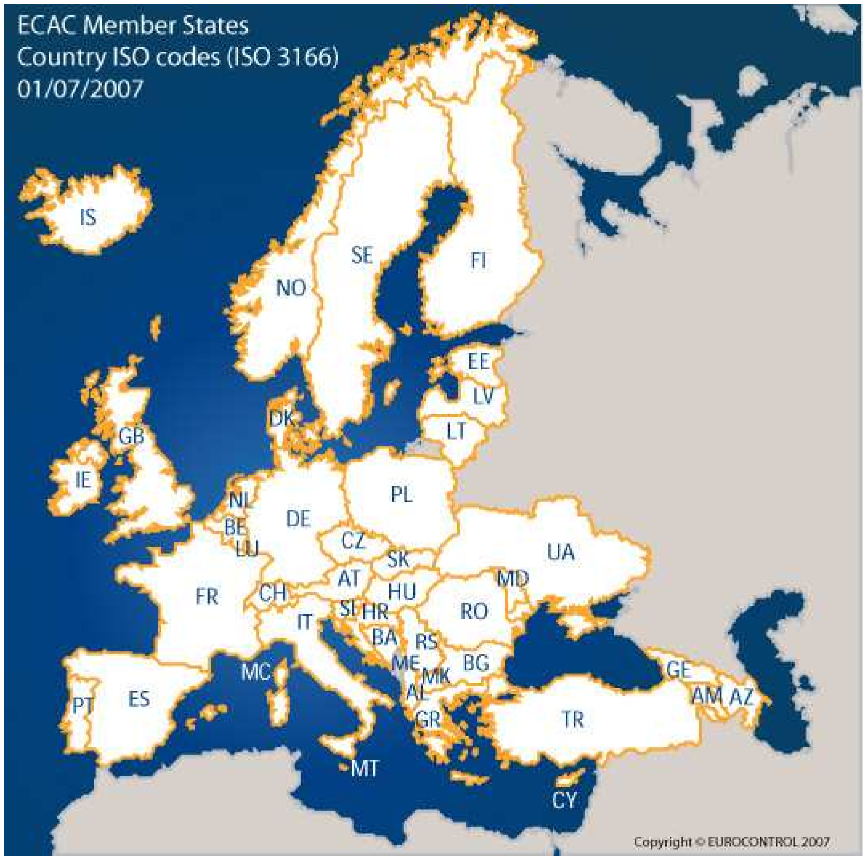
6 Airlines report to CODA (Central Office for Delay Analysis) on a voluntary basis. CODA covers approximately 60% of total number of IFR flights. This figure is referred to as CODA coverage.

7 www.eurocontrol.int/coda

1.1. Geographical scope

The geographical scope was defined as all arrival, departure and internal flights in ECAC for a specified list of 62 airlines which have full CODA coverage for requested period of time (Figure 2).

Figure 2: Geographical scope - ECAC States (2009)



1.2. Temporal scope

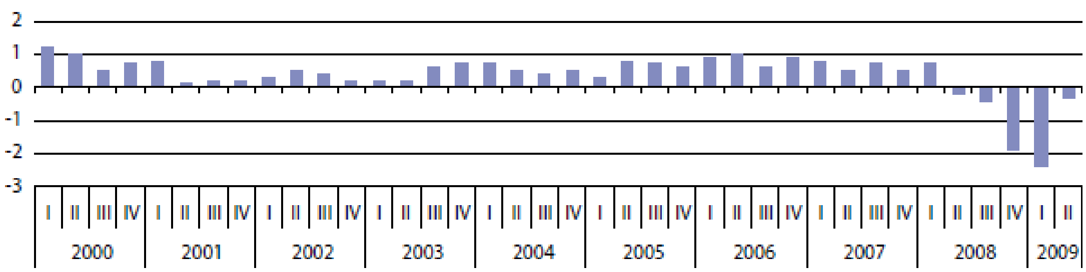
According to the main goal of the study which focuses on the impact of global economic crisis on airframe utilisation in 2009, temporal scope of the analysis includes years 2008 and 2009.

2. TRAFFIC IN 2008 AND 2009

Global economic crisis and increasing fuel prices in 2009 led to sharp decline in traffic demand in recent history. All market segments shrank in 2009 but load factors started to grow again in the second half of 2009. Available capacity of the airlines was largely exceeding demand. In order to attract passengers, airlines started reducing their fares. Passenger load factors started to rise again. Since airframes were spending fewer hours in the air due to capacity cuts, a drop in airframe utilisation occurred as an outcome of the crisis.

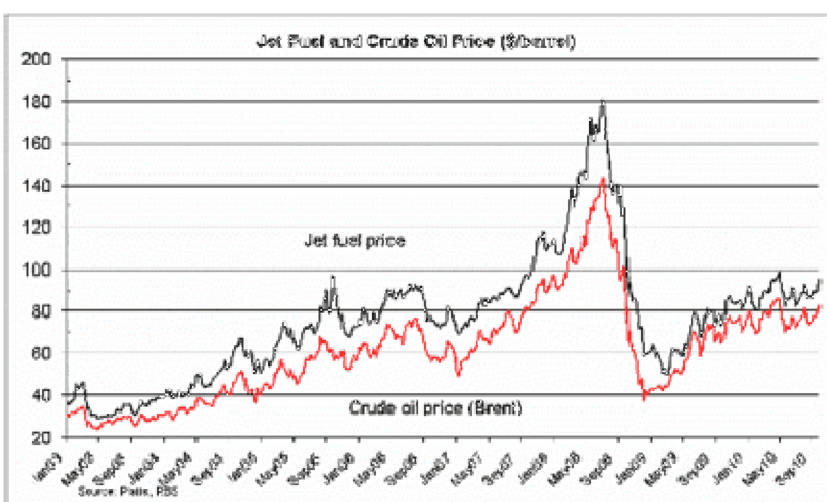
The global GDP (Gross Domestic Product) recorded positive growth rates for each and every quarter until the middle of 2008, the negative growth rates in the final quarter of 2008 and the first quarter of 2009 were greater in magnitude than any of the growth rates recorded in earlier years, underlying the severity of the recession. In fact these were the first negative rates of change since the series began in 1995 and it is widely acknowledged that this is the worst global recession since the 1930's. The most recent rates of change available show that the strength of the recession weakened during 2009 and estimates for the third quarter of 2009 show a return to growth in the EU-27 as a whole'[8], (Figure 3).

Figure 3. GDP, change on previous quarter, EU27 (%)



Source: Eurostat

Figure 4. Oil prices (Source: IATA Jet Fuel Price Development)



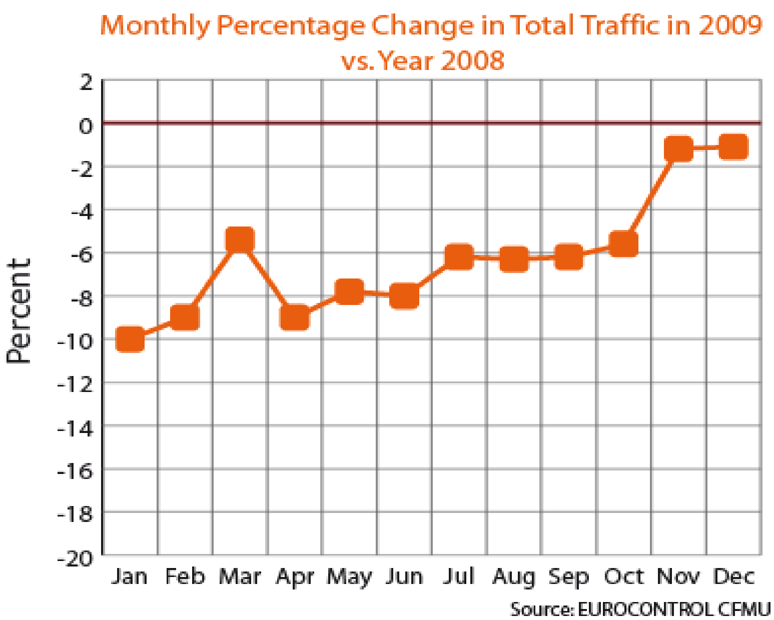
[8] Europe in figures, Eurostat yearbook 2010, EUROSTAT Statistical books, 2010

Oil prices were lower in 2009 in comparison to 2008, starting at around $40 per barrel in January 2009 and increasing to $80 per barrel by the summer. They remained quite stable during the second half of the year (Figure 4)

In recent history, airlines have recorded big declines in traffic after the events from 9/11 in 2001, SARS in 2003 and increasing fuel prices in 2004 when the average annual decrease was around 3%[9] in international transport. The severity of the influence of global economic crisis is highlighted in 2009 with recorded annual decrease of traffic of 6.6%[9]. Decline of traffic was bigger in the first half of the year (-8.6%)[9] and then started to recover in the second half (-4.6%)[9]. Since GDP is the main driver of air traffic demand, its negative rates have affected air traffic. Air traffic has suffered greatly because of the economic recession which started to affect European traffic at the end of 2008 and continued in 2009.

The average daily traffic in Europe in 2009 was around 25,800 flights[9]. For most of the year, the total number of flights in Europe has tracked the traffic levels experienced in 2006. But, with further capacity cuts from the start of the winter 09/10 timetable, the last 2 months of 2009 had similar volumes of traffic as 2005 (Figure 5).

Figure 5. Percentage change in total traffic in 2009 versus year 2008 (All IFR Traffic)



According to EUROCONTROL medium-term forecast[9], air traffic volumes decreased in 2009 in comparison to 2008, but the distribution of share of market segments remained stable except for low-cost carriers which gained 1% of the total share (Figure 6). All market segments shrank in 2009 compared to 2008, with business aviation (-14%), all-cargo (-13.1%) and charter (-13.1%) most severely hit respectively. At the very end of the year, low-cost and business aviation recovered slightly (Figure 7). Due to excess capacity, load factors were weaker in the first half of the year but they started increasing again from July 2009 onwards.

[9] Forecast of Annual Number of IFR Flights (2010-2016), EUROCONTROL Medium-Term Forecast, Volume 1, 24-February-2010

Figure 6. Distribution of market segments in 2008 and 2009 (All IFR Traffic)

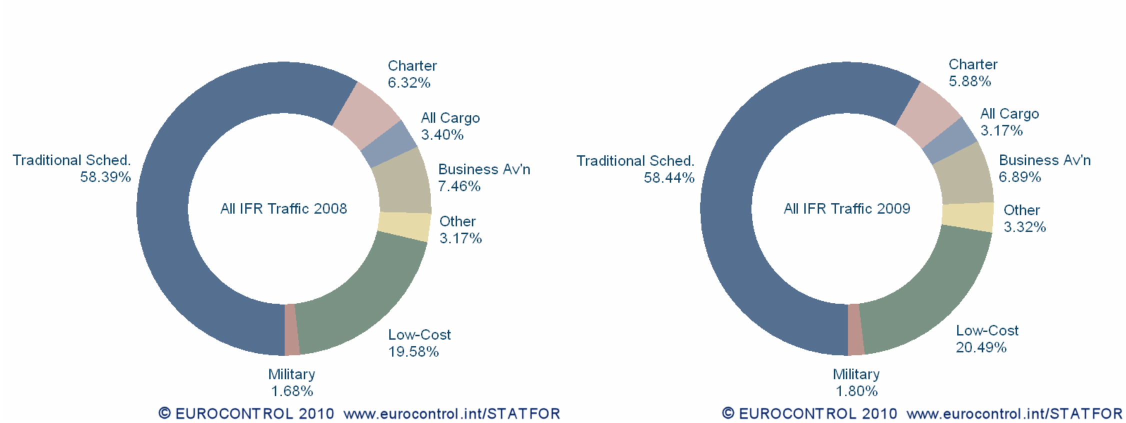
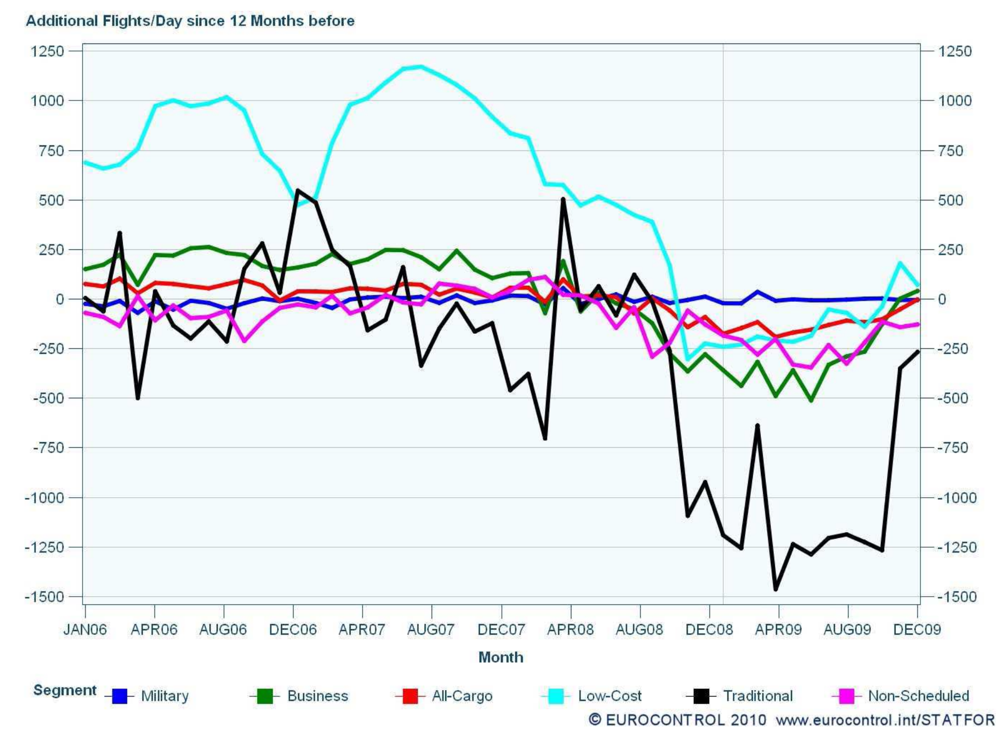


Figure 7. Evolution of traffic by market segment (All IFR Traffic)



Economic downturn, resulted in job losses and an impact on consumer confidence, was following a classical demand cycle:

During the first quarter of the year, airlines were trying to consolidate their businesses to match the decrease in demand. On the other hand, passenger load factors[10] decreased which had a negative influence on yields and profitability of airlines during the first quarter of 2009. Capacity reduction was not able to keep pace with steep decline in demand because of the slot use regulation ("use it or lose it" rule[11])

[10] Passenger Load Factor (PLF) is a measure of the amount of utilisation of the total available capacity of an airframe.
[11] Regulation (EC) No 545/2009, adopted on 18 June 2009, allowed air carriers to keep the same slots for the summer season of 2010 as attributed to them for the summer season of 2009. See Council Regulation (EEC) 95/93 on common rules for the allocation of slots at Community ,adopted by the European Community adopted in 1993.

in crowded airports. Traffic demand was falling faster on long-haul than on short-haul routes. It has also been shown that business class travel is falling faster than economy class, and that business class passengers are trading down to cheaper seats. Prevailing market conditions made airlines reduce their fares in order to attract passengers; airline fares were lower in 2009 in comparison to the previous year.

In the second quarter of 2009 airlines finally caught up with the slump in traffic demand. As a consequence, passenger load factors improved drastically but yields were falling. Soaring traffic demand could be increasingly attributed to the decrease in airline fares rather than economic recovery. The 2008/2009 recession caused a shift of traffic demand to the LCCs.

Excess capacity still remained in the third and fourth quarter of the year but capacity was more in line with traffic demand. This excess of available capacity made airlines lower their fares and revenues even more, subsequently values of load factors peaked in July and August.

3. PREPARING THE DATA FOR THE ANALYSIS

Incomplete data were tracked and modified.

Three data sources were used:

- CODA (***C**entral **O**ffice for **D**elay **A**nalysis*);
- CFMU (***C**entral **F**low **M**anagement **U**nit*)[12];
- CRCO (***C**entral **R**oute **C**harges **O**ffice*)[13].

CFMU contains detailed data of filed flight plans and ATFCM (***A**ir **T**raffic **F**low and **C**apacity **M**anagement*) delay information. In order to get a wider image about all delay causes[14], this data was joined with CODA database. In this way, for delay analysis purposes only airlines reporting to CODA were included. This data was then joined with CRCO data which contains more information about registration numbers, when this data was missing in both CFMU and CODA dataset.

Following market segments were included:

- Low cost flights;
- Traditional scheduled flights;
- Charter flights.

The list of airlines included in the analysis is given in the *Appendix*.

A classification of aircraft types was made by (*See Appendix*):

- Wide body aircraft;
- Narrow body aircraft;
- Turboprop aircraft.

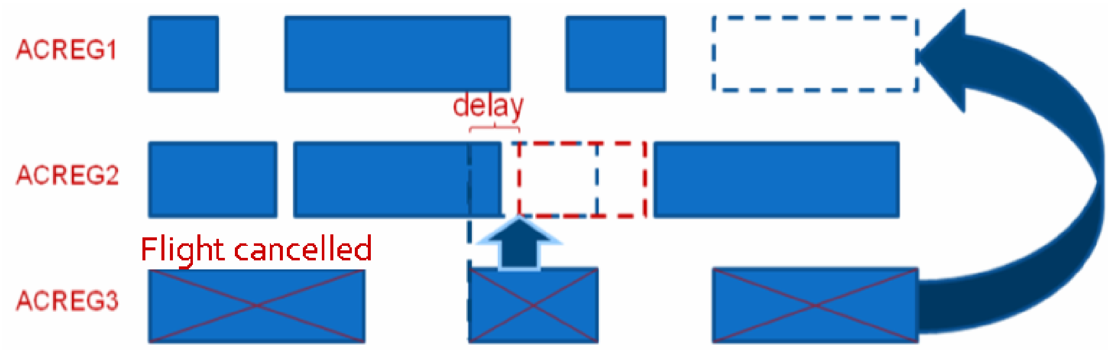
After a detailed examination of the data, some irregularities were corrected:

- <u>different aircraft types with the same registration number</u> – In cases when for the same registration number, two or more aircraft types had the same frequency, it would have been difficult to determine which aircraft type is the correct one for the corresponding aircraft registration so those cases were tracked. The number of those cases was so low (less than 0.7%), so those registration numbers were excluded from the further analysis.
- <u>missing values</u>- based on available data, some of missing values had been calculated but if no data was available, they were left blank, not excluded.
- <u>STD (***S**cheduled **T**ime of **D**eparture*) is before the STA (***S**cheduled **T**ime of **A**rrival*) on a previous flight leg</u>- those occurrences are not mistakes but are usually related to aircraft changes (e.g. technical problems) on the day of operation. If an unexpected

[12] www.cfmu.eurocontrol.int/cfmu
[13] www.eurocontrol.int/crco
[14] ATFCM delays represent between 30 and 35% of All delay causes.

technical problem with an aircraft arises the OCC (***O**perational **C**ontrol **C**entre*) of an airline tends to make some changes in its flight schedules in order to minimise the deviation from their planned schedule.

Figure 8: Changes in a operational scheme of an airline in case of a technical problem of an airframe with the registration number - ACREG3



A hypothetical example is given in Figure 8. Aircraft with the registration number ACREG3 was having a technical problem on the day of operation. In order to minimise the number of cancelled flights airline will try to operate the flights which were supposed to be operated with aircraft ACREG3 with other aircraft from the fleet. The last flight leg of aircraft ACREG3 was transferred to the aircraft with registration number ACREG1, with no disturbance of the schedule. The second flight leg of ACREG3 was 'squeezed' into the flight schedule of aircraft ACREG2 causing a problem of overlap. The problem was resolved by adding a necessary delay. Since there was no place to insert the first flight leg of ACREG3, the flight was cancelled. So finally instead of cancelling three flights, only one was cancelled and the other one suffered a shorter delay.

Turn-around times shorter than 20 minutes were ignored in further analysis.

4. AIRFRAME UTILISATION CALCULATION

The airframe utilisation was calculated as the sum of block-to-block hours divided by aircraft days available. Analysis was conducted on monthly and yearly basis allowing further benchmarking.

According to ICAO, airframe utilisation is defined as:'' Aircraft hours flown (block-to-block) divided by aircraft days available.'', where aircraft days available are defined as "The sum of the number of days an aircraft is available for use during the period in question. The following days are excluded from the days available:

- the days between the date of purchase of an aircraft and the date it is actually placed in service;
- the days subsequent to an aircraft's last revenue flight and prior to its disposal;
- the days that an aircraft is out of service due to major accidents or conversion;
- the days that an aircraft is in the possession of others;[15]
- the days that an aircraft is not available because of government action such as grounding by government regulatory agencies.

All other days must be considered as days available, even days required for maintenance or overhaul" and aircraft hours are based on "block-to-block" time (i.e. from the moment the aircraft is pushed back from the gate or starts taxiing from its parking stand for take-off to the moment it comes to a final stop at a gate or parking stand after landing); also known as block time.

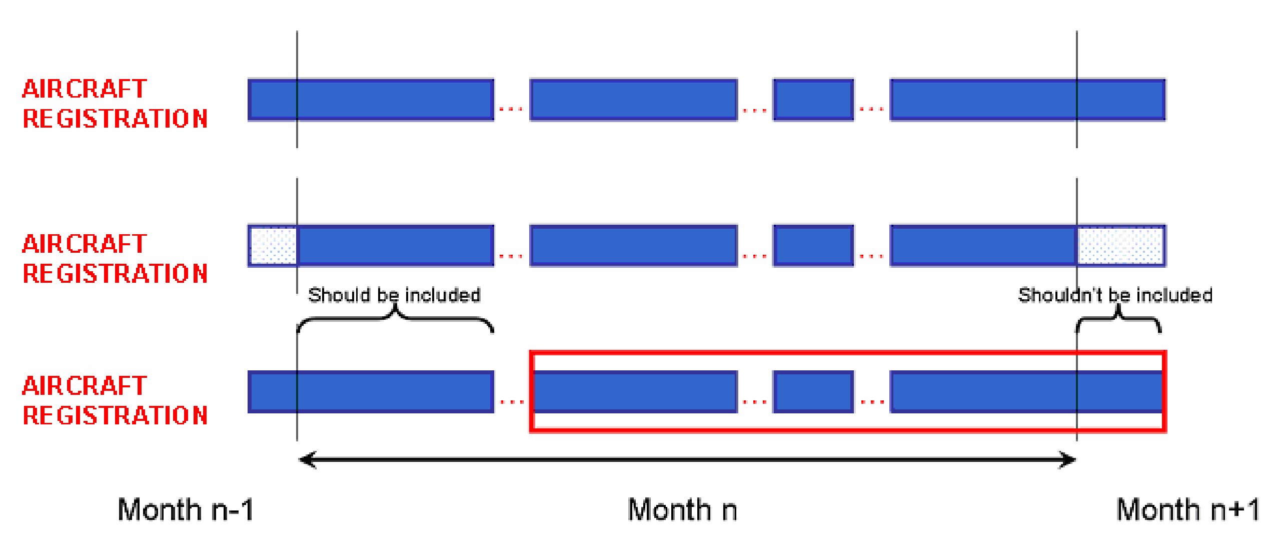
For the purpose of this study, the calculation of airframe utilisation is granulated into months in order to allow comparison of two corresponding months for the two consecutive years. In this way, aircraft days available are equal to a number of days in the month.

According to the definition, utilisation of an airframe is calculated as a sum of block-to-block times of all flights which were realised during the observed period of time (numbers of days in the month). Afterwards, for each airframe, daily value of utlisation is calculated as sum of block-to-block times divided by the number of days in a month. Depending of the type of utilisation analysis grouping (range, aircraft type, business model or market segment), a median value for all airframes per month was calculated and adopted as a representative utilisation value for further benchmarking.

Flights which start on one day and end on the following were included in the calculation of airframe utilisation for the previous day. It was calculated that those flights account for 4% of the total number of flights so it was decided to summarise for each airframe block-to-block times of all flights on monthly basis instead on daily basis. In this way this imprecision has influence only on those flights of each frame at the beginning and the end of an observed month and has been estimated that it doesn't influence the results. In order to better understand cases with this imprecision, look at the Figure 9. Since some parts of flight legs will not be included as they should and the others are included when they shouldn't be, on the average it doesn't have a big influence on the results.

[15] For example when aircraft is leased to another operator.

Figure 9. Example of block-to-block times taken into the consideration for calculating utilisation of an airframe with its unique registration number for month n



Observed distribution of airframe utilisation is close to 'Normal' except of the big peak for airframes with utilisation lower than 50 minutes per day. Detailed analysis disclosed following cases:

- wrong aircraft registration (callsign instead of aircraft registration);
- low values because airframe left the fleet at certain period;
- missing registrations from filed flight plan.

By adding two new criteria: exclude aircraft registrations which either have daily utilisation less then 50min or have less than 300 flights/year (meaning that they fly approximately 1 flight per day); this data irregularity was corrected. In this way sample was reduced by additional 0.7%. After this cleaning total sample size was reduced by 10% in comparison to the original size.

The days when an airframe is on lease to others[16] are not subtracted from the actual number of days in a month because that information is not available in Eurocontrol database. This means that some airframes might have been leased from non European country to operate in Europe and the other way around. Those data could have affected the obtained results but it is not possible to judge their influence because the data is not available.

[16] Corresponding to the part of ICAO definition of airframe utilisation of ''the days that an aircraft is in the possession of others''

5. AIRFRAME UTILISATION ANALYSIS

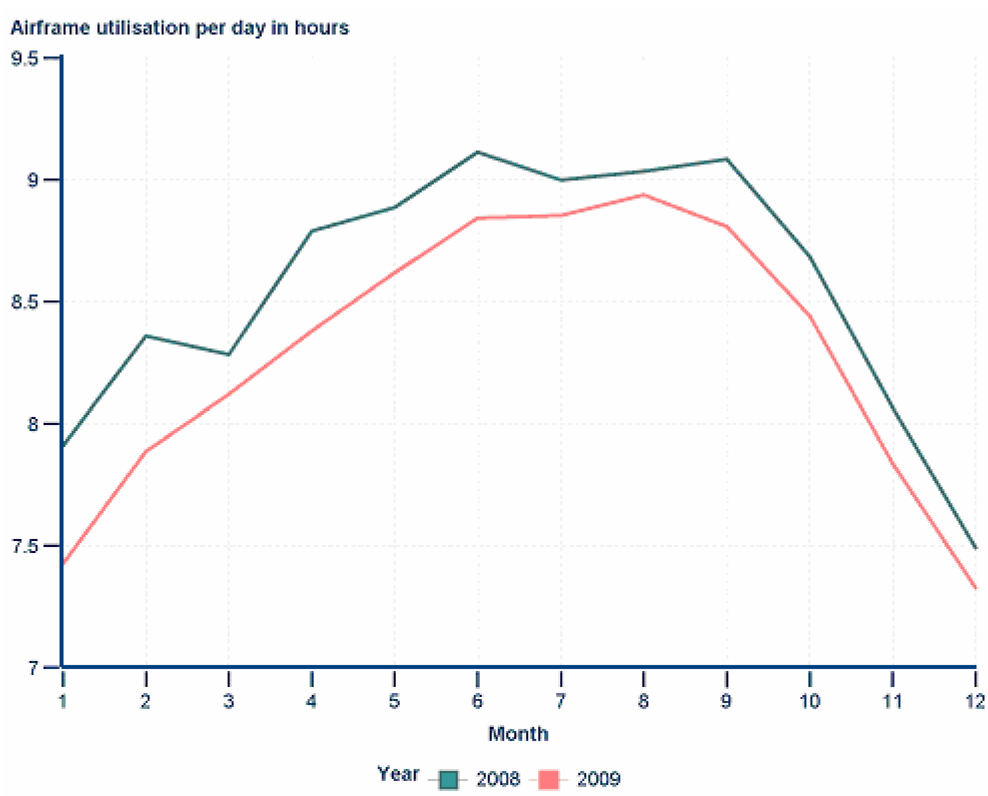
Based on the sample, a strong correlation was observed between the drop in overall traffic and airframe utilisation. The decrease in air traffic by 4.3% subsequently reduced airframe utilisation by 3.7%.

Airframe utilisation is a function of a number of elements including aircraft type, business model, market segment, network design, type of leasing[17], maintenance programs, technical checks and scheduling policy of an airline. It may also vary depending on the period of year but also of the range of routes on which airframe fly.

Airlines tend to maximise airframe utilisation in order to reduce cost per flight/seat-kilometre. The higher utilisation is the more flight-hours airframes can carry out during an operational day. In this way total fixed costs of an airline are divided with a higher number of flight-hours which reduces a cost per hour-flown for an airframe. On the other hand, higher values of airframe utilisation bring to more frequent maintenance checks.

Monthly distribution of airframe utilisation is given in Figure 10. It shows that during first half of the year airframe utilisation had a bigger drop but started to recover in the second half of the year.

Figure 10. Monthly distribution of airframe utilisation



[17] In example if the leasing is based on the 'Power by the hour' principle, airlines don't have to insist on high values of airframe utilisation during the periods of lower demand if the load factors are high.

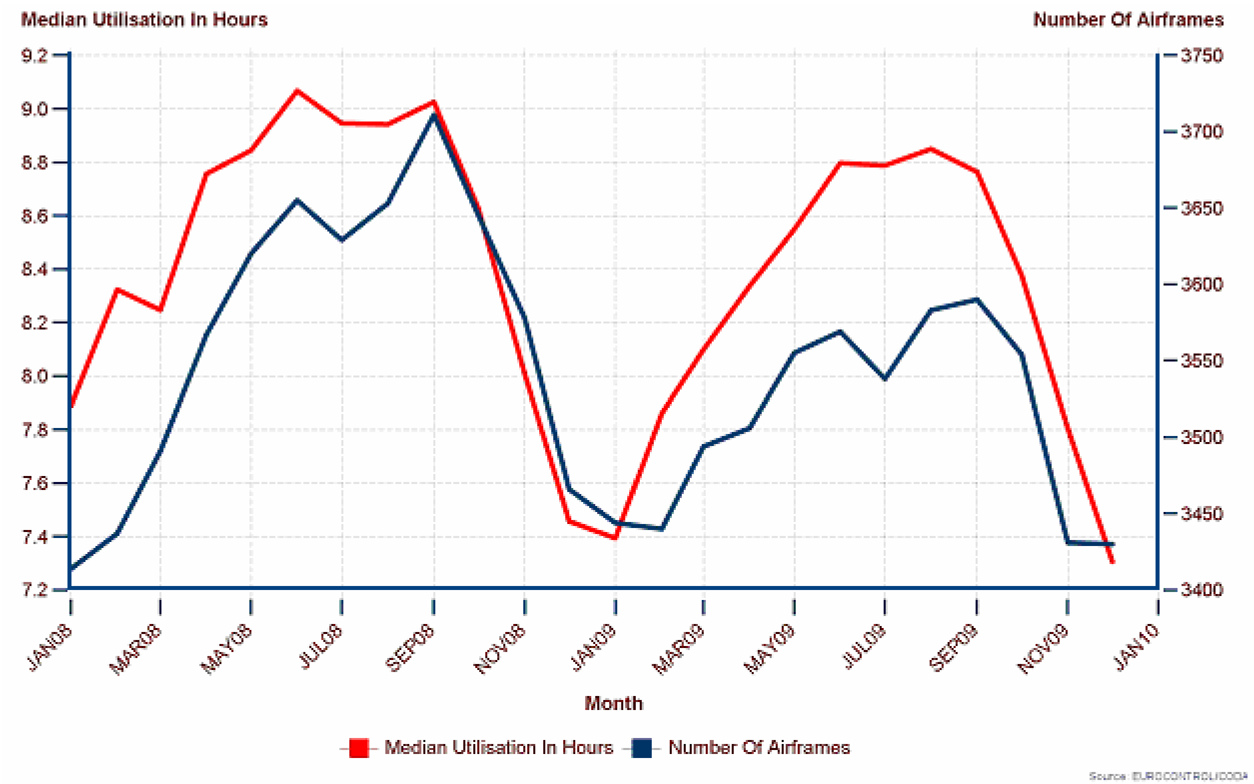
Median values of airframe utilisation for 2008 and 2009 are presented in the Figure 11:

Figure 11. Change in airframe utilisation from 2008 to 2009

Year	Airframe utilisation in minutes	Airframe utilisation in hours
2008	483	8.05
2009	465	7.75

Distribution of airframe utilisation shows pronounced seasonality (Figure 10 Figure 12). Due to decrease in traffic demand, airframe utilisation had a steeper decrease at the end of 2008. As a response, airline started reducing the number of airframes which explains the shift between distribution of airframe utilisation and the number of operating airframes.

Figure 12. Distribution of airframe utilisation and the number of airframes



The difference of 18 min between medium values observed in 2008 to the one observed in 2009 shows a drop in airframe utilisation by 3.7% in 2009. Overall traffic decreased by 4.3% based on above defined sample. Influence of drop in overall traffic on decrease in airframe utilisation was the initial hypothesis for this study.

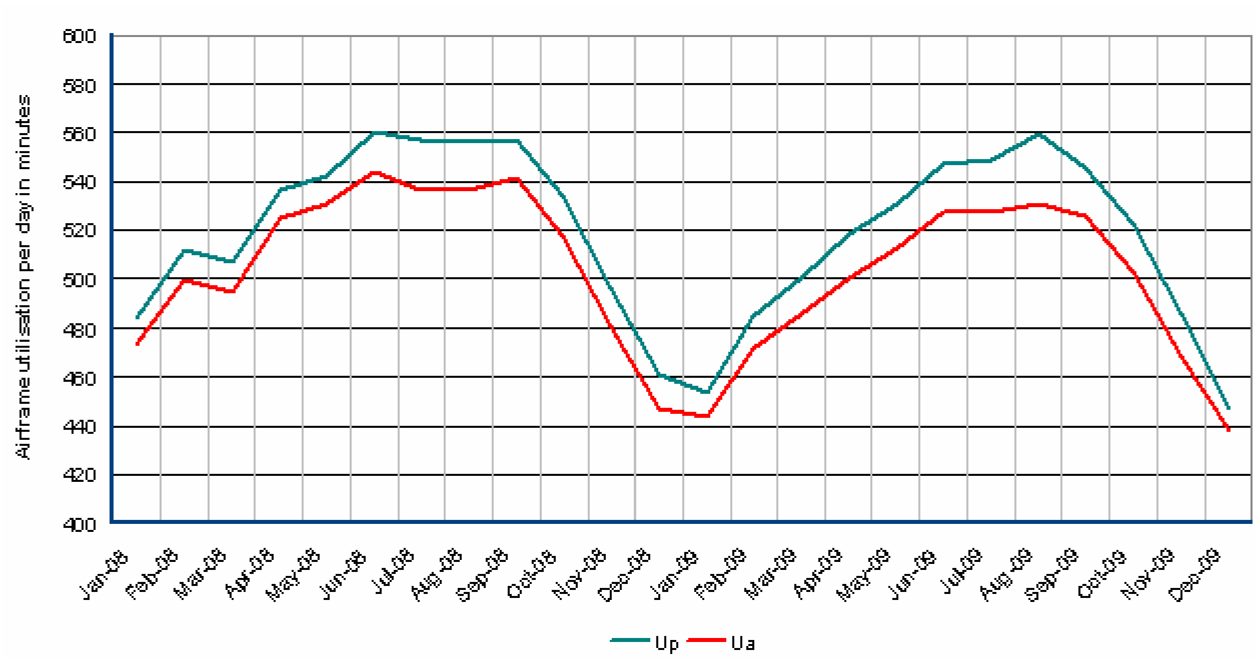
As can be seen from Figure 11 and Figure 12, as a response to a decrease of transport demand, airlines reduced airframe utilisation and the number of operating airframes but was still not enough to compensate the big fall in demand. Particularly because airlines were taking deliveries of aircraft ordered earlier. In order to cut capacity airframe utilisation dropped, an increased number of airframes were kept on the ground longer. This increased unit cost because fixed aircraft costs were spread over fewer hours aircraft spent in the air. Consequently, this excess capacity resulted in many old airframes being taken out of service.

Figure 13. Difference in planned and actual airframe utilisation in 2008 and 2009

Year	Actual Airframe utilisation in minutes	Planned Airframe utilisation in minutes	Difference between planned and actual airframe utilisation
2008	483	494	11
2009	465	479	14

As shown on Figure 13 and Figure 14, in 2009 even though the number of hours flown decreased, airlines were expecting to achieve higher values of airframe utilisation per day (by 3 minutes) in comparison to 2008. Planned airframe utilisation is between 2 and 3% higher. It should be noted that higher values of planned airframe utilisation mean that buffers are incorporated into the schedules to absorb congestion and delays.

Figure 14. Distribution of planned (Up) and actual (Ua) airframe utilisation in 2008 and 2009



A strong correlation between airframe utilisation and overall traffic was noticed and further analysed through:

- Range;
- Aircraft type;
- Market segment;
- Business model.

5.1. Range

As a result of the efforts to cope with the decrease in demand, airlines started reducing the number of operating airframes. The number of airframes decreased drastically at the beginning of 2009 but started to rise by the end of the summer season when they reached the levels of 2008. Again seasonality has an influence on airframe utilisation on short and medium-haul routes but not on long-haul routes. The biggest drop in airframe utilisation was on short-haul flights of 4.1%, 2.9% on long-haul and 2% on medium-haul flights. The big drop in traffic on long-haul flights resulted that some airframes were used on medium-haul routes instead. The number of sectors flown on medium and long haul routes were reduced which had a negative impact on airframe utilisation. On average, airlines plan to fly 10 min (3%) more a day than they actually do.

An airframe can operate on different ranges. According to the ICAO definition, utilisation has to be calculated per airframe. In order to do the analysis of airframe utilisation per airframe and range, only one type of range could have been assigned to an airframe. Range has been assigned according to the following criteria:

1. Short-haul flights – if an airframe had more than 70% of total number of flights on short-haul routes (routes shorter than 1500 km);
2. Medium-haul flights – if an airframe had more than 70% of total number of flights on medium-haul routes (routes between 1500 and 4000 km);
3. Long-haul flights – if an airframe had more than 70% of total number of flights on long-haul routes (routes longer than 4000 km);
4. Mixed Short-haul/Medium-haul – if an airframe operates on short-haul (routes shorter than 1500 km) and medium-haul (routes between 1500 and 4000 km) routes;
5. Mixed Medium-haul/Long-haul - if an airframe operates on medium-haul (routes between 1500 and 4000 km) and long-haul (routes longer than 4000 km) routes;
6. Mixed Short-haul/Long-haul - if an airframe operates on short-haul (routes shorter than 1500 km) and long-haul (routes longer than 4000 km) routes;
7. Mixed Short-haul/Medium-haul/Long-haul - if an airframe operates on short-haul (routes shorter than 1500 km), medium-haul (routes between 1500 and 4000 km) and long-haul (routes longer than 4000 km) routes;

The proportion of flights per range based on above defined criteria is following (Figure 15):

Figure 15. Proportion of flight by range in examined sample

Range	Share
Short-haul flight	89.5%
Mixed SH-MH	3.7%
Medium-haul flight	2.3%
Mixed MH-LH	2.1%
Long-haul flight	1.3%
Mixed SH-MH-LH	0.9%
Mixed SH-LH	0.2%

The distribution of the number of airframes per range shows seasonality on short-haul routes. The number of airframes is higher during summer season (from March till October). Due to economic crisis, the distribution of the number of airframes has changed. The number of airframes was reduced in the beginning of 2009 and started to grow during the remainder of the year, which shows the airlines efforts to cope with excess capacity but the number of airframes increased also because of some new deliveries (Figure 16). This trend lasted until the end of the summer 2009 (October), when the number of airframes was affected by the seasonal pattern (more airframes during the summer season in comparison to winter season). Even with those efforts, airframe utilisation remained underneath the levels in 2008 in average by 4.1% (Figure 17).

Figure 16. Change in the monthly distribution of the number of airframes on short-haul ranges for 2008 and 2009

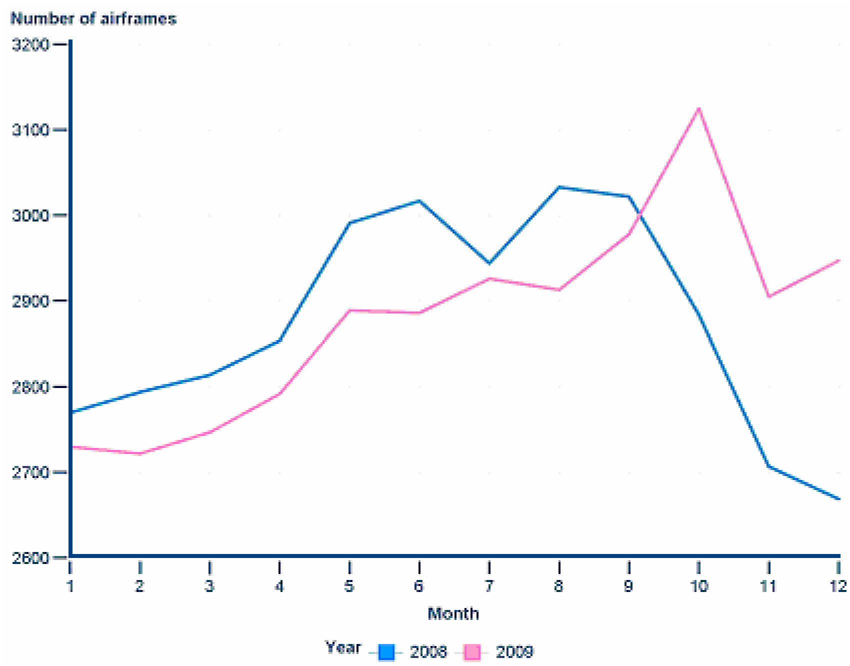


Figure 17. Monthly change of airframe utilisation per range (2009 vs. 2008)

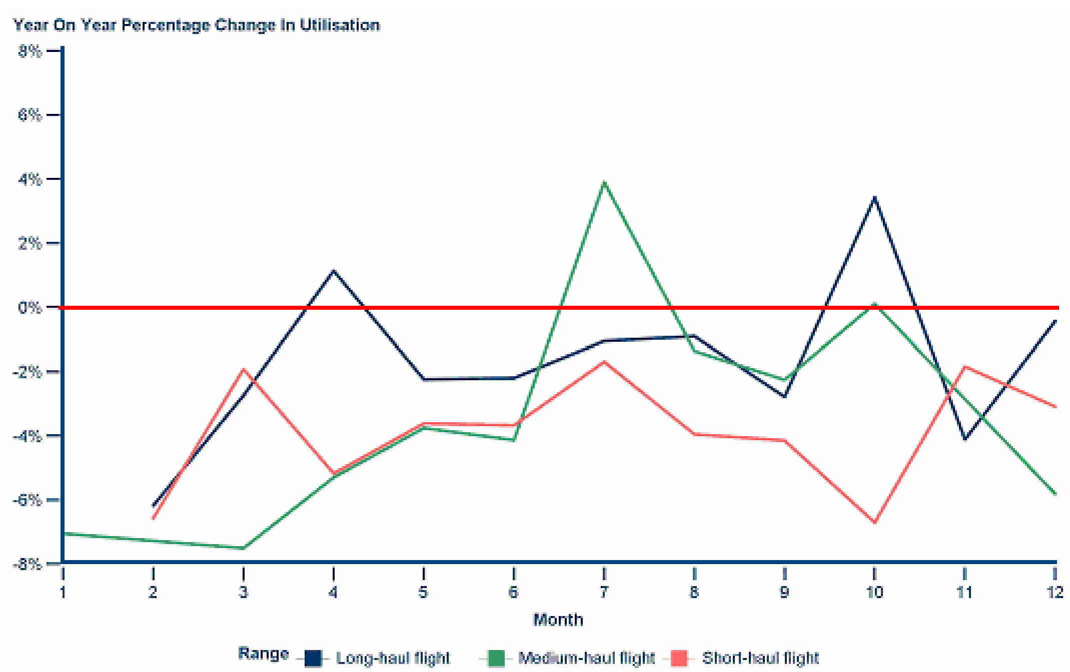
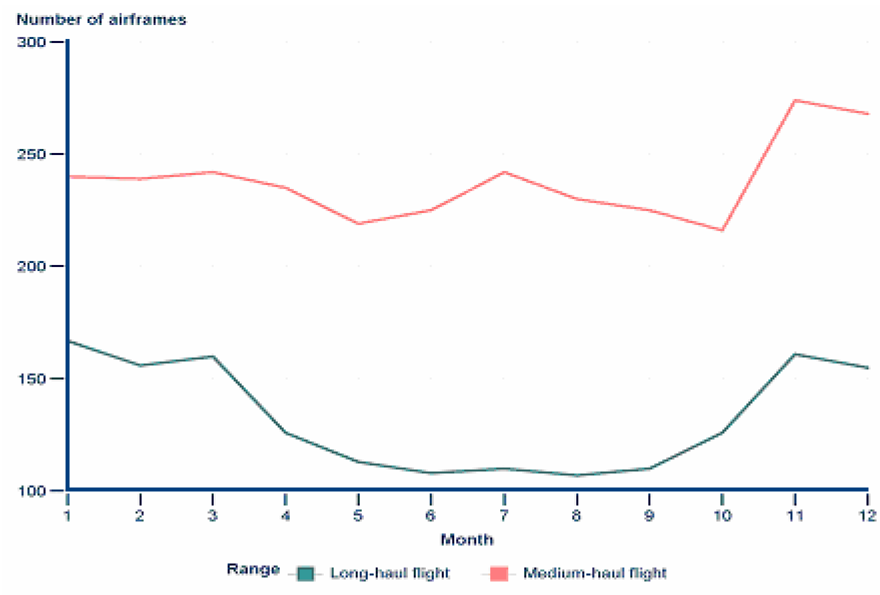
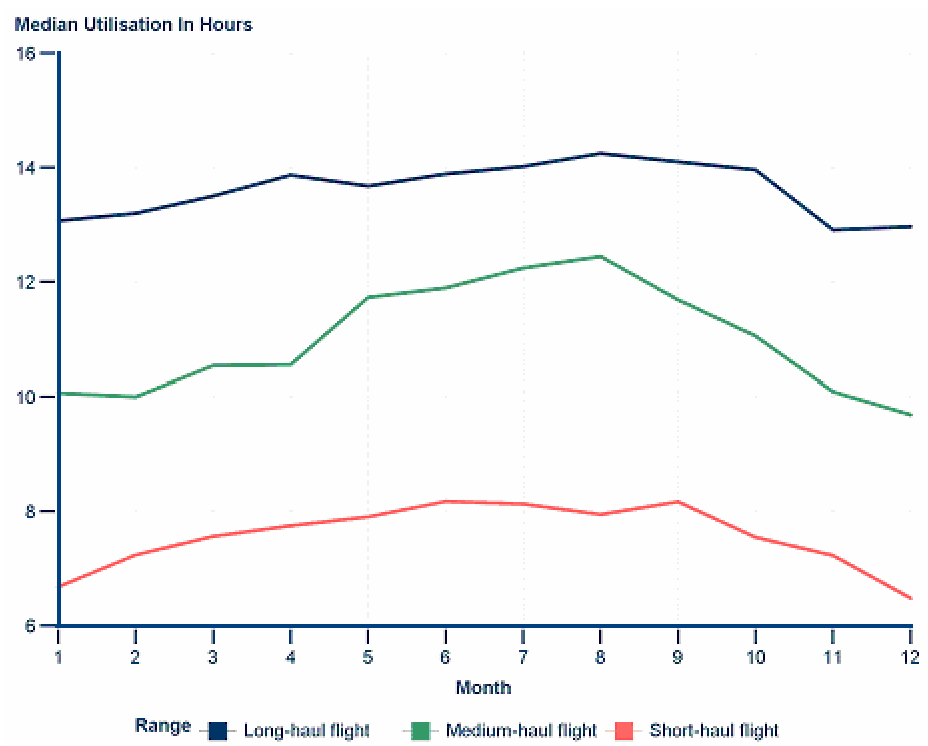


Figure 18. Monthly changes in the number of operating airframes for medium and long-haul flights (2008)



Seasonality is not that obvious on medium-haul and long-haul routes where the variations in the number of flights are smaller. For medium-haul flights, one could notice 3 peaks, for Easter, peak of the summer season (June, July and August) and Christmas holidays (Figure 18). Based on the correlation between the number of flights and airframe utilisation, seasonal changes influence airframe utilisation on short, medium and the combination of short/medium – haul routes, where for long and the combination of medium/long – haul routes airframe utilisation doesn't have big variations during the year and is fairly constant (Figure 19).

Figure 19. Monthly distribution of airframe utilisation per range (2008)



In 2009 the biggest decrease of airframe utilisation was by -4.1% on short-haul routes. Overall number of airframes hasn't changed in 2009 which is why utilisation had such a big drop (Figure 17 and Figure 20).

Since the 'demand is generally taken to be negatively associated with increased distance between origin and destination'[18], long-haul segment registered a big decrease in overall traffic (17%). Despite lower operating cost (longer time spent on optimal FL reduces fuel consumption, lower maintenance costs etc.) of airframes which fly on long haul routes and drastic reduction of the number of operating aircraft, utilisation has decreased by 2.9% because the reduction of the number of airframes was not enough to compensate the decrease in traffic and allow utilisation to stay on the previous year level (Figure 17 and Figure 20).

Figure 20. Change of airframe utilisation (2009 vs.2008) per range

Range	Change in utilisation per range (2009 vs. 2008)	Change of the number of flights per airframes (2009 vs. 2008) per range	Change of the number of airframes per range (2009 vs. 2008)	Change of the number of flights per range (2009 vs. 2008)
Long-haul flight	-2,9%	-2,4%	-14%	-17%
Medium-haul flight	-2,0%	-2,0%	4%	5%
Mixed MH-LH	-1,6%	-2,2%	1%	-1%
Mixed SH-LH	-0,3%	0,0%	-11%	-10%
Mixed SH-MH	-2,5%	3,7%	7%	11%
Mixed SH-MH-LH	-2,5%	-2,0%	18%	18%
Short-haul flight	-4,1%	-3,3%	0%	-2%

It is interesting to note that the number of airframes increased on medium haul routes and the combination of medium-haul/short-haul and medium-/long-haul routes which indicates that some of the airframes used were used on medium-haul instead of long-haul routes. Those figures are higher because of new airframe deliveries. Analysis of segments flown has shown that there was a reduction in the number of section flown on medium-haul/long-haul routes which had an impact on airframe utilisation.

Planned airframe utilisation is supposed to be on average 10 minutes longer then the actual one, which is depending on the airframe range between 1 and 3% of daily utilisation of an airframe.

Following table shows median values of airframe utilisation in minutes and hours per range (Figure 21). The longer average range, the higher values of utilisation an airframe can obtain due to the fact that it spends less time on the ground.

Figure 21. Median values of airframe utilisation per range in minutes and hours

Range	Median utilisation per range in minutes	Median utilisation per range in hours
Long-haul flight	834	13,9
Mixed MH-LH	816	13,6
Mixed SH-MH-LH	796	13,3
Mixed SH-LH	755	12,6
Medium-haul flight	733	12,2
Mixed SH-MH	666	11,1
Short-haul flight	503	8,4

[18] Holloway S.(2003), Straight and level: practical airline economics, Ashgate

5.2. Aircraft type

A strong link between airframe utilisation and the number of aircraft was noted. By reducing the number of airframes utilisation increases and vice versa. In 2009, narrow body aircraft suffered the most in terms of airframe utilisation which recorded a decrease by 4.20%. On the other hand, turboprop airframes had 5.80% higher values of airframe utilisation mostly due to flight efficiency of turboprop aircraft and the suspension of ''use it or lose it'' rule. The biggest drop in airframe utilisation was -7.1% for airframes from the family B737, B738 and B739 mostly due the large number of new aircraft deliveries.

Analysis of airframe utilisation was conducted by two criteria:

- Grouping into (Appendix):
  1. Wide body aircraft
  2. Narrow body aircraft
  3. Turboprop aircraft.
- Grouping into aircraft families which have the biggest frequency of appearance:
  1. A319/20/21
  2. A332/3
  3. A342/3/5/6
  4. B737/8/9
  5. B743/4
  6. B772/3
  7. Turboprop aircraft with more than 35 seats

The number of narrow and wide body airframes started to drop in 2009 as a result of airlines response to decrease in air traffic demand. The distribution of number of airframes in 2009 remained quite stable in comparison to previous year, being on average 2% lower in comparison to 2008. The number of airframes started to grow again from November 2009 which was in accordance to rise of traffic demand which started in the fourth quarter of 2009.

Figure 22. Proportion of flight by aircraft type in examined sample

Aircraft Type	Share
Narrow body aircraft	83%
Turboprop aircraft	10%
Wide body aircraft	7%

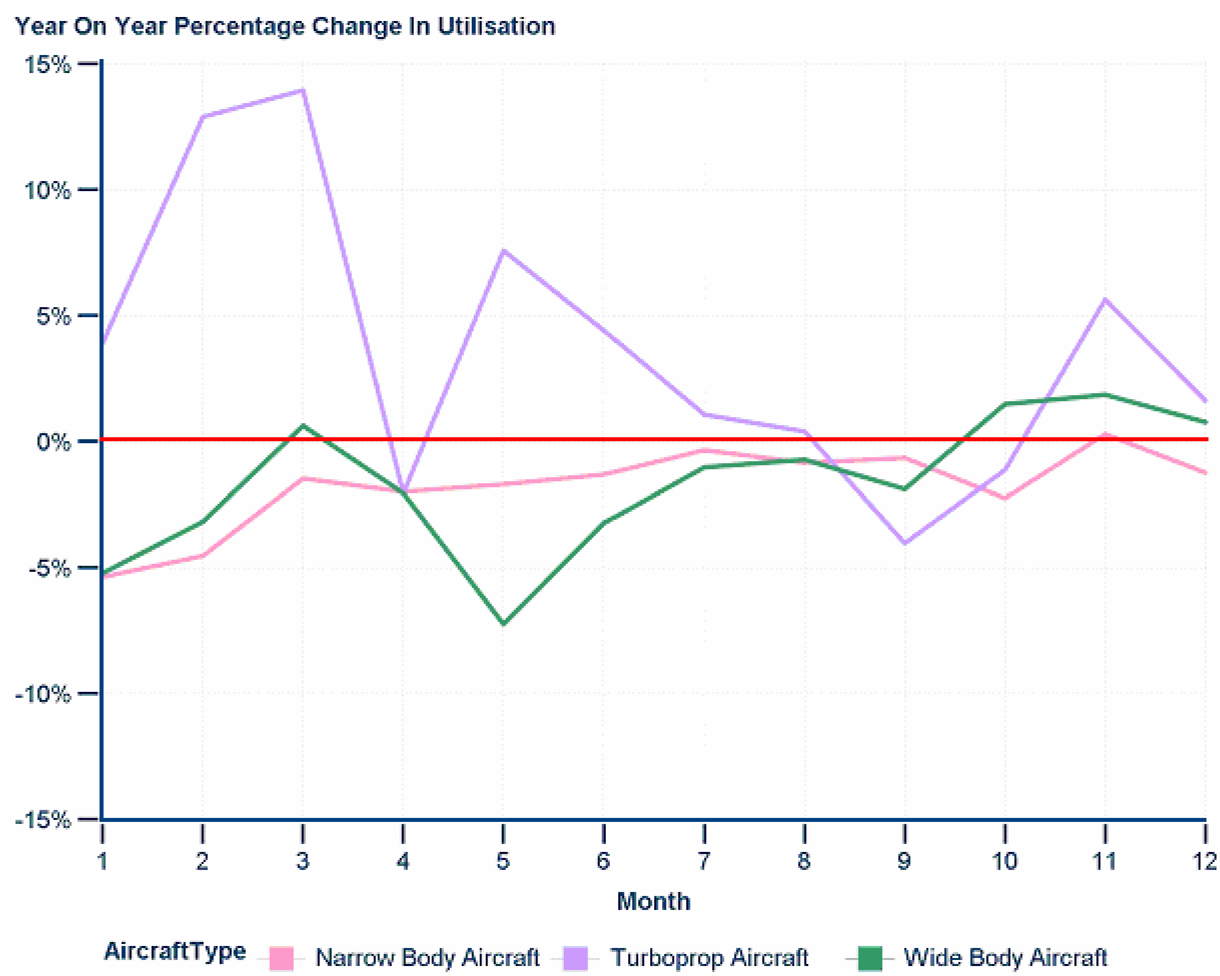
Narrow body airframes had the biggest decrease in airframe utilisation due to combination of two factors, increase in the number of airframes mostly due to some new deliveries and decrease of overall traffic (Figure 23 and Figure 24).

Figures for airframe utilisation for wide body airframes in 2009 were lower by 1.8% in comparison to the previous year. The fact that wide body aircraft 'can only be used efficiently when the combination of traffic density and product-driven frequency'[19] justifies the costs, forced airlines to reduce the number of their

[19] Holloway S.(2003), Straight and level: practical airline economics, Ashgate

operating wide-bodies (by 5.5%). Despite the overall decrease in the number of wide body airframes due to some new aircraft deliveries which increased the overall number of airframes, utilisation had a big drop. From May, airlines started to reduce the number of airframes which had a positive impact on airframe utilisation which started to grow in the fourth quarter reaching levels even higher than the ones from 2008 (Figure 23 and Figure 24).

Figure 23. Monthly change of airframe utilisation per aircraft type (2009 vs. 2008)



The trend for turboprop aircraft was different. Airframe utilisation was 5.8% higher in 2009 than the levels seen in 2008. This was due to combination of following factors:

- reducing number of operating aircraft to better match capacity with falling demand;
- decreased demand and subsequent decrease in the number of passengers made airlines operate flights with turboprop aircraft instead of narrow body jet aircraft. This was due to turboprop aircraft being more fuel efficient and can achieve better load factors and subsequently reduce operating cost in the period of economic downturn;
- as can be seen in the Figure 23, airframe utilisation had a pronounced growth in the first half of the year due to the "use it or lose it" rule which forced airlines to operate flights even with low load factors only to be able to keep their slots in the next summer season. On 18 June 2009 European Commission adopted Regulation (EC) No 545/2009, which allowed air carriers to keep the same slots for the summer season of 2010 as attributed to them for the summer season of 2009.

- 'low utilisation can be justified with … very low ownership costs – such as low-cost single turboprops on thin routes, and relatively old passenger conversions on denser routes'[20]
- turboprop aircraft provide a greater variation of operational capabilities.

For turboprops the distribution of number of airframes in 2009 was lower then in 2008 by 2.8% with the exemption of two peaks in September and November. The peak in September is due to the purchase of new DH8D by BEE. On the other hand, the big drop in November is related to IBE grounding/selling of DH8Cs. During 2009, AUA, DLH and IBE were grounding the old DH8Cs and DH8Ds. At the same time BEE started increasing the number of DH8Ds. MAH and REA started grounding SB20s and AT72s (Figure 23 and Figure 24).

Figure 24. Change of airframe utilisation (2009 vs.2008) per aircraft type

Aircraft Type	Change in Utilisation (2009 vs. 2008)	Change In the Number Of Flights (2009 vs. 2008)	Change In the Number Of Airframes (2009 vs. 2008)	Change In the Number Of Flights Per Airframe (2009 vs. 2008)
Narrow body aircraft	-4,20%	-0,60%	2,30%	0,00%
Turboprop aircraft	5,80%	4,70%	-2,80%	0,00%
Wide body aircraft	-1,80%	-5,50%	-2,30%	0,00%

Following table shows median values of airframe utilisation in minutes and hours per aircraft type (Figure 25).

Figure 25. Median values of airframe utilisation per aircraft type in minutes and hours

Aircraft Type	Median utilisation in minutes	Median utilisation in hours
Wide body aircraft	785	13,1
Narrow body aircraft	485	8,1
Turboprop aircraft	366	6,1

Planned airframe utilisation is supposed to be on average 10 minutes longer than the actual one, which is depending on the airframe range between 1 and 5% of daily utilisation of an airframe (Figure 26). The smallest difference is for wide body airframes (1% or 7 minutes), then narrow body (3% or 12 minutes) and the most significant difference is for turboprop airframes (5% or 15 minutes) which is in accordance with flight duration. This shows that wide-body airframes increasingly match their schedules more than narrow-body and turboprop airframes mostly due to the fact that they have longer turnaround time and can absorb better delays and deal with uncertainty by adding more buffer minutes.

[20] Holloway S.(2003), Straight and level: practical airline economics, Ashgate

Figure 26. Difference between planned and actual airframe utilisation per aircraft type

AircraftType	Up[21] in minutes	Ua[22] in minutes	Up in hours	Ua in hours	(Up-Ua) in minutes
Narrow body aircraft	501	485	8,3	8,1	15
Turboprop aircraft	362	344	6,0	5,7	18
Wide body aircraft	792	785	13,2	13,1	7

Airframe utilisation was also examined through families of aircraft which comprise about 60% of total number of airframes included in the study. Following table shows the average utilisation for aircraft families with the biggest frequency of appearances (Figure 27).

Figure 27. Change of airframe utilisation (2009 vs.2008) per aircraft families

Grouping	Change in Utilisation (2009 vs. 2008)	Change in the Number Of Flights (2009 vs. 2008)	Change in the Number Of Airframes (2009 vs. 2009)	Change in the Number Of Flights Per Airframe (2009 vs. 2008)
A319/20/21	-3,20%	13,8%	15,40%	-2,70%
A332/3	-1,10%	4,90%	1,80%	-1,90%
A342/3/5/6	-1,30%	5,00%	4,10%	0,00%
B737/8/9	-7,10%	-6,30%	-1,60%	-6,20%
B743/4	-3,60%	-7,00%	-4,20%	-2,40%
B772/3/W	-3,10%	-0,70%	1,50%	-2,10%
Turboprop aircraft >35	0,9%	3,7%	2,2%	0,00%

The biggest drop was -7.1% for airframes from the family B737/8/9[23] mostly due the large number of new aircraft deliveries (B737s for BER, KLM and B738s for THY, TRA, NAX and SAS). Instead of reducing the number of airframes, airlines were getting their new deliveries which had an even worse impact on airframe utilisation. Similar combination of factors influenced the drop in utilisation for the other aircraft families. The biggest increase in the number of airframes was in the family A319/20/21 (for following airlines ADH, AEE, AZA, BAW, BER, BMA, DLH, EZY, etc), though, the increase in number of airframes was 15%, it was followed with the increase of traffic of about 14% which was the reason why the utilisation didn't have a big drop as could be expected due to increase of the number of airframes during the decrease in traffic demand. This fact showed the importance of planning of airline operation on airframe utilisation (Figure 28).

Following table shows median values of airframe utilisation in minutes and hours per aircraft families (Figure 29).

[21] Median Planned Utilisation for 2008 and 2009
[22] Median Actual Utilisation for 2008 and 2009
[23] Aircraft included in the group B373/8/9 include following airframes: B737-200, B737-300, B737-400, B737-500, B737-600, B737-700, B737-800, B737-900.

Figure 28. Monthly change of airframe utilisation per aircraft families (2009 vs. 2008)

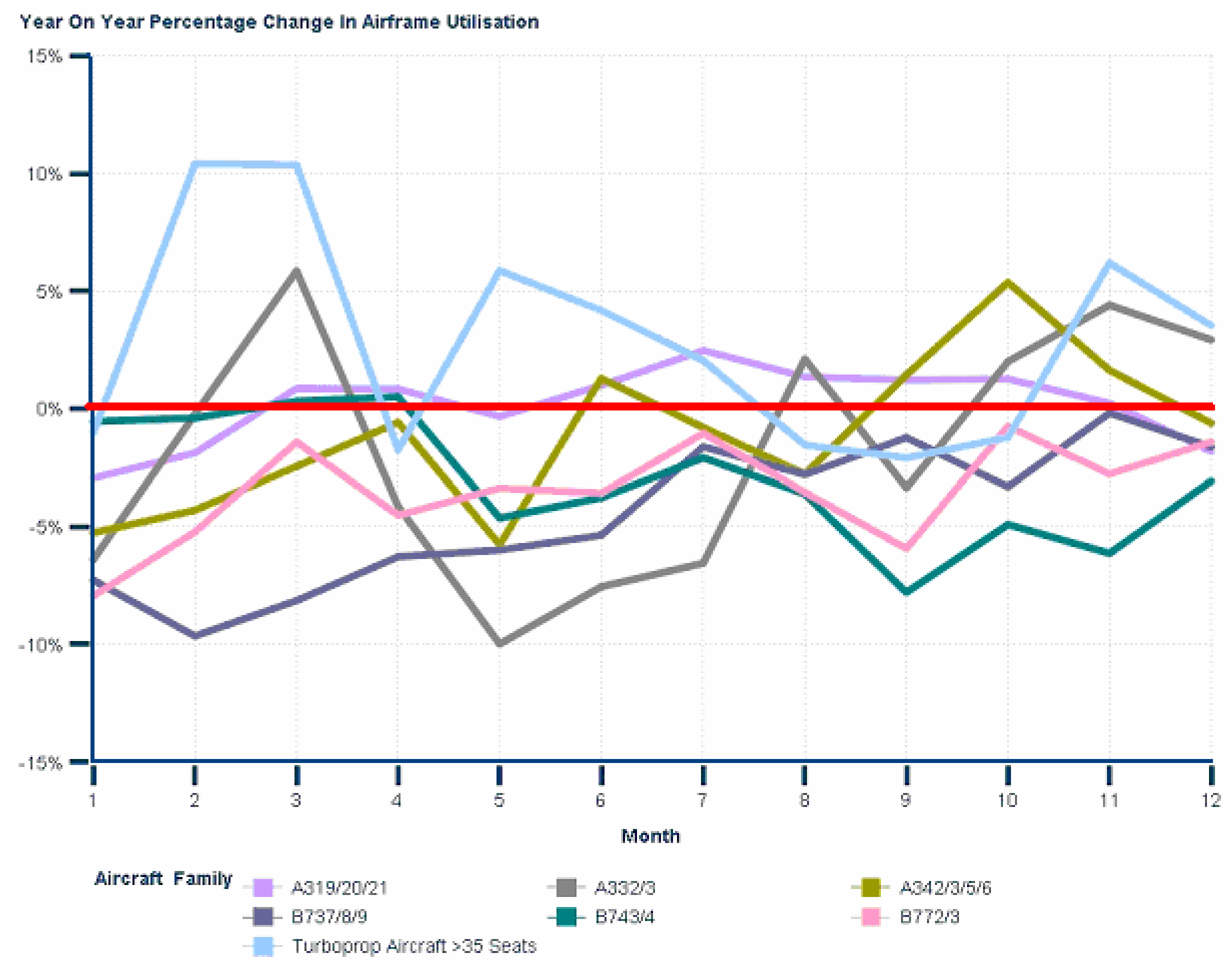


Figure 29. Median values of airframe utilisation per aircraft families in minutes and hours (2009 and 2008)

Aircraft families	Median utilisation in minutes	Median utilisation in hours
A319/20/21	531	8.9
A332/3	794	13.2
A342/3/5/6	801	13.4
B737/8/9	508	8.5
B743/4	783	13.1
B772/3	857	14.3
Turboprop aircraft with more than 35 seats	353	5.8

5.3. Business model

Point-to-point carriers have higher airframe utilisation in comparison to hub-and-spoke carriers. In terms of airframe utilisation, 2009 was bad for both business models especially for point-to point. Hub and spoke airlines managed to solve this problem by reducing the number of airframes. Point-to-point operators were severely affected by new deliveries in 2009 so they were not able to reduce the number of airframes to cope with fall in demand for air traffic.

In order to analyse airframe utilisation by business model, airlines had to be classified into one of 2 groups:

- Airlines with hub-and-spoke operations;
- Airlines with point-to-point operations.

Airlines with hub-and-spoke operations fly the majority of their flights from/to the same city (the hub), thus offering several connecting possibilities, as opposed to airlines with point-to-point operations which fly a series of point-to-point flights which offer direct routes. Hub-and-spoke operations minimise connections and travel time but they require longer turn-times due to congested hubs, which cause delays (forces aircraft to hold before they get the permission to land) and lengthening of taxi times. Hub-and-spoke operations also have to allow time for passengers and baggage to make a connecting flight. This enables carriers to achieve higher load factors. On the other hand, point-to-point carriers go directly to a destination, rather than going through a central hub. "Point-to-point carriers use a simplified fleet structure, fewer aircraft types, and increased airframe utilisation. With fewer aircraft types, these carriers are better able to substitute aircraft in the event of an unplanned technical problem with an aircraft. In order to optimise aircraft utilisation, point-to-point carriers operate with significantly faster turn-times. It's not unusual for a point-to-point carrier to operate with turn-times that are half as long as hub-and-spoke carriers because turn-times influence the number of trips an airframe can make in a given period of time."[24].

The majority of observed airlines have the combination of two business models but for the purpose of this study they were assigned into one of those two groups based on the type of operation which is predominant. Airlines which aircraft start or land at least 30% of all departures/arrivals on one particular airport (which is considered as a hub) were considered to have hub-and-spoke network, otherwise they were considered to have point-to-point operations. Given results were combined with the opinion of experienced CODA experts in those cases where airlines operated both types of operations in order to be placed in one of these two groups.

The utilisation dropped for point-to-point operations in 2009. This can be easily interpreted by taking into account that point-to-point carriers didn't reduce the number of airframes which was used to operate a 5% less traffic demand in 2009. As a result of that, the frequency of flights was reduced; airframes operated fewer sectors a day which had a negative influence of airframe utilisation. Drop in airframe utilisation for point to point carriers can be attributed to the fleet expansion of some LCC which created a big excess capacity. On the other hand, hub-and-spoke carriers were more flexible. They managed the problem of reduction of traffic demand in 2009 by reducing the number of airframes, mostly by grounding some older aircraft. The utilisation had a smaller drop in comparison to point-to-point carriers (Figure 30).

[24] http://www.boeing.com/commercial/aeromagazine/articles/qtr_4_08/article_03_2.html

Figure 30. Change of airframe utilisation (2009 vs.2008) per business model

Business model	Change in Utilisation (2009 vs. 2008)	Change in the Number Of Flights (2009 vs. 2008)	Change in the Number Of Airframes (2009 vs. 2008)	Change in the Number Of Flights Per Airframe (2009 vs. 2008)
Hub-and-spoke	-4%	-10%	-6%	-4%
Point-to-point	-6%	-5%	0%	-7%

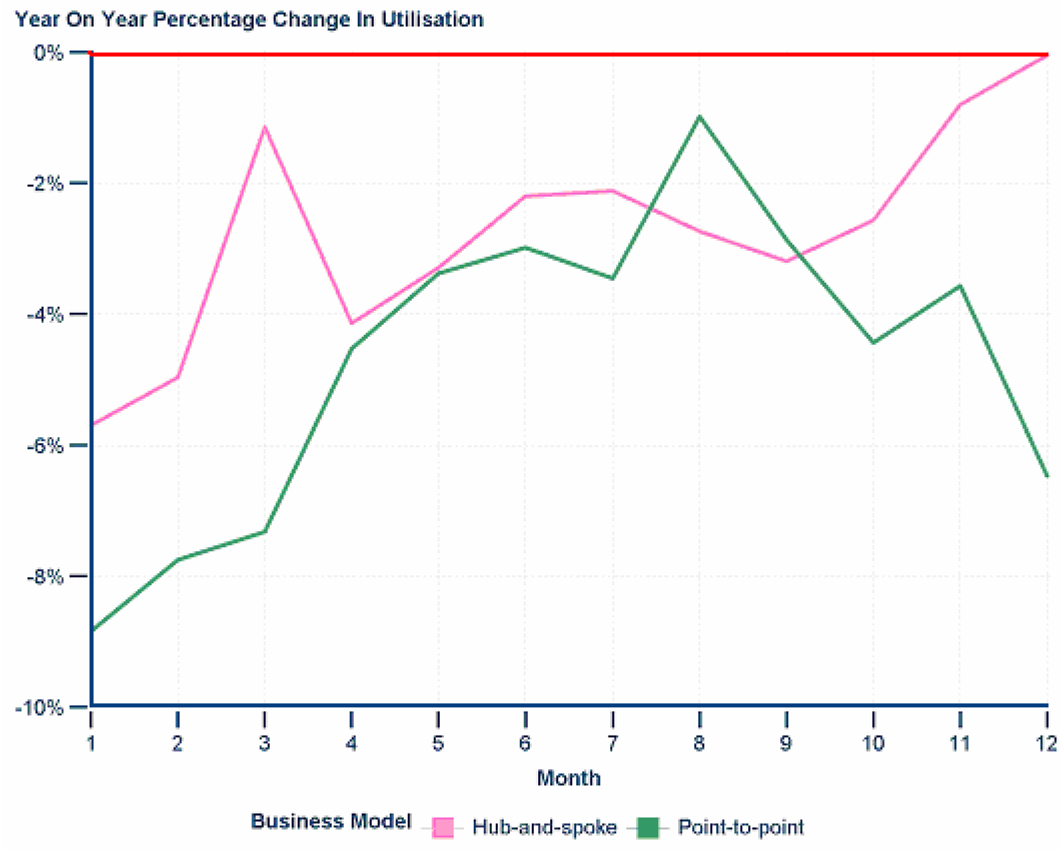
Point-to-point operations have a significantly higher daily airframe utilisation (72 minutes or 13%) in comparison to hub-and-spoke operations (Figure 31). Shorter turnaround times and no need to wait for connecting passengers, goods etc. allow point-to-point operations to have higher airframe utilisation but at the same time lower load factors. This is why most of the airlines depending on the type of operational network, on some of their frequent short-haul routes use point-to-point operations and on medium and long-haul use hub-and-spoke operations with increased load factors.

Figure 31. Median values of airframe utilisation per business model in minutes and hours (2009 vs. 2008)

Business Model	Median utilisation in minutes	Median utilisation in hours
Hub-and-spoke	493	8,2
Point-to-point	564	9,4

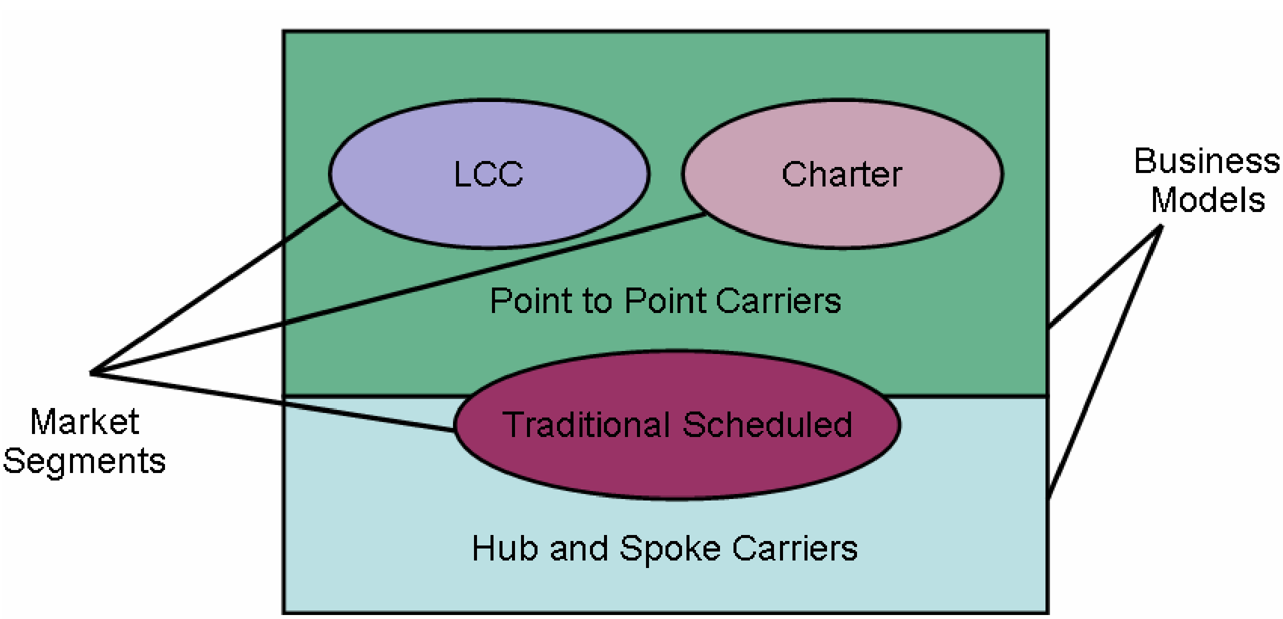
In terms of airframe utilisation the beginning of 2009 was bad for both business models especially for point-to point. Hub and spoke airlines managed to solve this problem by the end of the year by reducing the number of airframes during the months with lower demands. Point-to-point operators were severely affected by new deliveries in 2009 so they were not able to reduce the number of airframes to cope with fall in demand for air traffic (ADH, BER, EZY, WZZ, NAX, TRA, TOM), Figure 32.

Figure 32. Monthly change of airframe utilisation per business model (2009 vs. 2008)



Following section is related to analysis of airframe utilisation by market segment. Figure 33 gives a description of relations between business models and market segments:

Figure 33. Relation between business models and market segments



5.4. Market segment

Reduced traffic demand had the biggest influence on charter carriers. Number of charter flights was reduced by 15% but utilisation recorded an increase by 5%. In terms of airframe utilisation, LCCs have suffered the most in 2009 with a drop of airframe utilisation by 7% because of new aircraft deliveries and the decrease in traffic demand.

This final chapter shows the impact of global economic crisis on airframe utilisation observed through market segments. The analysis was conducted per airframe per month. Based on the STATFOR classification[25], each flight of an airframe is classified as either LCC, Traditionally scheduled or Charter. In theory, one airframe could operate in all three market segments. In order to do the analysis of airframe utilisation per market segment, only one market segment could have been assigned to an airframe. The problem was solved in a similar way to the one used for range analysis. Market segment has been assigned according to the following criteria:

1. Low-cost – if more then 70% of total number of operations of an airframe were low-cost;
2. Traditional-scheduled – if more then 70% of total number of operations of an airframe were traditional scheduled;
3. Charter – if more then 70% of total number of operations of an airframe were charter;
4. Mixed Low-cost/Traditional-scheduled – if an airframe operated both as low-cost and traditional-scheduled;
5. Mixed Traditional-scheduled/Charter – if an airframe operated both as traditional-scheduled and charter;
6. Mixed /Low-cost – if an airframe operated both as charter and low-cost;
7. Mixed Low-cost/Traditional-scheduled/Charter - if an airframe operated as traditional-scheduled, low-cost and charter.

Figure 34. Change of airframe utilisation (2009 vs.2008) per market segment

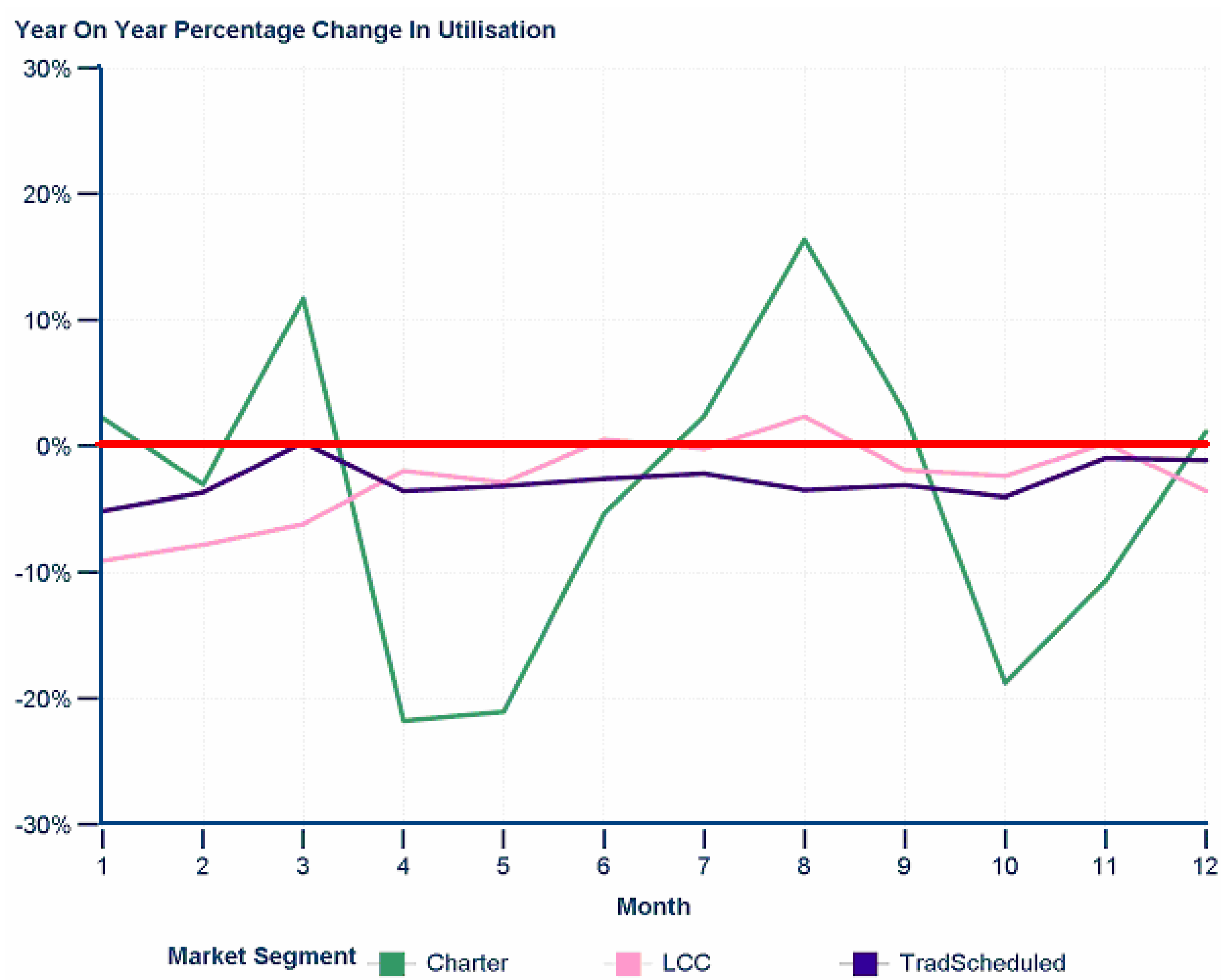
Market segment	Change in Utilisation (2009 vs. 2008)	Change in the Number Of Flights (2009 vs. 2008)	Change in the Number Of Airframes (2009 vs. 2008)	Change in the Number Of Flights Per Airframe (2009 vs. 2008)
LCC	-7%	0%	4%	-4%
Traditional scheduled	-4%	0%	2%	-4%
Charter	5%	-15%	-8%	-9%
Mixed LCC-TradSch	-10%	-44%	-41%	12%
Mixed All Market Segments	16%	19%	7%	13%
Mixed LCC-Charter	-32%	-91%	-78%	-42%
Mixed TradSch-Charter	-12%	-26%	-27%	3%

[25] For further information please contact STATFOR staff statfor.info@eurocontrol.int or visit www.eurocontrol.int/statfor

In terms of traffic demand of all market segments, charter flights had the largest decrease in 2009. The number of flights dropped by 15% because those flights are non-scheduled and in direct link to tourism which suffered greatly in 2009 because of the economic crisis. The number of airframes dropped because some traditional scheduled airlines were returning leased units used for charter in the periods of the increased demand. In this way, decrease in the number of operating airframes was in line with decrease in traffic. Airframes flew more sectors a day thus increasing airframe utilisation in 2009 by 5% (Figure 34).

Low cost carriers had many new aircraft deliveries in 2009. That was the year in which they planned to earn some new airport slots and expand their operations by conquering some new markets and airports. Airframe deliveries came in a wrong moment, when the decrease in demand prevented them to increase further airframe utilisation. As a result of more airframes flying the same amount of traffic like in the previous year, airframe utilisation dropped by 7% in 2009. That is why LCC carriers suffered the most in 2009 in terms of airframe utilisation. With new aircraft deliveries and decrease in traffic demand, LCCs didn't need to charter additional aircraft. That is why the number of airframes as well as the number of flights dropped so drastically (Figure 34).

Figure 35. Monthly change of airframe utilisation per market segment (2009 vs. 2008)



Traditional scheduled airlines didn't suffer greatly because they were given the right to keep their slots by easing of the slot-use restriction "use it or lose it" rule[26]. In order to retain assigned slots, airlines had to use their slots for 80% of the time to retain them from one season to another. At a time when airlines are under pressure to cut capacity, to prevent airlines maintaining their capacity and operating purely in order to keep their slots, European Commission proposed temporary freezing of the rules for the summer 2009 scheduling season, running from April to October. This gave some positive feedback from flag carriers and some very negative from LCCs. This reduction in the number of flights reflected mostly airframes which operated both as traditional scheduled and charter flights (Figure 34). The reduction in the number of flights can especially be attributed to those airlines which have leased aircraft based on 'power by the hour' principle.

The three market segments operate in different ways. LCC insist on high load factors and high airframe utilisation by avoiding congested hubs, fast turnarounds, high frequencies, minimal provision of catering, fast boarding grace to absence of seat selection, single type aircraft fleet. Charter carriers insist as well on high load factors and airframe utilisation but tend to operate with older larger aircraft on longer routes, mostly during peak season; which is the reason they have lower airframe utilisation in comparison to traditional scheduled carriers. The most of traditional scheduled carriers have adopted hub-and-spoke business model prioritising load factors instead of airframe ustilisation.

Daily utilisation is biggest for airframes which operate like LCCs , 9.6 hours per day, 8.3 hours for Traditional Scheduled and about 5.7 hours for Charters. Values for charters are low because of seasonality daily utilisation is drasticaly higher during peak of summer season (from June till October). In example, 'British Airways is configuring B737-300s with 126 seats and achieving a utilisation of 7.1 hours a day; easyJet has 148 seats on the same aircraft and achieves utilisation of 10.7 hours'[27]

Figure 36. Median values of airframe utilisation per market segment in minutes and hours (2009 vs. 2008)

Market segment	Median utilisation in minutes	Median utilisation in hours
LCC	577	9,6
Traditional scheduled	498	8,3
Charter	343	5,7
Mixed LCC-TradSch	651	10,8
Mixed All Market Segments	597	9,9
Mixed LCC-Charter	535	8,9
Mixed TradSch-Charter	500	8,3

[26] See Council Regulation (EEC) 95/93 on common rules for the allocation of slots at Community ,adopted by the European Community adopted in 1993.

[27] Mason, K.J., Whelan, C., and Williams, G. (2000), Europe's Low Cost Airlines: An Analysis of the Economics and Operating Characteristics of Europe's Charter and Low Cost Scheduled Carriers', Cranefield University, Air Transport Group Research Report 7

6. SUMMARY AND FURTHER WORK

According to AOG forecast, in 2009, the average aircraft utilisation for the world's commercial fleet was expected to drop by 4 percent compared to 2008. The results obtained in this study can justify this forecast. Based on sample used for the study overall airframe utilisation has dropped by 3.7% in comparison to 2008.

In response to the financial crisis, fuel price situation and consequently decreasing traffic demand at beginning of 2009, airlines implemented various strategies. Understanding those strategies is highly complex and depends on many factors such as current global economic conditions, industry's and the particular airline economies, medium and long-term traffic forecasts. To keep pace with the fall in demand, airlines were combining either selling of old aircraft; or returning of leased aircraft; or parking aircraft and subsequently reducing airframe utilisation. Since cutting back in fleet and frequencies wasn't sufficient to address excess capacity, airframe utilisation and load factors continued to decline. In this way airlines were cutting operating costs but still had losses because load factors were smaller in the first half of 2009. The situation both in terms of airframe utilisation and load factors started to improve in the second half of the year.

In 2009, more than 65% of observed airlines had a drop in airframe utilisation.

The biggest decrease in utilisation happened on short-haul routes because of new deliveries of narrow bodies from families A319/20/21 and B737/8/9.Hub-and-spoke carriers and especially LCCs had the highest drop in airframe utilisation because of the biggest number of aircraft deliveries.

Analysis has shown that aircraft usually achieve utilisation of 8.5 hours with maximum values ranging between 14 (90th percentile) and 18 (95th percentile) hours due to several reasons:

- night flying restrictions in order to try to reduce noise exposure at night;
- decrease of travel demand between 23:00-06:59[28];
- uneven distribution of traffic demand during day;
- turnaround times;
- congestion.

It should be noted that high airframe utilisation is not the only way to gain profit in airline industry. By increasing airframe utilisation, the number of ASKs and ATKs will be spread over more units but similar results can be achieved in example by improving load factors or increasing fares. Not all business models make profit basing their operations on high values of utilisation. For those airlines which insist on high rates of airframe utilisation there is space to improvements. Of course airframes can achieve much longer utilisation on long-haul flights because they can theoretically convert some turnaround but also connecting time into flying time thus increase airframe utilisation. Long-haul flight will always have higher values of utilisation because of the nature of their flights (long block times and insensitivity to schedule departure time and night flying restrictions), but there is space for improvement on short-haul routes. The first suggestion is to:

- smoothen out traffic demand over the full day. This could be done by attracting passengers with lower prices during off-peak periods. Consequently it would increase the number of movements, ease congestion and reduce delays. Increased

[28] Dependent on the Dark: Cargo and other Night Flights in European Airspace, EUROCONTROL Trends in Air Traffic , Volume 5, January 2009

number of movements would increase airframe utilisation. Also a reduction of congestion and consequently delays would as well increase utilisation per airframe by reducing the number of buffer minutes which are incorporated into schedules to absorb delays.

- optimise aircraft planning by maximising the number of rotations per airframe;
- work on SLAs (Service Level Agreements) with Ground handling agents on improving turnaround times, in example allowing boarding passengers while fueling within required safety standards;
- work with airports on reducing minimum connecting time. Minimum connecting time is a minimum time frame defined by the airport needed to transfer passengers and baggage between two flights as well as for turnaround of an aircraft. This variable is mostly dependant on baggage handling system. Modernisation of those systems could improve minimum connecting times;
- implementation of CDA (Continuous Descent Approach) includes monitoring stations which are capable of more accurate measurements of noise levels. This more up to date way of analysing noise in decibels (dB) within CDA's could help to increase throughput where there are currently heavy restrictions on the non-CDA procedures which could potentially increase airframe utilisation.

APPENDIX

I AIRLINES INCLUDED IN THE ANALYSIS

Aircraft Operator	ICAO Code
DEUTCHE LUFTHANSA	DLH
AIR FRANCE	AFR
EASYJET	EZY
IBERIA	IBE
BRITISH AIRWAYS	BAW
AIR BERLIN, INC.	BER
TURKISH AIRLINES	THY
KLM ROYAL DUTCH AIRLINES	KLM
S.A.S.	SAS
ALITALIA	AZA
AUSTRIAN AIRLINES	AUA
SWISS INTERNATIONAL	SWR
JERSEY EUROPEAN T/A FLYBE	BEE
WIDEROE	WIF
SAS BRAATHENS AS	CNO
LOT-POLISH AIRLINES	LOT
FINNAIR O/Y	FIN
BRITISH MIDLAND	BMA
CZECH AIRLINES	CSA
SPANAIR	JKK
BRUSSELS AIRLINES	BEL
AEGEAN AIRLINES	AEE
NORWEGIAN AIR SHUTTLE	NAX
AIR EUROPA	AEA
THOMPSON FLY LTD	TOM
AIR ONE	ADH
HAPAG-LLOYD FLUGGES	HLF
OLYMPIC AIEWAYS S.A.	OAL
MALEV-HUNGARIAN AIRLINES	MAH
WIZZ AIR	WIZZ
MERIDIANA S.P.A.	ISS
AIR BALTIC CORPORAT.	BTI
TRANSAVIA.COM	TRA
THOMAS COOK AIT LTD	TCX
MONARCH AIRLINES LTD	MON
EASYJET SWITZERLAND	EZS
LUXAIR	LGL

BMIBABY LTD	BMI
ONUR AIR	OHY
EUROPE AIRPOST	FPO
NL LUFTAHRT GMBH (FLYNIKI)	NLY
AIR MALTA PLC	AMC
MALMO AVIATION	SCW
CHANNEL EXPRESS LTD/ JET2	EXS
CYPRUS AIRWAYS	CYP
VLM VLAAMSE	VLM
TUI AIRLINE BELGIUM	JAF
MY TRAVEL AIRWAYS	VKG
IBER WORLD	IWD
BRITANIA AWY AB	BLX
THOMAS COOK AIRLINES	TCW
JET4YOU	JFU
MARTINAIR HOLLAND NV	MPH
DANISH AIR TRANSPORT	DTR
SKYEUROPE AIRLINE	ESK
GERMANIA	GMI
TUI AIRLINES NEDERLAND	TFL
CORSE AIR INT.	CRL
EDELWEISS AIR ZURICH	EDW
LTU	LTU
NOVAIR	NVR
HAPAG-LLOYD EX GMBH	HLX
NEW OLYMPIC AIR	NOA

II AIRCRAFT CLASSIFICATION

Wide body aircraft

A306 – Airbus A306
A30B – Airbus A300B2
A310 – Airbus A310
A332 – Airbus A330-200
A333 – Airbus A330-300
A342 – Airbus A340-200
A343 – Airbus A340-300
A345 – Airbus A340-500
A346 – Airbus A340-600
A388 – Airbus A380-800
B741 - Boeing B747-100
B742 - Boeing B747-200
B743 - Boeing B747-300
B744 - Boeing B747-400
B74D - Boeing B747-400 (Int)
B74S - Boeing B747SP
B762 - Boeing B767-200
B763 - Boeing B767-300
B764 - Boeing B767-400
B772 - Boeing B777-200
B773 - Boeing B777-300
B77L – Boeing 777-200LRF/LR
B77W – Boeing 777-300ER
DC10 - McDonnell Douglas DC-10
IL96 - Ilyushin Il-96
MD11 -McDonnell Douglas MD-11

Narrow body aircraft

A318 – Airbus 318
A319 – Airbus 319
A320 – Airbus 320
A321 – Airbus 321
B461 - British Aerospace BAe-146-100
B462- British Aerospace BAe-146-200
B463- British Aerospace BAe-146-300
B712 – Boeing B717-200
B722 – Boeing B727-200
B732 – Boeing B737-200
B733 – Boeing B737-300
B734 – Boeing B737-400
B735 – Boeing B737-500
B736 – Boeing B737-600
B737 – Boeing B737-700
B738 – Boeing B737-800
B739 – Boeing B737-900
B752 - Boeing B757-200
B753 - Boeing B757-300
CRJ1 - Canadair Bombardier RJ-100 Regional Jet
CRJ2 - Canadair Bombardier RJ-200 Regional Jet
CRJ7 - Canadair Bombardier RJ-700 Regional Jet
CRJ9 - Canadair Bombardier RJ-900 Regional Jet
DC85 - McDonnell Douglas DC-8-50
E135 – Embraer ERJ-135
E145 – Embraer ERJ-145
E170 - Embraer/Brazil EMB170
E190 - Embraer/Brazil EMB190
F100 -Fokker F100
F70 -Fokker F70
J328 – FAIRCHILD DORNIER 328 JET
MD81 - McDonnell Douglas MD-81
MD82 - McDonnell Douglas MD-82
MD83 - McDonnell Douglas MD-83
MD87 - McDonnell Douglas MD-87
MD88 - McDonnell Douglas MD-88
MD90 - McDonnell Douglas MD-90
RJ1H - RJ-100 Avroliner
RJ70 - RJ-70 Avroliner
RJ85 - RJ-85 Avroliner

Turboprop aircraft

A748 - British Aerospace HS 748
AN24 - Antonov An-24
AN26 - Antonov An-26
AT43 - ATR ALENIA ATR-42-300/320
AT45 - ATR ALENIA ATR42-500
AT72 - ATR ALENIA ATR-72
ATP - British Aerospace ATP
D228 - FAIRCHILD DORNIER 228
D328 - FAIRCHILD DORNIER 228
DH8A - DE HAVILLAND CANADA Dash 8 100
DH8B - DE HAVILLAND CANADA Dash 8 200
DH8C - BOMBARDIER Dash 8 Q300
DH8D - BOMBARDIER Dash 8 Q400
DHC3 - De Havilland DHC-3
E110 - EMBRAER Bandeirante
E120 - EMBRAER Brasilia
F50 - FOKKER F50
JS31 - BAE SYSTEMS Jetstream 31
JS32 - BRITISH AEROSPACE Jetstream 32
JS41 - BRITISH AEROSPACE Jetstream 41
L188 - LOCKHEED Electra
SB20 - SAAB 2000
SF34 - SAAB 340
SW3 - SWEARINGEN Merlin
SW4 - SWEARINGEN Metroliner

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