Aircraft Operating Costs and Profitability

By Mark Anthony Camilleri[1], PhD (Edinburgh)

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Abstract

The airlines' marketing policies are influenced by costs and expenses which could influence their levels of service, and their ability to be profitable. Their direct and indirect operating costs are affected by sector length; utilisation of aircraft, fleet size and labour costs, among other issues. Moreover, the aircraft design characteristics, such as aircraft size, aircraft speed, age of the aircraft, crew complement could also affect the airlines' cost structure. Furthermore, the airlines may have overheads, including; sales costs, administration, accounts, general management and employment costs, among others. Therefore, this chapter provides a detailed overview of airline operating costs and explains how to analyse their profitability. Initially, it introduces its readers to the airlines' direct and indirect costs, as well as overheads. Afterwards, it deals with cost comparison parameters and metrics.

12.1 Introduction

The airline marketing managers need to have a good understanding of the airline's cost structure. Therefore, this chapter provides an overview of the aircraft operating costs, as it explains how they are usually allocated. Of course, accountancy practices may differ from one airline to the next, and the cost allocation methods, and the headings under which these costs

[1] Department of Corporate Communication, Faculty of Media and Knowledge Sciences, University of Malta, Malta. Email: mark.a.camilleri@um.edu.mt

are reported, may also differ. It is not the intention of this chapter to provide a detailed analysis of accountancy techniques and practices. It is merely intended as a reference to guide airline marketers in their decisions. Yet, this contribution explains the terms that are frequently used in the aviation industry. Moreover, the following sections describe various cost comparison parameters and profitability metrics.

12.2 The Airlines' Cost Structure

Airlines cannot compete on price without reducing their costs and overheads. The airline industry relies on airport services, the provision of aviation fuel, labour, et cetera. Moreover, there may be airlines, particularly the legacy carriers which could also be dependent on costly distributive networks. Generally, the airlines' costs are divided into three categories; direct operating costs, indirect operating costs and overheads. The direct operating costs are incurred as a direct result of the operation of a specific service – for example, the fuel and oil consumed on a flight; The indirect operating costs are incurred for a whole period of time, such as an operating season, for example; pilot salaries must be paid, even if a specific service is cancelled, and; overhead costs are incurred for even longer periods, such as buildings, or the airline management's salaries.

12.3 The Direct Operating Costs (DOCs)

The direct operating costs occur when flights are actually operated. Within the airline industry there are two types of direct operating costs; aircraft-related DOCs and traffic-related DOCs. The main difference between the two sub-sections of direct operating costs is that aircraft-related direct operating costs are relevant to the type of aircraft being operated. For example, the budget carriers may keep their maintenance costs down as they operate the same type of aircraft. This way, they lower their direct operating costs. The traffic-related direct operating costs are independent of the aircraft type.

- Aircraft-related DOCs include; fuel and oil, maintenance (Excluding in-house labour), landing fees, en-route fees (including navigation fees), handling fees and crew expenses.

- The Traffic-related DOCs include passenger and cargo commission, airport load fees, inflight catering and general passenger related costs.

A detailed explanation of the Aircraft-related DOCs is given here:

12.3.1 Fuel and Oil

The fuel costs for any given operation are based on the price of fuel and the fuel consumption characteristics (and the efficiency) of the aircraft involved. Fuel hedging is a common risk management tool that is used to stabilise the airlines' fuel costs (Lim & Hong, 2014).

12.3.2 Maintenance Costs

These costs are affected by several factors, including: the price of consumable spares; the time between overhaul on the airframe engines and components; the failure rate of various components; the manpower effort required to perform the various maintenance tasks; the cost of labour; the cost of getting the aircraft or components to the overhaul location (where applicable).

Maintenance costs are unavoidable in the airline industry to meet safety requirements. However, it is necessary to make trade-offs between cost levels and punctuality performance. Although it may not appear quite obvious, the airline's punctuality record is of concern for marketing managers as this is often demanded by customers, whether they are business or leisure passengers. This issue may have an influence on the airlines' maintenance costs. The airlines which strive to achieve an excellent punctuality record will need to have a substantial line maintenance capability. This makes it possible for them to deal with technical problems as soon as they arise. For this same reason, a heavy investment in spare parts is called for. The airlines' maintenance costs are usually very high; but if they want to maintain a good punctuality performance, these expenses are unavoidable.

An additional factor which affects maintenance costs is scheduling. If the airlines want to reduce their operational costs, their schedules must ensure that every aircraft in their fleet has a high annual utilisation. The fixed costs of aircraft ownership will be spread over higher output. However, high aircraft utilisation rates may necessitate essential maintenance of aircraft.

Another drawback that is caused by high aircraft utilisation or tight scheduling is their effect on punctuality. This is virtually unavoidable. As soon as there is a delay in a flight schedule, it cannot be made up, unless there is a standby aircraft. So, for example, if an aircraft is delayed early in the day, every flight for the rest of the day will also be late. We can see that tight schedules may have their disadvantages. However, cost penalties could be incurred through slack scheduling. This may affect unit costs since the aircraft are under-utilised. Hence, their unit operational costs will be higher.

12.3.3 Landing Fees

These charges are levied by airport authorities for the airport facilities and services that they provide. It is common for charges to be divided into two categories at most airports – a fixed aircraft fee and / or a variable load-related fee.

- The fixed aircraft fee is normally based on the aircraft's maximum weight. However, some exceptions could be made, depending on the airport. Some airports allow reductions for quieter aircraft which meet ICAO's stringent noise rules.
- The variable load-related fee may usually consists of a charge per arriving or departing passenger.

12.3.4 En-route (including navigation) fees

These fees are charged by governments to cover the cost of en-route air traffic control and navigation facilities. Most countries in Europe use 'Eurocontrol' to charge for these services, in accordance with a standardised formula; which uses a centralised billing facility. The formula relies on two factors; the distance travelled in each country's airspace and the size of the aircraft.

The second factor is based on the aircraft's gross weight. Outside Eurocontrol, the charges may differ. For example, irrespective of the aircraft's size, some countries may either charge a flat rate per overflight, or a flat rate per mile. Other countries may base their charges on the maximum take-off weight.

12.3.5 Handling Fees

These fees are levied by outside handling agencies for aircraft turnaround services. Examples of such services may include; passenger check-in and boarding, baggage and cargo loading, aircraft cleaning and normal turnaround technical support. These costs are linked directly with aircraft capacity. However, additional factors may also have an influence on handling costs, for example; time of day (night time or peak period), whether the specific aircraft is equipped with an auxiliary power unit (this dispenses them of the requirement for ground power and air start units), whether or not the aircraft has a containerised baggage system, and so on. The costs for self-handling are treated as indirect operating costs, as these costs will be incurred regardless of the number of services handled.

12.3.6 Crew Expenses

The principal factor which influences crew expenses is crew complement. In some specific circumstances, an aircraft's block speed can have an impact on whether or not a crew over-night may be required. Crew salaries are usually treated as indirect operating costs.

The second category of direct operating costs is: Traffic Related DOCs:

12.3.7 Passenger and Cargo Commission

These commissions relate to the sales commission fees which an airline must pay to intermediaries, including cargo agents for selling their services. They are usually represented as a percentage of gross revenue. Many airlines have cut travel agency commissions in many countries.

12.3.8 Airport Load Fees

These have already been covered under the heading of landing fees.

12.3.9 Inflight Catering

Clearly, the costs of the food and beverage that are prepared for inflight catering are considered as direct operating costs (DOCs). Therefore, the costs incurred when meals are uplifted from a return sector are considered as DOCs. These costs are incurred if specific sectors are operated.

If the main base catering is prepared by the airline itself; then the catering employees' salaries and their equipment will be treated as indirect operating costs.

12.3.10 General Passenger Related Costs

These costs include mishandled baggage costs, interrupted and cancelled flight expenses, such as; the handling of denied boardings, et cetera. These expenses may also include the provision of specialised services to business and first-class passengers.

12.4 Indirect Operating Costs

Indirect operating costs are incurred for a whole period of time such as an operating season. These costs cannot be avoided once a certain level of flying has been chosen. In other words, if the flight programme changes (for example; due to a flight cancellation), the costs in aircraft standing charges, flight crew pay, cabin crew pay, maintenance labour (in-house) and the handling cost at base stations will still be incurred. All of these costs are directly affected by aircraft type.

12.4.1 Aircraft Standing Charges

Aircraft can be bought outright or acquired through loans or leasing agreements. In all cases, some form of regular payments is involved (for example; loan repayment, or payment of leasing charges). All of these payments are categorised as indirect operating costs. With regard to the leasing of aircraft, a lease charge replaces the depreciation and interest charges. Provision for major spares comes under the heading of depreciation. In the case of small fleets, the spares cost per aircraft is actually higher than it is for large fleets. This is because, regardless of fleet size, there is a certain minimum requirement for some items. Most of the standing charges are directly related to aircraft purchase price.

The depreciation period is shorter in the case of used aircraft. The same is true for a new aircraft due to the risk of premature technical / economic obsolescence; arising through improved aircraft design. With regard to used aircraft, the deals offered on financial arrangements and interest costs are usually less attractive than those offered for new aircraft. Development write-off constitutes the amortisation (death) of pre-service expenditure, such as training costs, route

proving costs and engineering costs. Generally, hull insurance is based on a percentage of the aircraft's insured value. This insured value is affected by both the safety record and the experience level of the carrier. It is not unusual for new, and yet unproven, aircraft types to be given a higher premium until they have established a safety record. Higher premiums are charged when airlines fly into specific areas that are designated as war zones.

12.4.2 Flight Crew Pay

Most of the long-haul aircraft may usually require a third crew member and sometimes a fourth for rest purposes. Other factors could influence the total number of crew which may be required for any given schedules. Such factors include scheduling, crew work rule and productivity. Crew numbers are usually influenced by the size of the airlines' fleet. In some airlines, crew salaries are established in accordance with a productivity formula. It is quite normal for the pilots of the larger aircraft to command higher salaries.

12.4.3 Cabin Crew Pay

The number of personnel in a cabin is directly related to the seating capacity of the aircraft. There are legal requirements that are derived from ICAO annexes for cabin crew safety. The number of cabin crew on board is usually dependent on the number of seats and the number of exits in the aircraft. However, most airlines have more cabin crew than the legal minimum. Normally, there is a cabin crew member for every 25-35 passenger seats, although these requirements can vary because of special inflight catering requirements, including services that are provided to business and first-class passengers.

12.4.4 Maintenance Labour (In-house labour)

Maintenance labour is affected by other cost categories that were already discussed under the heading of direct costs.

12.4.5 Handling Costs at Base Stations

These costs arise when performing handling services at airports where such services are dealt with on an in-house basis.

12.5 Overheads

The overhead costs and expenses are incurred for even longer periods. These costs may include; sales, administration, accounts, general managements, employment and HR departments, and property costs, among others. Many of these costs are relatively unaffected by both the type of aircraft used, and the level of flying operations. However, should the number of passengers increase; it is possible that a requirement might arise for additional staff in the revenue accounts (in order to deal with an increased ticket volume; if this department is still managed by the airline. Many airlines have outsourced this section).

12.6 The Effects of the Airline Environment on Aircraft Operating Costs

12.6.1 Sector Length

The short-haul operations have higher costs than medium or long-haul operations. There are a number of reasons for this:

- Short-haul operations must pay a higher proportion of landing fees and handling fees;
- A short-haul operation, by its nature; causes more periods of inefficient aircraft operation, particularly during approach and take-off periods;
- Fuel consumption is higher at low levels of operation. Therefore, fuel costs are proportionately higher for a short-haul operation, than for a medium or long-haul ones;
- In short-haul operations, there are more aircraft turnaround periods. This results in lower aircraft utilisation, and lower productivity levels.
- A short-haul operation incurs higher maintenance costs. This is directly related to the need to overhaul the cycle-related components, including; engine parts and under-carriage units.

12.6.2 Utilisation

Fixed costs such as standing charges can be distributed over longer flying hours to achieve lower unit costs. Long-haul operations provide the best opportunities for the maximum utilisation of aircraft. This is because, the higher the utilisation of aircraft, the smaller the turnaround periods. Turnarounds are obviously unproductive. Therefore, fewer turnarounds

would lead to lower costs for the airline. Today's modern aircraft are capable of increasing fleet utilisation as they are becoming more reliable in terms of operational efficiency and economy. With regard to short-haul operations, fleet utilisation could be improved if the turnarounds are kept, as short as possible.

However, an airline's ability to maximise its fleet utilisation is inhibited by certain commercial factors. For example, there are many markets where passengers are extremely reluctant to fly during particular times of the day (for example during late night or early morning), as this has the effect of shortening the commercial day.

12.6.3 Fleet Size

Cost levels are directly related to the number and type of aircraft, in a given fleet. As previously discussed, an airline with a small fleet (i.e. less than five units) will proportionally incur higher costs in certain areas, in terms of spares and crew; than an airline with a larger fleet. There are also other costs that may be related to having a small fleet. The smaller airlines are expected to have an adequate provision for standby capacity or schedule recovery. Furthermore, in-house functions (for example; maintenance and pilot training) may not be conducted by small airlines. They will have to purchase these services from external agencies, usually at very high costs.

12.6.4 Labour Costs

Local labour costs have an impact on costs such as crews, maintenance and handling costs. Operations in countries where there are lower wages, would translate to significant cost reductions. However, this advantage might be counter-balanced by losses which may arise from poor labour efficiencies in certain functions, such as; maintenance and handling.

12.7 Effect of Aircraft Design Characteristics on Operating Costs

12.7.1 Vehicle Efficiency

Vehicle efficiency consists of three separate elements, including aerodynamic efficiency, propulsive efficiency and structural efficiency.

a) Aerodynamic Efficiency is concerned with how the aircraft is streamlined. The achievement of the highest possible aerodynamic efficiency is restricted by considerations such as structural weight and interior passenger comfort;
b) Propulsive Efficiency is related to the fuel burn characteristics of the engine in relation to its power output. It is usually expressed in terms of specific fuel consumption. During recent years, there has been research into the maximum fuel efficiency of aircraft engines. A lot of progress has been made to that end.
c) Structural efficiency is concerned with how economical an aircraft has been designed in terms of structural weight. A common comparison is to relate the structural weight as a fraction of take-off weight, or to establish the structural weight per seat. It is important to realise that comparisons such as these are only valid when comparing aircraft with others with similar range capabilities. For example, different operational requirements mean that a long-range aircraft will usually have greater structural weight than a short-range aircraft. This is because the long-range aircraft must be capable of carrying a heavier fuel load. Thus, it requires a heavier structure and greater wing area.

12.7.2 Crew Complement

Many aircraft are operated by a flight crew of two pilots, even the largest and longest range types.

12.7.3 Engine Number

If an aircraft has fewer engines, its maintenance costs will be lower. As a result, twin engine aircraft have become very popular among airlines. Boeing and Airbus' wide-bodied aircraft have both developed two-engine aircraft and are often used in long range routes.

12.7.4 Aircraft Size

It has already been explained that unit costs are reduced when increasing aircraft size. However, this rule can be upset by the diseconomies of small fleet size (Caves et al., 1984).

12.7.5 Aircraft Speed

Generally, higher speeds result in increased productivity for a given aircraft size. Yet, there may be practical constraints which could place restrictions on the extent to which an aircraft's higher speeds can produce productivity benefits. If an aircraft's higher speed can be used to increase productivity, then it is possible for the fixed costs to be distributed among a greater

number of revenue flights, thereby reducing costs. In the past, Concorde and the Tupolev Tu-144 were designed to transport passengers at speeds greater than the speed of sound. These supersonic airliners involved high development costs, expensive construction materials, great weight, and an increased cost per seat; when compared to other aircraft.

12.7.6 Age of Aircraft

A used aircraft might not be an attractive financial proposition. An airline considering purchasing a used aircraft would have to think very carefully about the life of an old aircraft, and to consider its noise levels. This issue would reduce the resale value of such aircraft. A new aircraft has a life expectancy of at least twenty years. Consequently, the acquisition of modern aircraft can be written-down over a long period of time. Moreover, the airline may find more available financing arrangements with attractive interest rates, if they consider purchasing a new aircraft.

Another advantage of buying a new aircraft is that it will necessitate lower maintenance costs than used aircraft, especially during the first few years of operations. This is due to the fact that the major inspections will only begin after approximately six years of operation, when the manufacturers' warranty will usually cover the costs of repair.

The older aircraft will require frequent and stringent inspections on their airframe. Therefore, the maintenance of old aircraft may also need expensive spares. All of this leads to an increase in maintenance costs, particularly after 12-15 years of an aircraft's service. After a certain period, it may no longer be possible to maximise the aircraft's utilisation due to maintenance requirements.

The new aircraft will be more fuel-efficient than the old aircraft. Often, manufacturers introduce small fuel saving refinements during an aircraft's life. Occasionally, some of these refinements could be retrofitted to older aircraft. However, as the aircraft get older, they will usually develop more technical problems. They may become heavier as they develop imperfections in their outer skin. These may occur for a large number of reasons, for example, due to poorly rigged control surfaces, poor fitting or slight deformed access doors or undercarriages, et cetera.

12.8 Cost Comparison Parameters and Profitability Analysis

Up to now this chapter has dealt with the aircraft costs and how they are allocated. An understanding of cost comparisons and profitability metrics are also essential requirements for airline marketing managers, because their policies are directly affected by costs and expenses:

12.8.1 Cost per Aircraft Kilometre, Seat Kilometre and Tonne Kilometre

It is necessary to compare the operating cost characteristics of different types of aircraft. However, since the aircraft can vary so much in size and capacity, the only way to compare their performance is to express their costs in terms of units of production. This is known as unit cost comparisons. Unit cost can be defined as the average operating costs incurred per available tonne kilometre (ATK).

We now know what is meant by unit cost comparison. But what exactly are units of production? This can be explained through a simple example. Seat kilometres are calculated by multiplying a given aircraft's seating capacity by the distance travelled. So, a 100-seat aircraft flying a 500-kilometre sector produces 50,000 seat kilometres. Besides the passenger-carrying capacity, the aircraft also has belly cargo capacity. This must also be taken into consideration, because it is a capacity which can also be sold.

The full capacity of the aircraft is taken into consideration by converting the passenger and cargo capacity in terms of weight (i.e. each passenger plus their baggage). Moreover, the aircraft may be capable of carrying an additional tonne of cargo. In this case, the aircraft carrying 100 passengers (of 80 kg each) weigh 8,000kg. If we include their 2,000kg baggage (20 kg each) and the cargo capacity (1,000kg) in the equation, the aircraft's payload capacity is 11 tonnes. So, during the course of a 500-kilometre flight, the aircraft would generate 5,500 Capacity Tonne Kilometres / CTKs (500 x 11).

By using these calculations, it is then possible to make meaningful comparisons between the cost of operating a number of aircraft of different sizes and capacities. Airline marketers can work out the load factor and the break-even load factor.

12.8.2 The Load Factor

The load factor is the percentage of total capacity available for revenue passengers, freight and mail, which is actually sold and used.

12.8.3 The Break-even Load Factor

The break-even load factor is the percentage of total capacity which should be utilised to cover the operating costs, i.e. the point at which operating revenues will equal operating costs.

An accurate portrayal of the aircraft's economics can be established if CTK is calculated. For instance, if a route had a 50% load factor with a 100-seat aircraft. In such a case, replacing the aircraft with a 120-seater which had 10% lower seat kilometres would not be a good idea. It would actually be worse, financially; because the additional capacity would not be filled and so the reduced cost calculation would not mean a saving. Although the cost per seat kilometre is lower for the larger aircraft, the absolute costs of operation are higher. If this was not the case, no airline would ever buy smaller aircraft.

12.8.4 Profitability and the Break-even Load Factor

Profitability control is extremely important, not just to airlines, but to any business. It is an essential tool that is used to measure the profitability of a company's different products, customer groups, territories and channels. The profitability analysis will yield valuable information on the routes' feasibility. The airline marketers will decide whether to expand, reduce or discontinue their flight operations, based on their profitability analyses. As with many aspects of the airline business, there are many theories on how to measure profits. We will look at one such theory:

12.8.4.1 Return on Capital Employed

The return on capital employed is a useful measure for comparing the relative profitability of companies after taking into account the amount of capital used. The implication is that any expenditure on investments should have an effect on profits. From the marketing managers' point of view, the field of investment over which they can potentially exert the greatest influence is that of product strategy. It is their responsibility to invest in their airline product, in a manner which will maximise the profit earned by each unit of capital employed. Once the

costs have been established, the next step is to determine the likely profitability of the operation. A parameter which is often used is the break-even load factor.

Previously, in this chapter, it was seen that costs can be expressed in terms of cost per unit of capacity, for example, cost per CTK (Capacity Tonne Kilometre). Revenue, on the other hand, could be expressed in terms of revenue per unit of traffic carried. If, for example, on average passengers pay $100 fares and will travel 500 kilometres; the revenue per revenue passenger kilometre (RPK) will be $100 divided by 500 = 20c (therefore, the revenue is $100 / 500km X 1 = 20c). In a similar vein, the total revenue and the total number of RPKs can also be calculated. This will be influenced by the number of passengers, of course.

Let us assume that the cost of operating a flight with a 100-seat aircraft is $5,000 divided by the seat kilometre produced (i.e. 50,000), which is 10c; we can then calculate the break-even load factor by dividing the cost per seat kilometre by the revenue per passenger kilometre; which is 50%, in this case. It is possible to perform a similar calculation using the revenue per revenue tonne kilometre (RTK) and cost per CTK.

In the airline industry three basic parameters are relevant when assessing profitability: the revenue per RTK (the revenue tonne kilometre), the cost per CTK (capacity tonne kilometre) and the load factor. If fares begin to fall at the same time as costs begin to rise, two things happen: Firstly, the revenue per RTK would decrease. Secondly, there would be a substantial change in the break-even load factor.

Profitability can be examined on different levels, depending on (i) the timescale involved and (ii) any relevant costs.

For example, if the airline may consider operating an extra flight every week; it will have to cover both direct and indirect costs of operating the service. An extra weekly flight requires additional flight crew, cabin crew and other manpower. It also uses fleet capacity, which will eventually contribute to the need for an additional aircraft. An airline's profitability target must make necessary provisions for the recovery of all costs.

12.9 Questions

- *How are the maintenance costs affected by a) punctuality and b) scheduling?*
- *An airline's operating cost structure is affected by aircraft type selection. How?*
- *How will the sectors' length affect the airlines' operating costs?*
- *When deciding whether or not to operate an extra flight, the airline marketers must consider all options, from different perspectives. Explain why.*

12.10 Summary

The airline marketing managers' policies will influence their level of service. However, they are also affected by relevant cost and expenses. Airlines may have direct operating costs, indirect operating costs and overheads. The aircraft operating costs rely on sector length; the utilisation of aircraft, fleet size and labour costs. Moreover, the aircraft design characteristics, such as aircraft size, aircraft speed, age of the aircraft, crew complement, among other issues, will also effect the airlines' operating costs. Overheads include sales costs, administration, accounts, general management and employment costs. Many of these are relatively unaffected by both the type of aircraft used and the level of flying operations. However, should the number of passengers increase; it could be possible that the operational requirements might necessitate more resources.

It is necessary to compare the operating cost characteristics of different types of aircraft. However, because aircraft can vary so much in size and capacity, the only way to do this is to express costs in terms of various units of production. This is known as unit costs comparisons. Unit costs can be defined as the average operating cost incurred per available tonne kilometre.

Once the costs which will be incurred for airline operations have been established, the next step is to determine the likely profitability of the operation. Profitability control is extremely important, not just to the airline, but to any business. A parameter often mentioned in the airline environment is the break-even load factor. This is the percentage of an aircraft's total capacity which must be filled, in order to cover the costs of the operation.

In the airline industry, three basic parameters are relevant when assessing profitability; the revenue per RTK (or revenue tonne kilometre); the cost per capacity tonne kilometre (CTK)

and the load factor. Profitability can be examined on different levels; depending on the time scale involved and the level of costs that are actually incurred. An airline's profitability target must include provisions for the full recovery of costs.