OPTIMIZATION OF VARIABLE COSTS OF THE HAWKER 900XP AIRCRAFT

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Summary. This article focuses on optimization of the variable cost of the Hawker 900XP business jet aircraft in commercial operation. The article briefly describes the cost structure of a typical airline and further describes the variable costs and possible ways to reduce them by both the crew and dispatcher's procedures. The purpose is to show that cost optimisation has its clear spot even in the field of business aviation and potential saving are not marginal at all. And that the time spent by inventing new procedures pays clearly off in a short period of time.

Keywords: Hawker 900XP; variable costs; optimisation; fuel costs; fuel consumption

1. INTRODUCTION

The sole action of optimizing the costs in an airline, aero club, flying school or any other company is a thorough and complex process consisting of many stages and requiring deep cooperation within the company, i.e. from flight dispatcher to pilot, from ground handling agent to fuel tanker staff etc.

2. COST STRUCTURE

We can divide all costs of an airline or any other subject into two main categories. Those are fixed and variable costs. As one might expect, fixed costs are those unrelated to an extent of output (e.g. number of products), whereas variable costs vary with the output, meaning the higher the output, the higher the variable costs and vice versa.

2.1. Fixed Costs

Fixed cost, as mentioned above, are constant, regardless of the number of hours flown (talking about an airline), i.e. should the aircraft rest in the hangar all year long or fly 1,000 hours, these are the same.

Typically, among fixed costs of an airline are:

- Aircraft financing
- Insurance
- Hangar rental
- Office rental
- Books, charts
- Advertisement
- Maintenance (annual periodical maintenance etc.)
- Salaries (if paid a fixed annual salary)
- Some of the taxes, registration fees etc.

2.2. Variable Costs

Theoretically, if our imaginary aircraft would not fly all year long at all, the variable costs should be zero. But examining variable costs is not that straightforward as they can be somewhat more complex. There are costs which may belong to this group, but not exclusively. One of the examples might be airport costs for landing and parking. One may expect that with more time spent in the air, the landing costs would also ascent. But what about parking costs? Parking costs, we might say, are inversely proportional to the hours flown. So we may consider them as a special group of variable costs. Similar situation is with the expenditures on crew expenses such as hotel/accommodation and per diem expenses which are not solely a part of variable costs. We might say that they are partly fixed and partly variable costs.

Typical variable costs of an airline are:

- Fuel costs
- Maintenance (periodical maintenance after a specified period of time flown) costs
- MSP (Maintenance Service Plan) maintenance fee
- Airport and approach fees
- En-route charges
- Salaries (if paid proportional to the hours flown)
- Handling fees
- Catering

3. GROUNDS FOR OPTIMIZING THE VARIABLE COSTS

Before starting with the optimisation, one has to firstly evaluate the cost structure of the subject, i.e. the airline, and have talks with different people within the company who may influence and are responsible about the processes mentioned in the list above. They should discuss closely the current processes, i.e. simply how things are done, and how they all together can change those procedures in order to lower variable costs.

Only then should commence the process of the optimisation by altering the procedures with the new ones. Very important is to closely monitor the real savings (and if there are any) and compare them with the estimated savings, if the potential savings could be estimated prior to the evaluation in the environment of real operation.

As shown above, one may understand that the optimisation is long and thorough process which requires close cooperation within the company, as was mentioned in the introduction of this article.

4. OPTIMIZATION

The following part describes the real variable cost optimisation of the Hawker 900XP business jet aircraft.

4.1. Fuel costs

When defining fuel costs, we should note that these are influenced by two major factors: the fuel price and fuel consumption.

Fuel price has been steadily falling since 2014. U.S. Energy Information Administration shows a significant fall of kerosene prices since September 2014. Just a short rising of the fuel price was observed at the beginning of 2015 and the fuel price has been falling further down since May 2015 (see figure 1) [3].

We might influence the fuel price by choosing among several fuel suppliers (if there are more at given airport) and/or fuel tankering – the process of uplifting more fuel than needed for the given sector and flying that surplus fuel to the destination where the fuel price is higher. There is, however, no lunch

free as taking more fuel on board means also higher fuel consumption during the flight. So the obvious procedure is to calculate the effectiveness of the tankering prior to any flight using flight planning software or by other means.

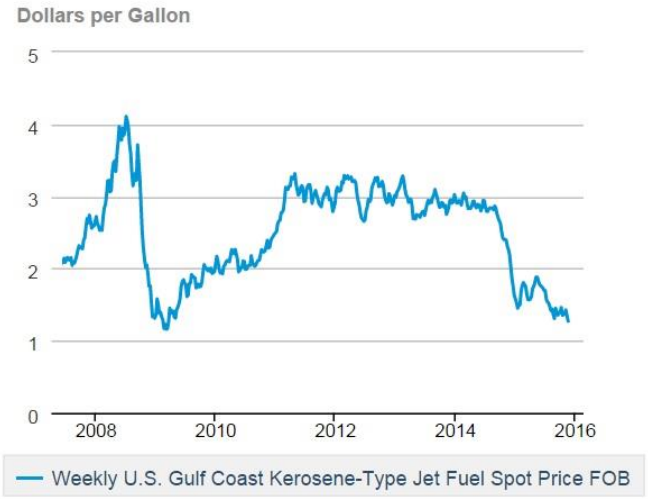

Figure 1 Graph of fuel prices 2008-2015 [3]

The next thing is the *fuel consumption* itself. There are myriad of ways how to lower the fuel burn of a particular aircraft. There also have been hundreds and maybe thousands of published articles, studies and works how to lower human impact on the environment through reduction of CO2 footprint, i.e. the fuel consumption. And there are even more studies internal and confidential which haven't been published.

A study published by BAE Systems of the United Kingdom "100 Ways to Reduce Fuel Burn" [4] shows the most important examples. This article uses some of the ideas and shows them tailored to the operation of the Hawker 900XP aircraft below.

In the aforementioned study is one important statement to think about:

Additional Fuel Flow ≃ 5% Additional Weight x Hours Flown

Figure 2 Fuel flow increases with higher weight substantially [4]

And it doesn't end there. There was an interview once with a former Concorde pilot who said that if he wanted one tonne of fuel extra at the destination (e.g. London-New York), he had to order a total of two tonnes more at departure. The carriage of the extra tonne cost one tonne because of the higher fuel burn.

Every company should think about the extra fuel carried on board as this is the easiest way how to lower the weight of a Hawker 900XP where there are no real possibilities to e.g. install lighter seats for the passengers as do many contemporary airlines flying larger aircraft. The same is with the galley equipment and catering equipment where there is not much space for weight optimisation. And if there is, the benefits are just marginal when compared to carrying less fuel.

APU usage is the next thing to consider. Quite common practise is to start the APU when the crew arrives at the aircraft and they usually keep the APU running during the taxi and turn the APU off after departure at approximately FL100 when speaking about the Hawker 900XP. If the outside air temperature is about 15-20°C, the crew may opt to avoid starting the APU too long before the EOBT, the Estimated Off-block Time. There are also possibilities to start the engines using just the battery power, not using the APU at all, if the flight is without any passengers, i.e. so-called ferry flight. This can be done at second and next flight of the day and can save thousands of U.S. Dollars annually.

One should also think about flapless take-off if the performance at the given conditions allows. This procedure lowers the noise pollution and also the fuel consumption. Similarly, common practice should be to lower the undercarriage and flaps not to soon before landing. However, the safety of the flight has always the priority and the aircraft has to be in the so-called stabilised approach with the approach configuration prior to passing the altitude of 500 ft above aerodrome level (AAL) during the Visual Meteorological Conditions (VMC) and 1,000 ft in Instrument Meteorological Conditions (IMC).

Very close attention should be paid to the phases of the very flight as it's the flight itself where the company may seek the most significant savings. It is the cruise flight where the aeroplane stays for the most of the time in the air and we should particularly optimize this phase of flight. It's, however, all parts including the climb and descent which should be optimised but the savings are not as apparent as with the cruise portion.

Talking about Hawker 900XP, there are three basic cruise flight procedures, the High Speed Cruise (HSC), Intermediate and Long Range Cruise (LRC). The HSC is the procedure flown with Maximum Continuous Thrust (MCT) on the engines whereas the Intermediate cruise equals most often to the speed of M.75 (Mach number). The Long Range Cruise is most of the time flown at M.70.

One may expect that slowing down should be the way how to lower the total variable costs but it's not always the case. To calculate the optimal speed for cruise flight, one should take into account the hourly fuel cost versus hourly aircraft cost among the all variable costs mentioned earlier. These variables should be summed up to get the total hourly cost of the aircraft. Other variable costs are not mentioned intentionally as they are either dependant on the distance flown or the number of flights.

Since the fuel price is quite low nowadays as shown in the Fig. 1, don't expect that the LRC is the best speed to fly the Hawker 900XP at. Most often, as of 2015 fuel prices, we should expect the optimum speed to lie between M.70 and M.75 most of the cases (it alters with change of weight, flight level, outside temperature and other factors).

4.2. Maintenance

The company operating the Hawker 900XP may search for most convenient maintenance centre in terms of distance from its home base, price and quality. But one should never decide to sacrifice safety for lower maintenance costs.

Some companies opted for the Maintenance Service Plan (MSP) to deal with the maintenance of the engines, for example. When doing so, the airline just pays a MSP fee which varies with the hours flown (flight time, not block time) to the manufacturer of the engines (Honeywell in case of 900XP) and the airline is free of any maintenance expenses which might appear.

4.3. Airport, approach and en-route charges

There are also ways how to pay less for any of the airport, approach and en-route charges. This is done by reducing the Maximum Take-off Weight (MTOW) of the particular aircraft. This is done airliner-wise among large airlines like Ryanair but is not of an importance when considering the Hawker 900XP.

4.4. Salaries

An excellent company does not primarily search many possibilities to lower the salaries. The salaries, if paid according to hours flown, should be however closely watched together with the en-route speed of the aircraft. There have been cases where the crew purposely flew at lower-than-optimum speeds in order to get higher salaries.

4.5. Handling and catering fees

Quite a significant savings could be discovered when finding the best handling provider/company at given airport in terms of the best value for money. As per the comparison between two such providers

at Geneva Airport in Switzerland, We have found a potential savings of 300 CHF with comparable quality provided by both companies. The names are undisclosed because the price is considered as confidential.

Table 1 Handling Comparison at Geneva

CHF	BASIC HANDLING SERVICES AT GENEVA					
	Handling	***Slot***	***Toilet Service***	***Potable Water Service***	***Pushback***	***TOTAL***
COMPANY 1	600	100	200	200	350	**1,450**
COMPANY 2	380	100	160	160	350	**1,150**

4. CONCLUSION

This article briefly described the process of variable costs optimisation in the operation of the Hawker 900XP business jet aircraft. This process is very complicated and takes several months, not to say years, to implement and verify in real environment of business aviation.

The aim was to present a paper with essential steps needed to be carried out to optimise the variable costs. There are also other ways how to do so which are beyond the span of this article and differs on a company basis.

A potential reader may discover that it is worth the time spent to think about the cost optimisation even in the corporate business aviation and we hope the article clearly depict this.

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