Airline Schedules Planning and Route Development

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Abstract

The airline's scheduling process is intended to provide a plan on the operating patterns of the companies' aircraft and their resources, to meet the anticipated demand. The schedules' plans are usually based on one season only. However, they should be integrated into a long-term corporate plans, as the latter plan specify the fleets' and other operational requirements. The main reason behind the short-term nature of the schedules plan is the unpredictable economic environment in which airlines operate. For this reason, this chapter provides an introduction to the schedules planning process, as it describes its conflicting objectives, including; customer satisfaction, productivity of human resources, high aircraft utilisation, high load factors, high frequency, maximisation of connections and consistent timing. It deliberates on scheduling constraints, including: slot problems; night curfews; industry regulations; pool agreements and peak surcharges; maintenance requirements, standby arrangements and general operational requirements; as it specifies about slot allocations, frequencies and resources, among other issues. Afterwards, this contribution also deals with the major routing patterns which are often considered during the scheduling process.

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11.1 Introduction

The major factors which may affect the airline product include: pricing policies, inflight services, seating density and schedules, among other things. The airlines' schedules attempt to estimate future demand for the companies' products for a given period of time. Therefore, the schedules planning process must be drawn up in such a way to satisfy a number of conflicting objectives. At the same time, the schedules planners may have to deal with internal and external constraints. For this reason, the schedules planning cycle is commenced six to nine months before a schedule is required for a given season. During this period, the airlines may need to develop specific route patterns which ought to be consonant with the strategic and operational plans, as well as with their schedules.

11.2 Corporate Plan and Schedules Plan

As mentioned above, the corporate plan is based on a number of years, usually five. However, the schedules planning process is not as long-term as the corporate plan, as it is usually based on one season only. The main reason behind the short-term nature of the schedules plan is the economic environment in which airlines operate. Over the past years, the airlines' macro environment has become increasingly volatile and unpredictable. Therefore, long-term schedules planning could be very risky. Consequently, the airline's strategic planning department may have to prepare several drafts before issuing their final schedules plan. Each drafted plan will be based on the fleet's requirements which have been outlined in the corporate plan. Each plan must be carefully examined before making a final decision on fleet size and resources (for the following season). The schedules plan must be drawn up in such a way to satisfy a number of objectives. The planning process may prove to be difficult as some of these objectives may be conflicting (these issues will be explained, shortly). Hence, the schedules planner must create a careful balance between these differing objectives, so that, the most productive schedule is achieved. This balance must be created while operating within financial, technical and operational constraints. The next two sections examine the scheduling objectives and any constraints which may affect the schedules planning process.

11.3 Scheduling Objectives

The underlying scheduling objectives include: customer satisfaction; productivity of human resources; high aircraft utilisation; high load factors; high frequency; maximisation of connections and consistent timing.

11.3.1 Satisfy the Customer

As was mentioned earlier, the schedules plan should satisfy the requirements of the various market segments which the airline targets (this is a schedules planning function). Therefore, the schedules planners require information on their airline customers' behaviours. They can obtain this data from a number of sources, including; historic data from the yield management department; information from sales and reservations agents, and from the airline's marketing research department. The schedules planner must make use of such information in order to accommodate the passengers' preferences, needs and wants. Thus, the schedules plan is an attempt to satisfy passengers with regards to time of day, the day of week, the frequency with which flights operate, and so on.

11.3.2 Productivity of Human Resources

The schedules planners must ensure that staff numbers are set at an optimal level for each shift. Their aim is to reduce the occurrence of peaks and troughs (highs and lows) in staffing requirements, so that the airline delivers a consistent service. If a schedules plan is well prepared, it will result in lower staffing costs. The extra staff who are on duty during given shifts in the weekends or in public holidays will usually receive additional allowances, even if there is little or no work for them to do. Yet, the operational and technical areas may always require minimum staffing levels for every shift. For instance, if a shift calls for ten loaders between 3 and 4 a.m., but only needs four loaders after this time, it is usual for ten loaders to work the whole shift. Obviously, this may not satisfy the scheduling objective which is to achieve maximum productivity from the available human resources. Therefore, the schedules planner must work towards improving efficiency so that the members of staff are not under-utilised. This applies to many areas within the airline, including the rostering of cabin crew, cockpit crew, maintenance, engineering and so on (Ernst, Jiang, Krishnamoorthy & Sier, 2004).

11.3.3 High Aircraft Utilisation

With regards to aircraft utilisation, one of the most important things to remember is that the aircraft can only make a profit while they are flying. Aircraft on the ground make no money for the company. One way of looking at this is to assume that the indirect costs of aircraft ownership (depreciation, interest, et cetera) are relatively fixed. Consequently, as aircraft utilisation increases, the total hourly, indirect costs decrease. This leads to a decrease in overall costs, and as a result, the overall financial situation of the airline improves.

The nature of an airline's route network has a major influence on aircraft utilisation. This is the reason why aircraft utilisation varies from airline to airline. If an airline's route network is dominated by long-haul routes, it will have high aircraft utilisation rates. Conversely, the shorter flights would translate to increased turnaround times. This means that the overall availability of the aircraft is reduced. Usually, the long-haul carriers will fly for more hours than the short-haul carriers. Their average daily utilisation is of 12-13 hours per aircraft or 4,250 hours per annum, as compared to the 7.5 hours per day or 7,250 hours per annum for short-haul carriers. However, there are short-haul carriers, particularly low-cost airlines that are achieving 8-9 hours per day or 3,300 hours per annum. The schedules planners' job is to prepare schedules which will maximise the aircraft utilisation for their route network.

11.3.4 High Load Factors

The schedules plan optimises the level of traffic available and the level of capacity offered. Excessive frequency can cost an airline a lot of money. If the schedule is misjudged and the airline operates too many flights on a specific route, some of the flights could take-off with empty seats. Consequently, the airline will lose money. The planning of the load factor is crucial issue, as it must not be set too high or too low. To increase load factors many airlines may consider reducing their frequency of flights. However, such a measure may be counter-productive; as high load factors will result in a situation where passengers could not find a seat on the flights they want. Hence, passengers could be intrigued to utilise the other airlines' services.

11.3.5 High Frequency

Industry experience suggest that many airlines have increased their market share (or became market leaders) after they have increased their frequency of flights to particular destinations

(rather than increasing the level of capacity on given routes). This argument contradicts what was discussed in the previous point, with regard to high frequency and load factors. However, it is the schedules planner's job to reconcile one requirement with another. It must be noted that certain destinations may require lower frequencies and larger load factors. For instance, certain routes that are used by business passengers may require frequent flights and smaller aircraft. The schedules planners are expected to maintain a balance between high load factors and high frequency. However, they are constrained by their fleet numbers and aircraft capacities.

11.3.6 Maximisation of Connections

The airlines' schedules could also be planned in such a way which could optimise passenger connections at both ends of a given route. Many carriers have developed connecting hubs with the underlying objective of adding new points for *traffic* to *feed* and de-*feed* long-haul *flights* (McShan & Windle, 1989). For example, Iceland's fast-expanding WOW *Air connect*s European points with North American destinations. The layovers in Reykjavik could boost the economics of long-haul flights from short haul flights. Airlines can shuffle passengers through intermediary hubs, where they can feed and de-feed short-haul and long-haul routes. There are other developments which can boost traffic flows, like for example; marketing arrangements between carriers, the use of code share flight arrangements, et cetera.

11.3.7 Consistent Timings

The schedules should be as consistent as possible in terms of maintaining the same flights departure times for particular services, from season to season. This is also known as 'clock-face timing'. The airlines' back catalogue of schedules consistency will help them build familiarity and loyalty among their consumer base (Wu, 2005). At times, the airlines may find it difficult to maintain such consistency due to certain scheduling constraints (these constraints will be discussed, shortly).

11.4 The Schedules Planning Process

The schedules' planning is constrained by the airline's fleet size. The schedules planners need to ensure that the prescribed number of aircraft is scheduled on the airline's network, in such a

way which will help their airline to achieve its overall objectives. When the schedules planning process has been completed and the final plan has been drawn up; the actual flight dates approach and the plan is given to the airlines' operational departments. Then, it is their responsibility to put the schedule into action. Therefore, the schedules planning process is an integral part of the successful operation of any airline. It affects and is itself affected by the considerations of other departments.

The importance of the schedules plan cannot be over-emphasised. The plan must be as accurate as possible, as the airline can never under / over-estimate its fleet's requirements. If it under-estimates the fleet's requirements, the airline will not schedule enough flights and will find itself unable to operate the flights that are being demanded by target customers. Alternatively, if the airline over-estimates its fleet's requirements, it will probably schedule too many flights which will result in the under-utilisation of its fleet. This will ultimately result in significant financial losses to the airline. For these reasons, the scheduling department should always work in collaboration with other departments (Pinedo, 2005). Clearly, every department within the airline should be involved in the schedules planning processes as their involvement would improve the schedules planning process and the airline's operations. The airline departments which should be involved in the schedules planning decisions may include; corporate planning, fleet planning; sales; marketing; product development; operations control; catering; cargo; ground operations and staff recruitment; among others. The marketing department will ensure that the airline schedule will meet and exceed the customers' expectations.

11.5 Scheduling Constraints

The external constraints include; slot problems, night curfews, industry regulations, pool agreements, and peak surcharges. Whilst, the internal constraints include; maintenance requirements, standby arrangements and general operational requirements.

11.5.1 Slot Problems

Many airports are increasingly experiencing congestion problems. Very often, the volume of air traffic to and from certain airports could exceed their runway capacity. Such problems exist in London Heathrow, Tokyo Narita, Washington National, Frankfurt and Milan Linate, among

others. As a result, the air traffic co-ordinators have had to operate a slot system, whereby time slots are allocated for arrival and departure times. Such a system operates on the basis of certain principles. The most basic of these principles is the 'grand-father's rights'. This specifies that if a carrier had a particular slot in a given season, it will be entitled to use that slot again in a subsequent equivalent seasons. This system has suited incumbent carriers. However, it could impose severe constraints on the schedule planners to change timings and / or increase their frequencies at congested airports. This system may be considered as anti-competitive; however they are adopted in many congested airports. The landing slots may have a commercial value and can be traded between airlines. For instance, Oman Air paid $75m to Air France–KLM for a pair of take-off and landing slots at Heathrow Airport in February 2016. A year before, American Airlines paid $60m to Scandinavian Airlines (Sunday Times, 2016)

11.5.2 Night Curfews

Many airports are either closed at night or they may operate well below their daytime capacity levels. Therefore, night curfews place restrictions on schedules planners as they have to schedule flights to and from such airports during day time hours. Time restrictions like this are usually enforced at airports which are lobbied by strong, local environmental groups. An airline which breaks night curfew regulations is usually subject to heavy fines. For example, many airports in Germany have restrictions and curfews during the night. Frankfurt International Airport, has banned scheduled aircraft movements between 23:00 and 05:00 hours. Moreover, a limited number of flights are allowed during the periods (22:00-23:00 and 05:00-06:00 hours), providing they comply with ICAO Chapter 4 noise regulations. In addition, further restrictions will usually apply to noisier aircraft (AIP, 2016).

11.5.3 Industry Regulation

In certain cases, governments may grant exclusive rights to one of more airlines to operate on given routes. They may decide that certain point(s) could be served for tourism, commercial, or for other purposes. Such regulations may be considered as another form of constraint, which could have a strong influence on the construction of schedules.

11.5.4 Pool Agreements / Joint Venture Agreements

Occasionally airlines may enter into joint venture agreements in many areas. However, the agreements relating to the provision of frequency, type of equipment and timings could have an impact on the airlines' schedules planning process.

11.5.5 Peak Surcharges

The airports which experience severe congestion problems could apply specific measures. Peak surcharges are usually applied to passengers and to aircraft which operate during specific peak periods. Their purpose is to discourage carriers from flying during congested, peak periods. These measures may not be very successful as there are many other variables which could influence or even dictate flight timings. At times, peak surcharges may compound congestion problems, particularly during peak periods by creating additional, more acute peaks, before and after the original peak periods.

11.5.6 Maintenance Requirements

The schedules planners must consult with the engineering department as aircraft maintenance requirements affect schedules. Each aircraft within an airline's fleet has its own individual maintenance schedule. Provision is made within the schedule for different kinds of maintenance checks to be carried out on the aircraft, at various intervals. The schedules planners have to know when the aircraft will be grounded for maintenance. They must 'block off' enough aircraft time from their overall fleet availability so that appropriate maintenance checks can be completed. The maintenance periods must be built-in within the schedule.

11.5.7 Standby Arrangements

The schedules planners have to strike a balance between the airline's need to operate as economically as possible, and their objective of delivering their schedule. When the schedules planners draw up the schedule, they need to ensure that they provide reliable and punctual services. This could be easier in theory than in practice. Aircraft delays may be inevitable, regardless of the schedule planners' level of competence in drawing up optimal schedules. The delays may arise due to unscheduled maintenance snags, bad weather, air traffic control, awaiting connecting passengers, and so on. The airline must be ready to deal with contingent situations when they happen. Schedules planners may rely on specialised software which

analyses past schedules and punctuality records to predict future performance. For delay reasons, some airlines may have a back-up plan, in order to maintain the schedule's punctuality. An aircraft could be designated to act as a standby vehicle for the rest of the fleet. Several factors could influence the level of standby cover which is required by a given airline, including the airline's financial circumstances, the condition and age of its fleet, the state of the competitive environment, and so on. The standby arrangements are expensive as they involve the under-utilisation of aircraft. Consequently, many airlines may not have an aircraft for standby, particularly if they possess modern, reliable aircraft in their fleet.

11.5.8 General Operational Requirements

There are a number of general operational requirements which must be taken into consideration during schedules planning. The operational requirements may include, turnaround times, crew meals, breaks, provision of aircraft cleaning, catering and so on.

Every year, the schedules planners prepare two schedules, one for summer and one for winter. Generally, the schedules cycle is initiated nine months before a schedule is required for any given season. Although, many airlines may use specialised systems, this procedure will usually cover the following steps:

a) The aircraft in the airline's fleet are allocated, one by one to certain routes throughout the day;
b) This procedure is repeated for a number of times so that each aircraft is allocated to a particular route for each day of the week;
c) The information created by steps 1 and 2 sets out the tasks for each aircraft. This data is compiled into a document that is known as the aircraft integration chart;
d) When the integration chart is complete, copies of it are dispatched to each of the operational area which it affects. These areas will then provide their feedback on the chart.
e) The integration chart is an operational document and is not meaningful to commercial areas within the airline, such as sales and marketing. Consequently, at approximately the same time when the integration chart is being circulated within the airline's operational areas, a draft time table is also prepared and circulated in the airline's commercial areas. The draft time table contains the same information

as the integration chart, but in a different format. The commercial areas will also provide their feedback on the commercial aspects of the draft timetable;

f) When the integration chart and the draft time table have been circulated, the operational and commercial areas will meet together to discuss on them. For instance, the marketing departments will be concerned with ensuring that the final schedule will achieve their objectives. Following the communications among departments, the schedule planners will modify and refine their drafts. Hence, subsequent drafts will be circulated for approval. The final drafts constitute the airline's schedules for a given season.

The discussions and feedback which take place between the operational and commercial areas will clearly evidence the interactive nature of the schedule planning process. Inevitably, these departments may often have to compromise on their differing commercial, economic and operational interests.

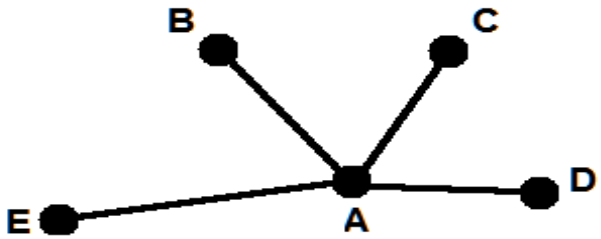
11.6 Different Routing Patterns

This section deals with the major operating patterns which are often considered during the scheduling process. There are three major types of routing patterns:

11.6.1 The Hub and Spoke System

In situations where the volume of traffic is sufficient, the hub and spoke routing system that is featured in Figure 11.1, is widely considered to be the most satisfactory and effective pattern. The hub and spoke involves the operation of non-stop direct flights which lead to low operating costs (McShan & Windle, 1989). The absence of intermediate stops may result in high passenger load factors. If this is case, it would be easy to match the capacity with demand.

Figure 11.1 The Hub and Spoke System



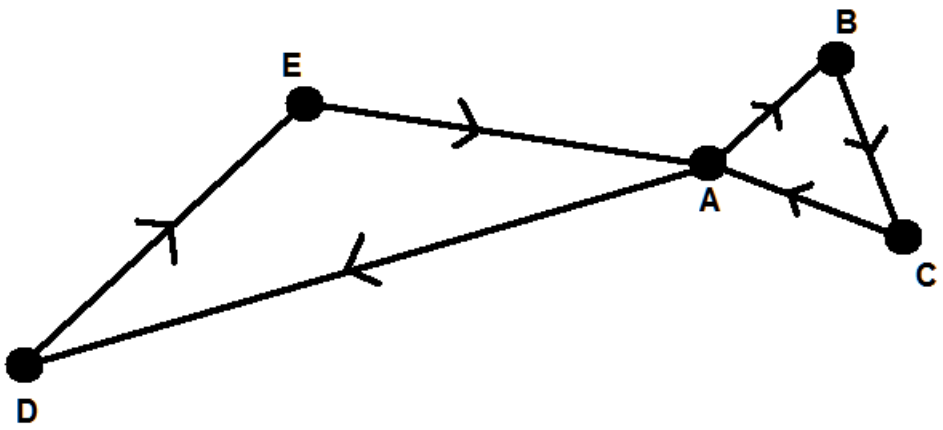
The hub and spoke philosophy suggests that the airline can operate services more frequently between hubs, as it could feed traffic into the hubs from the spokes, and vice versa. The main advantage for the passengers is access to a traffic system with many and frequent departures to various destinations. The hub and spoke method has been adopted by many airlines, but particularly in the United States. There, it has been developed in order to expand the number of routes from central hubs, like Chicago, Detroit, Denver, et cetera.

The hub and spoke diagram illustrates a situation where an airline serves four city markets from point A. The direct routes are: AB, AC, AD and AE. However it is possible for the airline to add six new (one-stop) city pairs to their route network. It can do this by scheduling the times of the flights AB, AC, AD and AE in a way which enables point A to act as a connecting hub. The new city pairs that could be created are: BE, BC, BD, CE, DE and CD. If point A is used as a connecting hub, the airline concerned can rapidly expand its route network. This would result in a significant increase in traffic. Another device that could be used in a hub and spoke systems is the utilisation of through flight numbers over the connecting hub, even though an aircraft change may occur.

11.6.2 The Triangular System

In a triangular system, there may not be enough traffic from the outlying points B, C, D and E to absorb the total aircraft capacity. For this reason, it may be necessary for the airline to combine two or more points on one service. This routing pattern produces the triangular pattern, as illustrated in Figure 11.2.

Figure 11.2 The Triangular System



An important consideration is the fifth freedom traffic rights which have to exist between BC and DE. However, this routing will only cater for one-way traffic. Therefore, the airline may not provide a good competitive product on BC and DE.

The triangular pattern may be justified when the traffic between AB, AC, AD and AE is not sufficient to support non-stop direct services. Therefore, this routing can also be useful in certain geographic locations, for example, small island communities could feed gateway airports.

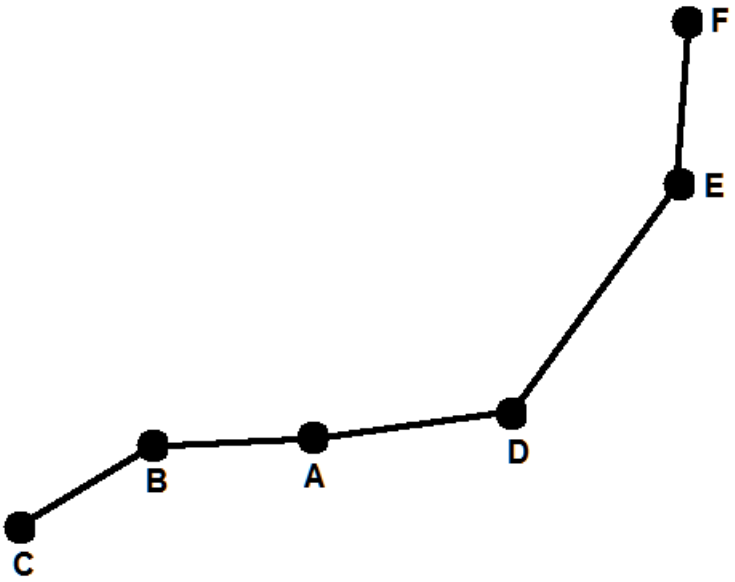
Yet, this routing may also allow the airline to enhance its frequency to higher levels (as previously discussed, the level of frequency may be an important determinant for an airline's market share). The triangular pattern could be feasible if particular carriers would make use of larger capacity aircraft.

11.6.3 The Linear System

An airline using the linear routing pattern operates from point A, as shown in Figure 11.3. It transits points D and E, before it reaches F; in the eastern direction (and returns in the same manner). It serves points B and C in the same way; in the westward direction (and returns in the same manner). Depending on the sector lengths, it may be necessary for the aircraft to overnight away from the home base (i.e. point A). The linear pattern involves the acquisition

or use of Fifth freedom rights and a combination of Third / Fourth and a Fourth / Third freedom rights.

Figure 11.3 The Linear System



This routing pattern may result in high operating costs. The combination of different points in the same service could make it difficult for the airline to match traffic and capacity over the different sectors. This issue may lead to lower load factors. On the other hand, it may enable airlines to provide services to major destinations since they are transporting passengers from more than one originating point. In such a situation, the airline has the ability to board and land passengers at different points along the route. For example, there are airlines in West Africa who are serving the coastal regions by using such a linear system.

In conclusion, the schedule planning function is a strategic activity, and getting it right is a major contributing factor to successful airline operations. From a marketing point of view, it is imperative that the schedule is carefully prepared as it has an influential role in achieving the objectives of satisfying the requirements of various market segments. The schedules planning department cannot work in isolation. The schedules planners will have to collaborate with commercial, operational and technical departments within the airline. This way, they will be in a position to construct the schedule which will best support the airline to achieve its corporate objectives.

11.7 Questions

- *Outline the role which the schedule plays in satisfying customers;*
- *Why is it important for the schedules planners to familiarise themselves with maintenance schedules?*
- *Briefly outline the steps involved in schedule construction.*
- *Do you think that the schedules produced by your airline genuinely help the company to achieve its corporate, operational; and commercial objectives? Discuss.*

11.8 Summary

The airlines' schedules planning processes are integrated into their overall corporate plans. The long term corporate plans will usually consist of: an assessment of the fleets' requirements to meet the forecasted demand; as well as an evaluation of the financial implications arising from the fleets' requirements. Therefore, the schedules attempt to estimate future demand for the companies' products, for a given period of time.

The schedule is based on one season only, at any given time. The main reason for the short-term nature of the schedules plan is the unpredictable economic environment in which the airlines operate. Hence, the schedules planning must be drawn up in such a way which will satisfy a number of conflicting objectives. A trade-off is necessary among financial, technical and operational departments.

The scheduling objectives are customer satisfaction, productivity of human resources, high aircraft utilisation, high load factors, high frequency, maximisation of connections and consistent timing. There are two categories of scheduling constraints; external and internal. The external constraints include slot problems, night curfews, industry regulation, pool agreements and peak surcharges. The internal constraints may include maintenance requirements, standby arrangements and general operational requirements.

The construction of a schedule takes place as part of the schedule planning cycle. This cycle occurs twice a year and produces two schedules (one for summer and another one for the winter period). Generally, the cycle is commenced six to nine months before a schedule is required for a given season.

There are three major types of routing patterns. They are hub and spoke, triangular and linear routing networks.