



KEYS TO SUCCESSFUL AIRLINE SCHEDULING

An Embark advisory product

Overview

The flight schedule is fundamental to an airline's customer offering and operated travel experience, impacting virtually every stakeholder in the travel experience. This article defines the schedule, discusses key development concepts, tools, and communications.

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In the airline world, few areas are as fundamental as the flight schedule. The concept of the schedule seems obvious and yet defining what the schedule is can be nebulous. The schedule impacts more airline stakeholders – from customers to operations teams, from flight crews to commercial planners – than most other key concepts.

So, what is an airline schedule?

A COMMERCIAL OFFERING

First and foremost, the schedule is a basic component of an airline’s commercial offering, which is why the scheduling team is almost always a part of the greater commercial organization. The core service an airline offers is transportation of passengers and/or cargo between two points. The schedule defines the service and includes days and times at which the service is offered, necessity of making connections, and even aspects of the onboard product when different aircraft types have different onboard products.

In the advent of computerized reservations systems, airlines competed heavily on the details of schedule, such as on-the-hour scheduling and managing trip durations to be as short as possible. None of this was about satisfying customer demand, but instead was about occupying limited space on travel agent screens to ensure it would be the most ‘shopped’ offering. Today, this jockeying has moved to the internet and is more influenced by price than schedule.

While price has become the most critical competitive element, schedule remains solidly in second place. Schedules offered need to be in line with customer expectations which vary based on customer and market segmentation. For example, business travelers demand schedules designed for flexibility around tight schedules, while “VFR” passengers work their personal schedule around travel. International and long-haul travelers almost always prefer redeyes and other schedules that assist in time zone acclimation.

Schedules also need to be cognizant of the larger travel environment around them. Leisure market schedules

often require consideration of timeframes around accommodations, cruise schedules, or other recreational activities. Short-haul schedules must consider convenience of schedule as part of competing with other modes of travel, including personal auto, passenger ferries, and trains.

Also related to scheduling (and implicitly demanded by customers) is satisfactory on-time performance. Customer choices can be swayed by the perception of longer-term on-time performance trends, both positively and negatively. Strong on-time performance can lead airlines to revenue premiums, while poor performance has had impacts that include excessive costs, tarnished carrier reputation, and increased regulations to demand more timely operations.

AN OPERATIONAL PLAN

It was legendary Continental Airlines CEO Gordon Bethune who acknowledged, “the airline business is the biggest team sport in the world.” Nowhere is that more evident than in the development of the schedule as an operational plan. Virtually every department of an airline impacts and is impacted by the schedule. Consideration of, input from, and coordination with every department within an airline – essentially every player on your team – is crucial.

Adding complication is the fact each department inhabits its own unique environment full of distinct needs and constraints related to fulfilling its individual mission. These factors include regulatory matters, employee and commercial agreements, and training requirements as unique as each department. While operational teams often create buffers to soften requirements and provide some perceived flexibility, most have a rigid baseline requirement. These can vary by circumstances as defined in requirements, such as approved deferrals of certain aircraft maintenance.

Overall responsibility for day-to-day execution of the operational plan normally falls to an operations control center. The control center collects aspects of the plan from the scheduling team and major operational divisions. They coordinate routine activities to achieve the overall daily plan and ensure the successful completion of key departmental responsibilities. As the commercial scheduling team and the operations control center share the airlines’ responsibility for wide-ranging

operational performance, a strong relationship between these groups is essential.

An important driver of decisions worked jointly by the scheduling and operations control teams is on-time performance. In addition to the commercial and regulatory requirements for timely operations, strong on-time performance is a contributor to cost control. These efforts include ensuring each flight is properly scheduled with strong block, arrival, and turn performance, as well as implementation of contingency plans that allow irregular operations to return to schedule or operate in a controlled but delayed manner.

A COLLECTION OF COMPROMISES

Ultimately, an airline's schedule amounts to a collection of compromises. These tradeoffs take several forms. First, the commercial team will maintain (formally or informally) a prioritization of flights, with seasonal, day-of-week, and time-of-day considerations. Successful airlines generally have more flights in their commercial consideration set than their resource plans will allow, making the network plan the first compromise.

From there, the optimization of the schedule for operational needs is packed with compromise. Most of these exchanges are individually minor, but collectively drive resource need and work-flow decisions across the organization. Like the commercial realm, many of these trade-offs are made or accommodated within impacted departments. Regularly, the needs of one department will impact the others, particularly as changes are implemented to existing, understood, and planned to schedule patterns. In these situations, it becomes the role of the schedule planner to evaluate alternatives and arbitrate solutions between the other departments.

To manage the diverse set of demands on the schedule, airlines typically develop and maintain a series of constraints around which the schedule is built. A strong set of constraints contributes to the efficiency of the resulting schedule as well as the speed with which the schedule can be produced. The schedule planning department maintains these standards, and ensures they are widely communicated across the airline. Often, these standards correlate to operational KPI's which are used to measure operational effectiveness and diagnose concerns around on-time performance.

SCHEDULE DEVELOPMENT

In its simplest form, the schedule is a series of flights organized into lines of flying, with the characteristics of each leg driven by block times, turn times, and other constraints, designed to achieve as much of the frequency plan as possible. Because of the iterative nature of optimization, schedules usually pass through several rounds of development over time, including multi-year advance planning exercises, annual budgets, operational reviews, and publication cycles.

Frequency Plan. The starting point for schedule development is the frequency plan – a 'ranked list' of flights developed by the commercial team. For mature networks, this can be an informal process that focuses on the changes to historic schedules rather than a literal ranked listing of priorities. The multiple cycles of review and optimization often drive change that requires further examination of the frequency plan and incremental prioritization over time-of-day, day-of-week, and hub/network considerations.



Fleet Plan. The most basic constraint is the number of aircraft in the fleet, as this drives the maximum lines of flying available. A fleet plan is more complicated than counting the aircraft on property. Accommodations for **Heavy Maintenance** events (i.e. longer-duration aircraft checks which cannot be accommodated by normal downtime) and spare aircraft that are typically required.

Airport Constraints. The airport environment has the potential to constrain schedules in several ways. The most obvious airport constraint is airport capacity – the airline simply cannot create a schedule which exceeds the capacity of the facilities to process those flights. Geography and related demand patterns, stage length variation, and time zone considerations all carry a strong influence on airport constraints (both at the individual airline and airport-wide level) by defining periods of peak activity.

For network carriers reliant on connecting hubs, **Banking**, the idea of scheduling arrivals and departures in ‘waves’ to maximize hub connections, drives schedules in both the hub and spoke airports. For low-cost point-to-point carriers, airport facilities such as check-in areas and security checkpoints can serve to define capabilities and resulting limitations.

Another specialized airport constraint is Slots. A **Slot** is an authorization to routinely use airport facilities at certain times-of-day and/or days-of-week. Where utilized, slots are granted on a “use-or-lose” basis and can carry significant value at constrained airports. Therefore, airlines work to ensure its slots are properly utilized to preserve their value.

Maintenance Planning. The requirements of aircraft maintenance create several different types of needs in the schedule. The schedule and maintenance planning teams work together to maximize fulfillment of maintenance needs during schedule gaps and off-peak periods. As noted previously, Heavy Maintenance impacts daily aircraft availability in the Fleet Plan.

Routine maintenance drives a few different constraints. Airlines typically do not have capabilities for routine checks in every location where aircraft rest, thus maintenance bases are developed in locations where multiple aircraft routinely overnight, creating long-term requirements at impacted airports. Further, the scheduling team develops lines of flying that ensure each aircraft will routinely pass through maintenance bases and create swap opportunities that allow aircraft to remain on the maintenance plan, despite irregular operations disrupting the schedule.

Crew Planning and Scheduling. The process of assigning pilots and flight attendants to work assignments (known as **Pairings**) is especially complex. Work schedules for inflight crew members are guided by regulations and

collective bargaining agreements which govern the amount of time individuals can fly and be on duty, along with rest periods and days off between assignments. These rules may also vary between pilots and flight attendants, thus doubling the work requirement of this team. Large carriers typically use linear optimization models to maximize crew efficiency. Elements of this optimization can impact the overall operational plan.

In the U.S., new crew rest rules implemented in 2014 have created a long-term pilot shortage, the impacts of which have been notable for regional and niche airlines prior to the Covid-19 pandemic. Carriers have found pilot hiring and attrition to be much less stable than before, which has driven schedule reductions due to lack of crew at certain times. This highly impactful constraint has elevated the importance of crew optimization.

TOOLS OF THE TRADE

Managing all the variables and constraints to develop an airline schedule is a complicated task. Two types of tools assist scheduling teams in their day-to-day work:

Schedule Editors are primarily visualization tools that improve schedule optimization by depicting schedules in multiple views and allowing users to make manual changes and review in an iterative process. Most editors have modules to allow schedules to be viewed from line-of-flying, airport operations, and customer-facing perspectives. The editors typically have robust constraint engines primarily designed to show but not solve schedule conflicts, instead relying on the scheduler to review problems. They usually include an optimization engine focused only on aircraft routing. Resolution of other constraint conflicts is managed through error reporting and user intervention.

As a last stop before publication via SSIM files, editors also include tools to attach supplemental information to flights, including inventory classes, codeshare information, on-time performance and terminal indicators, and cabin service. They often have tools to assist in managing minimum connection times and slots, and extensive reporting to facilitate communication and review of schedules by multiple departments.

Virtually all airlines use schedule editors. Typically, smaller airlines can complete all optimization efforts with a good schedule editor.

Optimization Models are more advanced than editors, as they work to automate the manual optimization elements and include financial approaches to define constraints. These models are designed to rearrange schedules while assessing the profitability impact. The amount of change the model is permitted to make can be controlled. Most models include “warm” starts where a desire to minimize changes over time is a factor. The revenue model is typically derived from QSI modeling while costs are determined by a series of dollar-based and binary constraints. Both require careful calibration to ensure accuracy.

Optimization models are critical for larger airlines or more complicated networks. The value of optimization models is exponential with carrier size and complexity.

COMMUNICATING SCHEDULE CHANGES

Once the schedule development process is complete, the scheduling team must focus on communication. The process to convey schedule information is almost as complex as its development. In addition to the stakeholders involved in the optimization process, other customers of schedule information also include passengers, customer service teams, reservations and third party distribution systems, codeshare partners, critical internal systems such as operations control software, plus revenue accounting, finance, and marketing departments.

The scheduling team accepts a varied range of inputs, synthesizes them into a resulting schedule, and shares customized, but routine, communications with each department within the airline. To be most effective, communication tools should be robust, descriptive, time-sensitive, and automated. Use of a scheduling editing tool is valuable to achieving these goals.

Communications between systems are reliant on file standards created by IATA in the Standard Schedules Information Manual, or SSIM, which dictates file contents and format. For humans, visual reports are customized to the unique needs of each department. Ensuring a consistent underlying schedule across all customized communications is critical. This promotes confidence in the process and supports how teams communicate with one another.

ENGAGING EMBARK

Embark can be engaged for several different scheduling projects – from a single transition exercise, to ongoing management of all schedule functions. Our scheduling experts have decades of experience across airlines of all types and sizes. We have worked with airlines through personnel transitions, reservations system migrations, start-ups, emergencies, and routine business.

Our Approach

No two airlines are alike. Therefore, our approach always starts by working with the airline’s functional teams to quickly gain a strong understanding of the constraints and circumstances surrounding schedule decisions. We will review the scheduling, decision-making, and support processes for improvements in schedule execution, communication, and strategy. Because a key part of our service is execution and tangible results, we work closely with all stakeholders.

Embark Experience

Embark has fulfilled all scheduling functions at several niche and regional carriers. In these cases, we work with leadership to develop frequency plans and lead the functional areas through schedule development and publish schedules as a single, coordinated solution. We also supply critical talent to major airlines during team member transition and other periods of high workload.

CONTACT US

Embark is more than a consulting firm; we help craft airline business strategy - then work with our partners to make it a reality. Embark provides airlines with (short term or long term) outsourced support across any commercial function. Whether support is required with scheduling, or developing strategic airline partnerships, or pricing and revenue management, Embark offers over 100 years of experience to take airlines to new heights.

Contact our team via phone or email and we would be happy to discuss how we can work together to support your needs.

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