



AIRPLANE UTILIZATION
AND TURN-TIME MODELS
PROVIDE USEFUL
INFORMATION FOR
SCHEDULE, FLEET, AND
OPERATIONS PLANNING.

Economic Impact of Airplane Turn-Times

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Optimizing airplane utilization, which includes efficient airplane turn-time at the gates, can help an airline maximize the large capital investment it has made in its airplanes. Efficient airplane utilization requires close coordination among an airline's own fleet planning, schedules planning, passenger reservations, flight operations, ground operations, and airplane maintenance systems, as well as with air traffic controllers and airport authorities (see following article, "Improving Ramp/Terminal Operations for Shorter Turn-Times"). Even a small reduction in turnaround time at the gate can produce impressive benefits, particularly for short-haul carriers.

Airplane utilization is a key performance indicator for airline operations and a significant differentiator for some business models. Airplane utilization is a function of a number of elements, including airplane design features and characteristics, airline maintenance programs, airplane technical reliability, airline business philosophy, market demand characteristics, and availability of trained labor.

Traditionally, some carriers rely on more efficient airplane utilization based on point-to-point service and faster airplane turnaround at the gate. Improved airplane utilization helps spread fixed ownership costs over an increased number of trips, reducing costs per seat-mile or per trip.

AIRPLANE AVAILABILITY AND TURN-TIMES

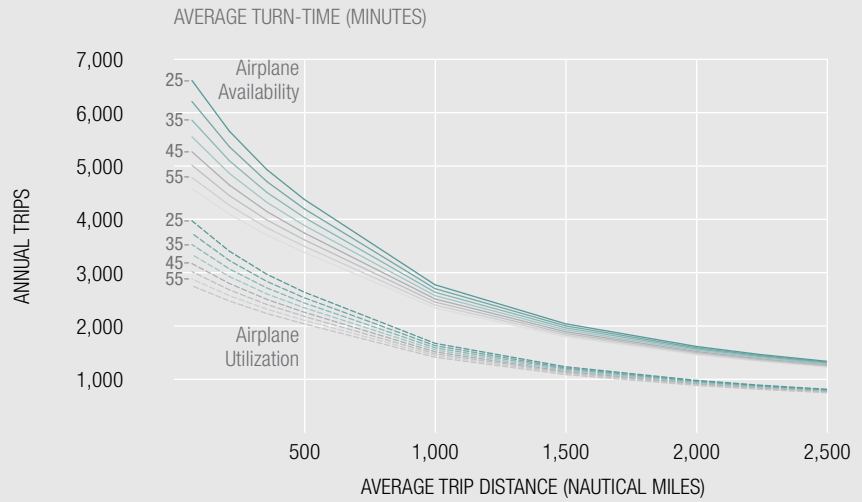
Airplane availability is the total number of days in a given period, less downtime required for airplane maintenance. Maintenance check intervals and check contents are key drivers for overall maintenance program efficiency, which in turn impacts airplane availability. Airplane systems and components reliability further influence the downtime required for additional maintenance. Airplane aging also leads to increased maintenance requirements and lower airplane availability.

For planning purposes, it is useful to convert airplane availability from number of days to number of trips. In order to simplify the analysis, assume that the airplane performs all trips at a specific trip distance. Based on airplane performance characteristics, average block time (defined as time from airplane pushback from the gate at origin to arrival at the gate at destination) for the trip can be estimated, using typical mission profile and speed schedule.

AIRPLANE AVAILABILITY AS A FUNCTION OF AVERAGE TRIP DISTANCE

Figure 1

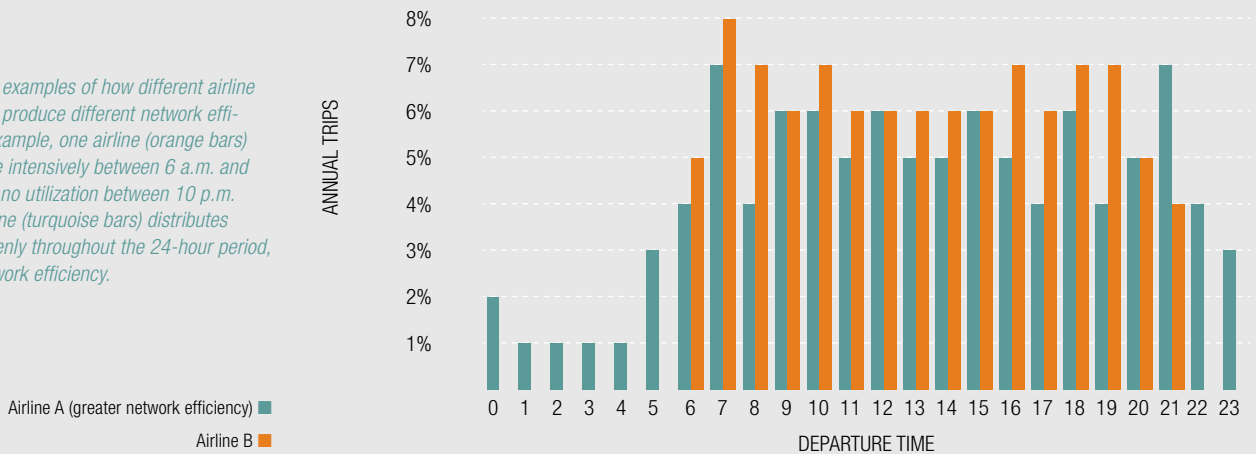
Airplane availability (in terms of number of trips) is quite sensitive to average turn-time for shorter average trip lengths. In this graphic, the solid lines represent the maximum number of annual trips for which an airplane is available as a function of average trip distance using various incremental turn-times. Additional operational factors further limit achievable airplane utilization which is captured in network efficiency factors. The dotted lines represent actual airplane utilization: airplane availability (maximum possible trips) multiplied by network efficiency (which is less than 100 percent by definition).



NETWORK EFFICIENCY IMPACTS AIRPLANE UTILIZATION

Figure 2

This graphic shows two examples of how different airline operating environments produce different network efficiency factors. In this example, one airline (orange bars) operates airplanes more intensively between 6 a.m. and 10 p.m. but has almost no utilization between 10 p.m. and 6 a.m. Another airline (turquoise bars) distributes departures relatively evenly throughout the 24-hour period, resulting in greater network efficiency.



Before an airplane can make another trip, it must remain at the gate to allow passengers to disembark, have cargo and baggage unloaded, have the airplane serviced, cargo and baggage loaded, and board passengers for the next trip. Averaged over a number of trips, this time at the gate is defined as average turn-time.

A typical hub-and-spoke system requires longer turn-times to allow for synchronization between the feeder network and trunk routes. This enables carriers to achieve higher load factors. On the

other hand, carriers that typically rely on point-to-point service use a simplified fleet structure, fewer airplane types, and increased airplane utilization. With fewer airplane types, these carriers are better able to substitute airplanes in the event of an unplanned technical problem with an airplane. In order to optimize airplane utilization, point-to-point carriers operate with significantly faster turn-times at the gate. 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 airplane can make in a given period of time.

Average block time for a given trip distance plus average turn-time constitutes average elapsed time per trip for the airplane. Dividing airplane availability by average elapsed time for a given trip distance provides the maximum number of trips an airplane can complete in any given period. Repeating these calculations for different trip distances using incremental turn-times in minutes provides a maximum number of trips for which an airplane is available, as a function of average trip distance (see solid lines in fig. 1).



Operators who would like to take advantage of the cost savings and efficiencies of increased airplane utilization may want to start by educating their workforces about the positive effects of reducing turn-times.

EFFECT OF NETWORK EFFICIENCY ON AIRPLANE AVAILABILITY

Airplane availability — maximum number of trips possible — represents an extreme condition and assumes no other constraints and unlimited traffic demand. In reality, traffic demand is unequally distributed around the clock. Lack of traffic demand and nighttime curfews limit airplane utilization at certain times of the day. Seasonality of demand implies less intense airplane utilization during certain months of the year. Traffic rights, arrival/departure slot restrictions, and other system

limitations also restrict actual airplane utilization. All these factors combined create the network efficiency factor. Airplane availability (maximum possible trips) multiplied by the network efficiency factor (being less than 100 percent by definition) gives the actual airplane utilization (see dotted lines in fig. 1).

Flight departures may be distributed around the clock in very different ways, depending on the carrier (see fig. 2). For example, one airline may operate airplanes more intensively between 6 a.m. and 10 p.m. but have almost no utilization between 10 p.m. and 6 a.m. Another airline may distribute departures relatively evenly throughout the 24-hour

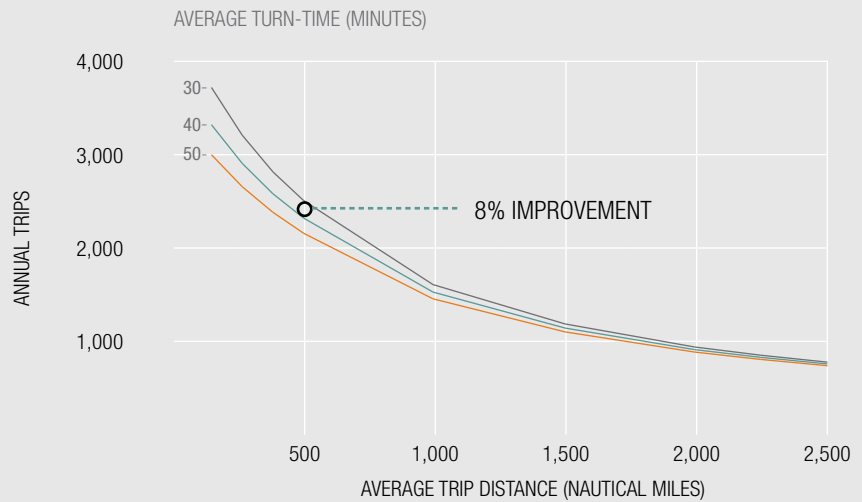
period, resulting in a better network efficiency factor. This factor varies from operator to operator and by the business model the airline has adopted. Analysis of actual in-service data — such as annual utilization and average flight length — for a number of operators provides an opportunity to calibrate and benchmark the network efficiency factor for different business models.

In figure 1, the actual utilization levels as a function of average trip distance and turn-time are based on a 60 percent network efficiency factor, typical for most point-to-point carriers.

EFFECTS OF TURN-TIME REDUCTIONS ON AIRPLANE UTILIZATION

Figure 3

Reducing turn-time by 10 minutes with an average trip length of 500 nautical miles improves airplane utilization by 8 percent.



AIRPLANE UTILIZATION PROFILE

Figure 4

Point-to-point carriers have a significant advantage in airplane utilization compared to carriers operating on a typical hub-and-spoke system.



REAL-WORLD APPLICATIONS OF AIRPLANE UTILIZATION

Airplane utilization and turn-time models provide useful information for schedule planning, fleet planning, operations planning, and economic and financial analysis. For example, using the utilization/turn-time model for a point-to-point carrier with an average turn-time of 40 minutes gives an estimated utilization level of 2,304 trips per year with an average mission length of 500 nautical miles. Reducing the average turn-time

by just 10 minutes — from 40 to 30 minutes — improves the utilization level to 2,491 trips per year, an increase of 8.1 percent (see fig. 3). This efficiency can enable a carrier to reduce the number of airplanes it needs to have in its fleet to make an equal number of trips.

With increased average trip distance, airplane utilization in terms of flight hours increases but number of trips per year decreases, reducing the potential savings from shorter turn-times. Because of their average trip distances, point-to-point carriers can achieve greater airplane utilization than hub-and-spoke carriers (see fig. 4). The advantage

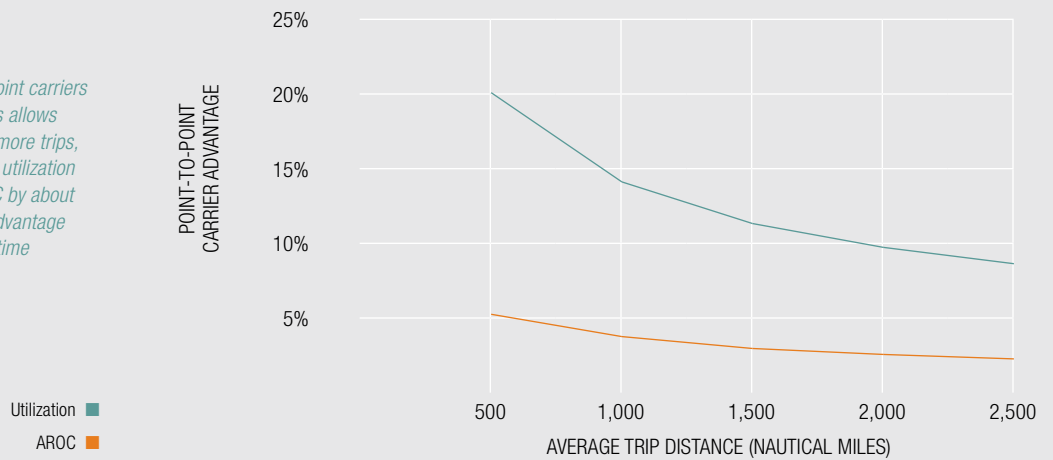
is quite significant at around 20 percent for shorter mission lengths (approximately 500 miles) and reduces to about 10 percent for longer mission lengths (approximately 2,000 miles).

This increased utilization allows operators to distribute fixed ownership costs over higher number of trips, effectively lowering airplane-related operating costs (AROC) compared to hub-and-spoke carriers. Increasing airplane utilization by 20 percent effectively lowers AROC by about 5 percent, a significant reduction. As mission lengths increase, this advantage decreases (see fig. 5). In fact, the

AROC ADVANTAGE OF IMPROVED AIRPLANE UTILIZATION

Figure 5

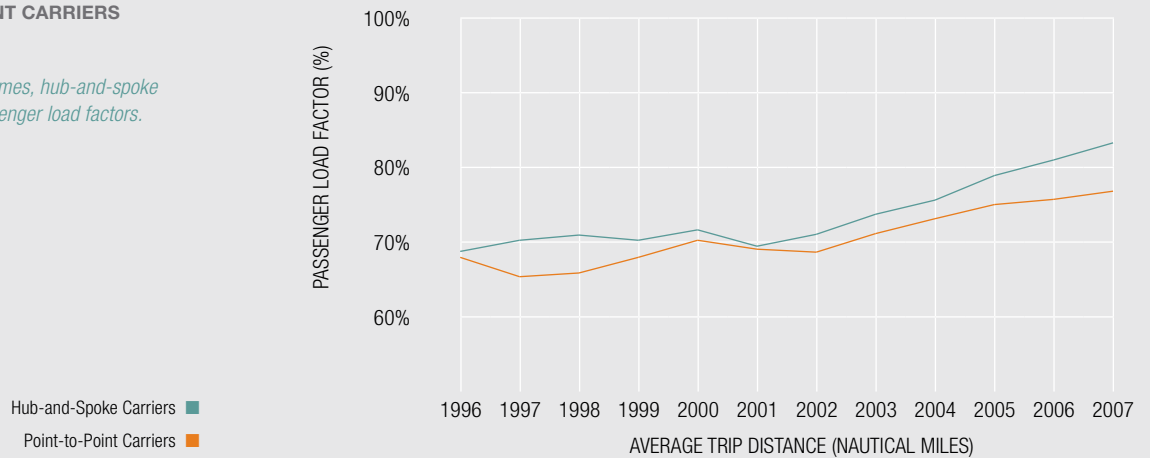
The greater airplane utilization that point-to-point carriers can achieve relative to hub-and-spoke carriers allows them to distribute fixed ownership costs over more trips, effectively lowering AROC. Increasing airplane utilization by 20 percent has the effect of lowering AROC by about 5 percent. As mission lengths increase, this advantage decreases due to fewer opportunities to save time at the gate.



PASSENGER LOAD FACTORS FOR HUB-AND-SPOKE AND POINT-TO-POINT CARRIERS

Figure 6

Although they have longer turn-times, hub-and-spoke carriers tend to have higher passenger load factors.



hub-and-spoke model, which requires relatively longer turn-times, offsets the disadvantage of lower airplane utilization by capturing higher load factors (see fig. 6).

HOW OPERATORS CAN INCREASE AIRPLANE UTILIZATION

Operators who would like to take advantage of the cost savings and efficiencies of increased

airplane utilization may want to start by educating their workforces about the positive effects of reducing turn-times. For example, the airline may explain that saving 10 minutes on 2,000 trips per year means an additional 20,000 minutes — or more than 300 hours — available for additional flights. More flights mean more paying passengers and, ultimately, more revenue.

SUMMARY

Reducing airplane turn-times means more efficient airplane utilization, particularly for airlines that emphasize point-to-point routes. Benefits of shorter turn-times are significant for shorter average trip distances. For example, a 10-minute faster average turn-time can increase airplane utilization by 8 percent and lower AROC for a typical single-aisle airplane by 2 percent.

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