Applications are now available forecast passenger demand, revenue and route performance in more detail. Systems that process revenue and passenger data have evolved to provide airline analysts with detailed information about the factors affecting their network's performance.

Forecasting & analysing route & network performance

Economic performance on flight legs, routes and markets can be forecast pre-departure and analysed post-departure using various software applications. These all require an analysis of an airline's planned or flown schedule, projected or actual passenger numbers and revenue, and actual or projected operating costs.

It is possible to analyse route performance and identify the various reasons for poor profitability. On a macro level these can be weak passenger demand and low load factors, and low average fares. Drilling down to a more detailed level it can be due to a poor yield mix, weak demand in premium cabins, or a low feed of passengers from connecting flights due to unattractive connections at hubs.

Airlines ultimately want to analyse the unit revenue, yield and cost on each flight. The capabilities of various applications in the market that analyse route financial performance and expose the reasons behind poor, average or strong performance, are examined here.

Forecast performance

The performance of routes can be forecast in the years and months leading up to operations, using historical passenger numbers and average fare data. These forecasts can then be adjusted closer to the date of operation as actual demand, passenger numbers and revenues become clear.

Several planning and production applications and systems are used by airlines to generate schedules, assign aircraft types to routes and forecast fleet size requirements. Within Sabre's AirVision Network suite of products is Schedule Manager for creating and managing airline schedules. SITA offers its FleetPlan system *(see Systems for aircraft scheduling & flight operations, Aircraft Commerce, December 2009/January 2010, page 47)*. Sabre's Profit Manager application forecasts and evaluates the performance and profitability of routes and networks five to 10 years prior to actual operation, based on an airline's planned schedule, as created in Schedule Manager. "The system is designed to evaluate a whole network, as well as new routes, hub-and-spoke operations, airline alliances and code shares, and how to respond to changes by a competitor," explains Jeremy Million, product manager, AirVision suite, at Sabre Airline Solutions. "ProfitManager starts off with the airline's own planned schedule, as

Software applications can now predict point-to-point and connecting passenger volumes on routes. The systems can further analyse reasons for why connections generate poor passenger volumes, as well as the effects of altering departure and arrival times and other factors.

well as all other airline schedules. These are important, since they allow the system to predict and calculate all possible connections. ProfitManager also has a connection builder, which is used to analyse all possible routeings between two cities. One example is where a passenger wants to fly from London to Shanghai. British Airways, Virgin Atlantic and Air China operate direct flights, but there are also many connecting flights, including transits at Hong Kong, Helsinki, Dubai and Frankfurt, as well as many other possible connecting cities.

"Profit Manager has a market share functionality, which is used to calculate the demand for each route in an airline's itinerary," continues Million. "A third main functionality is the spill and recapture mode, which forecasts the passenger demand the airline is likely to experience on each each city-pair in its schedule, and compares this with the aircraft size to determine if the route is expected to experience passenger spill. If so, the system tries to predict if this spill can be recaptured by deploying larger aircraft or by adding additional service frequencies. Therefore, the system overall estimates the traffic the airline is likely to get for its planned itinerary."

The overall forecast revenue that this traffic volume generates is then predicted by using historical data to determine likely average fares, which can be applied to derive revenue performance. "Actual fares and fare mixes are hard to estimate, so for long-term planning and network evaluation an average fare has to be used," says Million. "Once revenue has been forecast, costs can be assigned. This will be based on the aircraft types allocated to the routes so that financial performance can be assessed."

Network analysis

Within Sabre's Profit Manager is a module called Profitability Explorer that analyses the performance of a network, group of routes or individual routes. "The user can type in the codes for an airport-pair or several routes to analyse their performance in detail," explains Million. "The system tabulates and displays all the flight numbers for the route, together with the forecast passenger numbers, departure and arrival times, elapsed time, aircraft type, seats offered, total demand, load factor, passenger revenue, beyond revenue, and total revenue. Costs and gross profit can also be listed *(see picture, page 18)*.

"The system can further drill down to show the user more detailed reports. The passenger volume and revenue performance on a route for an individual airline can be examined, as well as the performance in each direction," explains Million. "It must not be forgotten that passenger flows and volumes in both directions on a route vary because of the different connections. The user can also use the system to see what share of revenue each airline is getting on a route.

"The system can show an airline's flow of traffic on a route, and how much of this is origin and destination (O&D) traffic and how much is connecting from other flights," continues Million.

The user is interested to see how much revenue on the route is attributed to O&D traffic and routes, and how much is derived from connections. Moreover, the user needs to see which connections are generating the highest passenger numbers, fares and revenues. Taking Atlanta-Dallas (ATL-DFW) as an example, all flights on this route or just one flight number over a period can be analysed. All possible connections at both airports and the traffic volume this provides can be analysed. Examples of cities connecting with Atlanta are Tallahassee (TLH), Charleston (CHS) and Jacksonville (JAX). The system can forecast passenger numbers on the TLH-ATL, CHS-ATL and JAX-ATL routes that will connect on the ATL-DFW sector. Taking pro-rated fares into account, Profitability Explorer will split the revenue from these flights into the various

segments, so that the user can see the pro-rated revenue generated for the ATL-DFW portion of these fares, and the beyond pro-rated revenue for the segments from various cities into ATL. This generates an average fare for all traffic and passenger numbers for ATL-DFW. This data can be compared with revenue generated from the O&D traffic on ATL-DFW. Moreover, the system can help identify markets where the airline may be 'spilling' passengers and where the passengers are being recaptured. Sometimes these passengers are recaptured on the host airline or by the airline's competition. The reverse is true where the competition can be spilling passengers to the host airline. All this information allows the user to determine whether capacity needs to be adjusted on a specific flight or across the network, whether the airline is underperforming in its revenue management (RM) function, and how well certain interline and alliance agreements are performing (or may perform if the airline is considering a 'what if?' scenario.

Hub analysis

Profitability Explorer can also analyse the performance of an entire hub-and-spoke system. This means that a larger number of connections have to be examined, and the number of passengers and revenue that a connection will generate depend on certain factors that include total transit time, available connection time, aircraft type and fare. The forecast passenger numbers and load factors for each route will vary. Flights will arrive at hubs in succession and then leave again in succession. Connecting and total transit times will therefore vary, so not all connections will have the highest appeal for passengers and generating revenue. The passenger numbers and revenue for each connection can be viewed in tabular form, but the route network from the hub can also be displayed as a map. Routes can be colour-coded according to their passenger load factor, to reveal the strongest and weakest.

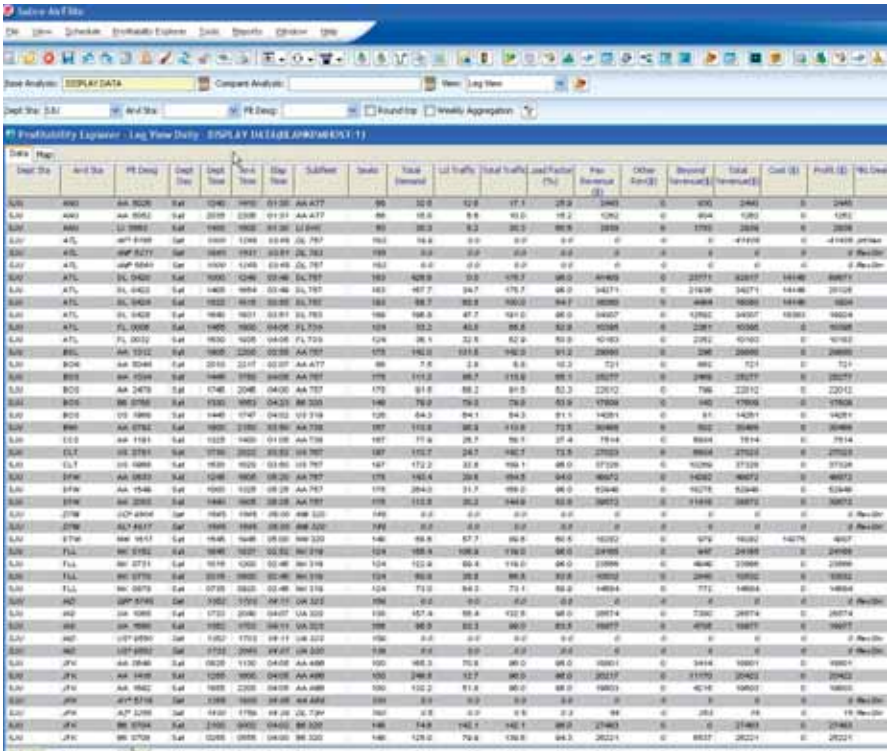
The user can further drill down to see why load factors are poor on particular connections and flights. The results can be displayed in tabular form, and a market report generated for each flight number to indicate if poor connections, long transit time, aircraft type or low operating frequency is the cause of low load factor and passenger volumes. Routes can be colour-coded according to revenue performance, passenger demand or different connecting airlines.

The user can then change departure and arrival times of connecting flights to examine how passenger numbers and revenue volume change. New flights can also be created. "This allows an incremental forecast to be made, which gauges the incremental change in passenger numbers, average fares, revenue, operating costs and overall performance each time a change in the departure and arrival times of connecting flights is made," explains Million. "The performance of each option can be summarised in a standard report provided by Profit Manager, or the user can customise the reports. The user can therefore tweak the network schedule to find the best performing option."

When a schedule is being built, the system also informs the user whether the departure and arrival times for each connection are connecting well with other flights. Reasons for poor connections include insufficient connection time in relation to the minimum connection time, and a long transit time. "Profit Manager has all the airline itineraries in the system, so all possible connections can be analysed and examined," says Million.

Revenue analysis

Applying a revenue figure to forecast passenger numbers at the long-term planning stage is relatively basic. "Profit Manager can be populated with the



Sabre's Profit Manager has a module called Profitability Explorer that analyses performance on an entire network or individual routes. The system tabulates routes, together with forecast passenger numbers, revenues and costs.

airline's fare data. Using historical data the fares from all fare classes and buckets are grouped into four basic groups for O&D flights," explains Million. "The four fares that result are: high-origin fares, high-return fares; low-origin fares; and low return fares. The same four average fare segments are calculated for connections. These average fares are then applied to forecast passenger numbers to derive a revenue figure for each leg and flight number."

When applying costs, the user has several options for creating the costs. One is to write them in detailed format, and split them between variable and fixed cost categories. "Some airlines go for a simpler format of calculating average costs per flight hour (FH) for each aircraft type, and then get the system to calculate operating costs based on flight and block times," says Million. "Another simple method is to calculate average cost per available seat-mile (ASM) for each type, and then apply this unit cost to the number of ASMs for each flight segment to derive an operating cost figure."

Overall, Profit Manager has the functionality to predict route and network performance through its analysis of generating the best passenger flows. However, it only uses simple, historical average fare data, so it is not a tool for analysing actual revenue information in detail down to the unit revenue and yield performance level. Moreover, it does not reveal an airline's revenue generating performance in terms of examining what is affecting an airline's yield mix. This requires other applications that can be used close to the flight's departure and post departure.

Actual route performance

Detailed analysis of actual revenue performance in the short-term phase prior to flights and post-flight operations requires information to be fed from an airline's reservation, revenue management and revenue accounting systems. "Data concerning actual sales, revenues, and seats sold in each booking and fare class can be used in the few days prior to flights departing so that airlines can make adjustments in aircraft types and fare-class availability to improve the eventual performance of each flight," explains Paul Rainford, product manager for FleetWatch Services, at SITA. "Data fed from revenue accounting is often used to aid future decisions in RM and fare-class availability, but can also be used to provide detailed analysis on the performance of each route. This allows airlines to see how individual legs have performed, as well as reveal how flight numbers, routes and networks have performed over a defined period."

SITA's tool for pre- and post-flight financial performance analysis is FleetPlan Max. This sits on top of its FleetPlan system *(see Systems for aircraft scheduling & flight operations, Aircraft Commerce, December 2009/January 2010, page 47).* FleetPlan generates airline schedules in a gantt chart, which is then used by FleetPlan Max as a basis for analysing financial performance. "The application takes feeds from revenue and cost departments in an airline, and plans can be compared with actual performance as just one example of its functionality," says Rainford. "FleetPlan Max also has various optimisers that can be used to tweak the operation to get the best performance from different perspectives. One is optimising the operation for the best connections between flights. Another is optimising the operation according to the maintenance programme of each aircraft type so that aircraft downtime is minimised and check interval utilisation is high.

Softec GmbH, a subsidiary of NIIT Technologies also offers its Route Profit Analyser solution to analyse route financial performance. Like SITA's FleetPlan Max it requires feeds of data and information from an airline in relation to flight operations, revenue and costs. "Route Profit Analyser can apply the revenue and cost information to all flights, and allows the user to analyse route performance in terms of passenger numbers, revenue, load factor, cost, yield, unit revenue as RASM, unit cost as cents per available seat-mile (CASM)," explains Mamta Saxena, managing director at Softec. "The system can then do sensitivity analysis. This will change items such as fuel costs. Ultimately, the user can ask for profit or losses generated by aircraft tail number, flight segment, flight number, route, or a complete hub to be analysed." Route Profit Analyser is, however, a standalone system for analysing route performance, and is not linked to schedule-planning applications. All data to make the route profit analysis has to be fed from various airline departments.

In contrast, a FleetPlan Max user starts by viewing the airline's schedule that will have been created in SITA's FleetPlan. The schedule can either be a specific flight number, route or entire schedule for a specific period. Performance is summarised for the leg, flight number, route or schedule by presenting the information in tabular format and listing the revenue, passenger costs, net revenue, direct costs and gross margin or contribution for each flight. Other information shown can be the number of legs, passenger count and passengers spilled. Flights can be ordered by highest gross margin contribution, with losses indicated in red. "Besides presenting this analysis, the real value comes when the user drills down the revenue data for each flight. The system can break down the revenue in various formats," explains Rainford. "For example, revenue for an individual flight

ORACLE Answers — RPA Example1

Revenue Analysis

Iata Routing	Flight No Code	Revenue Sum	Passenger Onboard	PLF Percent	ASK	RPK	Revenue Per ASK	Cost Per ASK	Y
BKK - BOM	504	5,084,634	17,470	57	50,103,648	28,371,280	0.1015	0.1055	
BLR - BOM	102	1,378,361	13,524	52	12,032,100	6,234,564	0.1146	0.1647	
BOM - BKK	503	5,437,821	18,681	60	50,279,040	30,337,944	0.1082	0.1117	
BOM - BLR	101	806,550	7,797	43	9,841,428	3,594,417	0.0820	0.1587	
BOM - DEL	104	2,864,290	18,155	59	19,009,440	11,147,170	0.1507	0.1332	
CCU - IXA	107	290,919	5,109	62	1,415,880	873,639	0.2055	0.2865	
DEL - BOM	103	2,835,952	18,154	59	19,009,440	11,146,556	0.1492	0.1390	
DEL - DXB	501	4,133,626	20,965	68	36,501,840	24,717,735	0.1132	0.1086	
DEL - MAA	105	4,131,055	17,738	68	24,795,000	16,851,100	0.1666	0.1243	
DXB - DEL	502	5,445,993	27,479	89	36,501,840	32,397,741	0.1492	0.1207	
IXA - CCU	108	417,886	7,402	89	1,415,880	1,265,742	0.2951	0.2865	
MAA - DEL	106	4,023,108	16,985	65	24,795,000	16,135,750	0.1623	0.1332	
Grand Total		36,850,196	189,459	64	285,700,536	183,073,638	0.1290	0.1231	1

can be shown graphically where the average fare and passenger numbers for each fare class can be shown. This can be done at any level across the operation, by individual flight, flight number, route, or group of routes."

This type of information alone does not actually explain why the route is performing as it is. FleetPlan Max can also show the revenue by comparing the profit or loss on each route with passenger numbers, load factor, average fare, unit revenue and unit yield. The breakdown of revenue into passenger numbers, average fare and fare class will then explain the unit revenue and yield performance. This overlaps with the more specific task of analysing revenue and yield performance. This uses data from an airline's revenue accounting department, and the analysis can be fed back to RM to improve future sales performance *(see Systems & techniques to analyse revenue & yield performance, page 22)*.

Softec's Route Profit Analyser works on a tab-based system. The user selects the tabs to select what level of performance they are interested in. "The first tab is for viewing the overall performance of a network," explains Saxena. "The user can specify exactly what they want to be displayed, such as the performance of the previous day, week or month. Tables indicating the best- and poorest-performing 10 flights or routes can be shown. Tables listing each route and the revenues they have generated and costs they have incurred can also be shown. One special feature is a ticker tape across the screen which shows the basic performance of each flight number. Criteria such as revenue, load factor and profit or loss figure can be shown. The subsequent tabs in the system are for analysing revenue and costs in detail, airline key performance indicators (KPIs), aircraft KPIs, airport KPIs, and route performance."

Revenue performance

The first step on route profit analysis is examining revenue performance. FleetPlan Max can calculate unit revenue, in cents per available seat-mile (RASM). "This can be done each night after operations for post-flight analysis, provided information is being fed fast enough from the airline's revenue accounting system," says Rainford. "Unit revenue RASM data can also be calculated daily for pre-flight analysis."

FleetPlan Max further analyses revenue to determine demand characteristics. "Total seats available, constrained demand, and unconstrained demand can be compared," says Rainford. "The airline's RM system will estimate the volume of unconstrained demand, the number of passengers that want a ticket, and so also indicate the number of passengers that are being spilled. The airline user will want to analyse passenger demand in all cabin classes, and will need to know which cabin classes are spilling passengers and which have low load factors. In some cases this can simply mean moving a curtain cabin divider. Where dividers are fixed it will mean a change in RM strategy with respect to fare class availability. An airline user can also analyse performance with different aircraft types, and the simulator functionality of FleetPlan Max makes it possible to analyse different scenarios."

Revenue analysis is the second tab of functionality in Route Profit Analyser. "This uses post-flight data from the user's revenue accounting department," explains Saxena. "The user has various choices for analysing revenue, but can select graphics or tables. Criteria that can be used include flight number, revenue, passengers, unit revenue in RASM, unit yield and average fare. The user can also add in revenue passenger miles (RPMs), available seat-miles (ASMs), and unit cost in CASM. Routes can be listed in ascending or descending order *(see picture, this page)."* The tabulation of passenger numbers, load factors, revenue, unit revenue and yields will reveal which routes are performing well, and which are underperforming. The application can also make a report at a specified frequency so that airline management is given a regular update on route performance. In some airlines the revenue accounting department is able to give revenue information on the day after operation, so reports can be generated for the previous day's performance.

Besides analysing post-flight revenue data, the system can also simulate performance pre-flight, provided an accurate estimate of costs can be given by using historical data. Route Profit Analyser can therefore be used as a budgeting tool.

Route performance

While the system can display the profit or loss generated by each route, this only gives a macro picture of a route's performance. Airline planners also need to examine a route's performance over time. For example, a route may have eight flights on week days and six flights on weekend days. Planners will not only want to know how each flight number performs over an extended period, but also how each flight number performs on each day of the week. That is, an early morning flight on a business route may have high load factors at either end of the

week, but poorer performance in the middle of the week when demand is lower. A route may overall be making a loss, while some flights are generating a small gross margin and the majority are making a loss. "The revenue and contribution data can be shown together with load factor for each flight number on each date, or however the user wishes to analyse the information," says Rainford. "The user can drill down to analyse why certain flight numbers or segments on different days are performing as they are. The reasons why some flights are performing poorly can be examined by drilling down into revenue and yield mix data. Decisions can then be taken with respect to RM, changing cabin divider positions, and altering aircraft size. The system will recalculate the revenues and costs for each scenario so that the best strategy for future operations can be determined. The system can therefore optimise the operation for each route and the route network. The final result of optimising a network is that the gantt chart indicating all the flights will show flights with an improved gross margin performance in green, and those with a lower gross margin in red. Changes to revenues, costs, passenger spill, gross margins, average fare and several other criteria can all be analysed. The system's ability to take data from an airline's RM and reservation system means that an airline's schedule can be optimised just a few days prior to operation."

Operating costs

Costs are clearly an important issue, particularly those which can fluctuate or where the airline is able to reduce them. As with revenue performance, Route Profit Analyser can tabulate the costs for each flight number. Total costs, plus total ASMs and unit cost as CASM can be shown in the table. "Cost can also be analysed by other criteria such as by markets, by routes from a hub, per aircraft flight hour, or by each aircraft type," says Saxena. "It takes several days or weeks to accumulate actual costs, so budgeted costs can be be used first before being updated with real costs."

As described, while a route can be profitable, this can disguise the fact that different flight numbers can be unprofitable. Moreover, overall operations in one direction on a route can be unprofitable, while operations in the other direction on a route can generate positive margins. Route Profit Analyser can display the profits and losses on routes in a matrix, with departure cities on the vertical scale and arrival cities on the horizontal scale. The overall profits for routes departing from each city are totalled, and the profit or loss from the overall network also shown.

The ninth tab on Route Profit Analyser analyses the performance on single routes in detail. The user defines the period and dates of the analysis, and also selects the criteria shown.

Summary

The systems described provide airlines with a full capability to analyse performance pre-flight, and then tweak departure and arrival times to improve passenger flows; and post-flight, to drill down to detailed levels of yield mix, unit revenues and load factors.

These systems not only provide valuable information for revenue management departments to improve future performance, but also provide detailed information on the performance of each route. There are many factors that affect route and flight number performance, and the actual causes of poor performance need to be determined so that the appropriate corrective action can be taken quickly. This is now possible. AC