Airlines have been forced to evolve their legacy revenue management systems. Airlines are less interested in demand forecasting and are seeking yield optimisation. The latest techniques involve the development of passenger net values (PNVs).

Evolution from legacy to modern revenue management systems

Recent years have seen network carriers invest heavily in transforming their revenue management (RM) systems to restore their competitive advantage. According to a survey conducted by SITA, 42% of airlines are maintaining legacy systems, while the other 58% are transforming their systems. The impact of the gradual evolution in network carriers' RM systems will be tremendous.

The main objectives of RM are: determining fare levels and the number of fare classes; controlling the availability or non-availability of fare classes; optimising the timing of departures for revenue capture; controlling passenger spill; and maximising revenue.

What has changed is the methodology of maximising revenue. The fundamental change has been to use passenger net values (PNV) for RM and forecasting demand, instead of passenger name records (PNR). PNV represents the profitability that a passenger is expected to contribute to an airline's revenue. This is derived from the passenger's historic booking record and a large number of personal details. This has only been possible for a few carriers in recent years.

RM evolution

"A few competitive factors are affecting airlines' attitudes towards RM," says Gary Parker, president at RM Training Group. "These are: low-cost carriers (LCCs) offering no-frills, price-based services, which have made the public more sensitive to, and aware of, prices; legacy carriers with higher cost structures that make it difficult for them to compete; and the internet, which has made it possible for the travelling public to research and find the best deal without the services of a 'middle man'.

"To compete with low-cost airlines, the legacy network carriers must establish a competitive advantage through cost-cutting strategies and introduction of simplified value-based fare classes," adds Parker. "Airlines are now looking for less demand forecasting, and more price or yield optimisation. They are most interested in the price they can charge each customer based on their willingness to pay. An airline's network and global traffic flows still make price optimisation complex. An RM solution is needed to address simplified domestic pricing, international bilateral pricing, and the optimisation of origin and destination (O&D) traffic across the network."

"The differences between old and new RM systems begin with the data input. The most important advance in systems over the past 10 years has been the inclusion of PNR data into the RM data feed. Determining which O&D routeings to sell is now possible with PNR data," says Peter Pernice at Manugistics. "Airlines can now understand passengers' booking characteristics from all elements found in a PNR. Airlines can find out where each passenger's specific journey begins and ends, and not just how many passengers are booking on each leg of the flight routeing. The focus is now more on the passenger, and not only total airplane passenger load and revenue."

Thomas Büermann, director sales division revenue management at Lufthansa Systems adds that RM systems have evolved: "Compared to the RM systems used 10 years ago, current-generation RM systems have several distinguishing features: the ability to optimise O&D revenue; low-fare features that include rule-based control, price-based forecaster, hybrid optimiser and competition monitoring; flexible availability of data and reports; and user-friendly graphical user interfaces (GUI), that take advantage of the computer's graphics capabilities (such as Microsoft Windows or Apple Macintosh) to make the programme easier to use."

"The traditional RM system still exists in much the same form as it did 10 years ago, and continues to work perfectly well in traditional, usually long-haul, markets where pricing boundaries are maintained and no LCCs operate," says Paul Rose, product manager for revenue management & revenue integrity at SITA. "Pricing fences have been abandoned in the markets penetrated by LCCs, which results in a 'spiral down' effect on demand for high-yield fares and a loss of revenue if a traditional RM system and its expected marginal seat revenue B (EMSRB) version algorithm is still employed. This is an improvement on the original A version (EMSRA) devised by Dr Peter Belobaba, known as the 'grandfather' of revenue management', who teaches at MIT, Boston, MA.

"EMSR calculates when to open or close selling classes within an RM system, based on the demand for one class versus another. EMSR uses the net revenue for each class and integrates the current seats sold plus expected future demand. Cancellations and no-shows are also factored in to the calculation," says Rose. "RM system suppliers have recognised the problem of a downward spiral of demand for high-yield fares, and have been delivering LCC RM modules over the past 12 months to combat it. SITA's own LCC module is currently being used by two European flag carriers, with an Asian carrier due to implement it in early 2006, and several more expressing an interest in doing so. The system allows a

carrier to operate in both traditional and LCC markets, by using either RM system. The LCC modules use modified algorithms or simplistic approaches on an automated basis to close a selling class, either based on a set time prior to departure, or on its load factor. Typically only one class is open for sale at any one time, although this is a carrier's choice," continues Rose. "Multiple fare classes and a step-pricing model can also be used. When a class closes it usually never re-opens, to ensure that more yield is achieved as only higher fare classes are left open. This increases the yield mix of the fares that are still selling. Gradually all airlines will have to adapt to competitive pressures and make some changes both to their pricing and business approach, and their RM systems."

KLM's Triumph

KLM has led the way for several years in using the most advanced RM systems in the industry, since developing 'Project Odyssey', an initiative that came to serve as a catalyst for significant changes across the company's entire reservation, point-of-sale (POS), and RM system platforms. These improvements included a real-time TPF module developed by KLM, major CRA enhancements, and substantial hardware upgrades.

"POS control means that the seller, such as an airline, can manage or prioritise the source of booking and payment for a journey," says Peter Pernice at Manugistics. "For example, an airline may be better off selling a return business-class ticket for London-Frankfurt, rather than for Frankfurt-London, because the foreign exchange rate, or even the price the airline can

charge, is favourable. The revenue contribution made by a sale therefore governs where the sale takes place. It might even be used for non-revenue considerations, such as protecting local market share of selling points along a route. For example, on a flight originating in Delhi going to London via Dubai and Frankfurt, an airline might want to distribute seats to each origin POS to ensure that each has some allocation to sell to local originating traffic, even if the currency or price is lower than at another sale point."

KLM's efforts were based on the analysis that yields will increase by 0.25-1.75% based on O&D- rather than segment-based optimisation, as load factors increase. Additionally, analysis suggested that optimisation with POS control offered the potential for revenue increases of 1-2%. KLM's network required the enhancement of its RM system. Its Amsterdam hub has connecting passengers in virtually every direction. There are huge flows of intra-European traffic between Germany and the UK, for example, but also between Scandinavia and southern Europe. KLM has 17,000 city-pair connections in its network and another 20,000 connections in its partner network. Connecting passengers account for 70% of its traffic.

KLM also selected Manugistics and Unisys to design and implement the new O&D RM solution to optimise the revenue of every flight within its network. The solution's logic was based on O&D optimisation, traffic flow forecasting based on demand and PNV, and detailed revenue forecasting. PNV is derived from the cabin class and flights selected by a passenger, POS, and month of purchase.

The 'Odyssey' O&D RM solution

manages over $4 billion in annual passenger revenues. KLM invested a total of $45 million over a four-year period, but achieved a return within just 12 months. Other significant results included a revenue available seat-mile (RASM) increase of 4-5%, major improvements in POS mix, better adaptability and greater sales focus.

From PNR to PNV

KLM's success is partly derived from the PNV approach, which replaces PNR, and constitutes a solid basis for O&D optimisation. It is still hard to know how airlines will conduct their analysis of passenger net value (PNV). Although KLM has yet to disclose its PNV approach, it is expected that a correct PNV analysis will begin by obtaining three fundamental sets of information: establishing a picture of an active customer to know who they are and how they behave; segmenting inactive customers to better understand their characteristics; and demonstrating how one segment differs from another in psychographic, demographic or lifestyle traits so that the airline can more effectively identify key market segments and penetrate new markets.

PNV determination

Sophisticated computer models are needed to further this analysis. The model appends a group or cluster code to each record on the airline's database, based on the psychographic and demographic make-up of each particular record. These records are then grouped together and summarised by cluster code and active status. Active status is given to a

KLM developed 'Project Odyssey', which served as a catalyst for it to make significant changes across its entire reservation, point of sale and revenue management platforms. KLM's success has partly been derived from its PNV approach.

passenger that frequently purchases tickets. The number of active customers is then compared to the number of total customers within each cluster code. Finally, each cluster is ranked from the highest to the lowest based on the percentage of actives in the cluster.

The next step is to segment inactive passengers (ones that have not bought tickets for some time) into those that are highly likely to buy tickets in the future (those with a positive balance) and those that are not (those without a positive balance). This gives a better understanding of how these customers differ from each other. This objective is met by building another analysis profile, which compares the inactive customers with a balance to the total inactives. The model appends a cluster code to each record on an airline's database based on the demographic and psychographic make-up of each particular record. These records are grouped together and summarised by cluster code, inactive status and balance status. The number of inactive customers with a balance is then compared to the total number of inactive customers within each cluster code. Finally, each cluster is ranked from highest to lowest based on the percentage of inactives with a balance.

The last objective segments the active customers using the finalised PNV report, which differentiates those clusters that fall to the bottom deciles from those that rise to the top. This allows an airline to distinguish the characteristics of those clusters that tend to have higher net value from those with lower ones.

Using PNV

"PNV offers much for the future, but requires updates to many systems, and not just the RM. Reservations, inventory, revenue accounting, increased direct sales, and an airline's processes and reporting capability must all be reviewed and upgraded," says Rose. "However, in the absence of total system support, a few major airlines have already taken initial steps down this path. I am sure this trend will grow over the next five years as airlines choose 'Profit Management' over RM. Realistically though, many airlines still do not have accurate figures for essential areas such as true cost of sale,

variations on yield from utilising different distribution channels, and other data to establish PNV. The immediate focus appears to be on more direct sales, and zeroing agents' commission to reduce distribution costs, while gaining valuable data about clients through the airline's own website. This facilitates information-gathering not possible when a travel agent was the main link between the airline and the client, and kept such data for their own purposes," continues Rose. "Most airlines do not use and cannot establish the true net value of revenue and often use gross revenue values. Even when they do establish and use PNV, they often do not replenish the data regularly, and at best do it seasonally or annually."

O&D optimisation

Moving from leg-based to O&D optimisation has also contributed to KLM's success. Traditional leg-based RM systems make fare availability decisions on individual flights. As these systems do not consider the O&D market, which is a combination of the passenger's departure and arrival points, they cannot maximise total network profitability. In particular, when optimising fare availability for one flight these systems may assume that space is available for connecting demand on the other connecting flights, when in fact there is not. These systems operate mainly for convenience.

The O&D optimisation approach explicitly considers all combinations of connections, itineraries and booking classes. It forecasts passenger demand, and recognises the revenue contribution of each O&D combination, and cases where POS distinctions are important.

This approach solves a large mathematical optimisation problem that determines which connections, itineraries, and booking classes to make available by utilising limited capacity to maximise total network revenue.

Several airlines have expressed an interest in O&D optimisation. "I think that future RM systems will manage capacity at an O&D, rather than on a sector, leg or flight, level," says Pete Yap, network strategy manager at Air New Zealand. "This will determine the O&D that provides the least value to an airline's network."

"A network revenue optimisation system is still only suitable for airlines that have a network with sufficient traffic flowing across it to produce enough sales volume to supply reliable forecasting data. For most carriers, improvements to their existing segment- or leg-based RM system (improved by forecasting) and, where appropriate, combining with an LCC module, still offer as much payback as an O&D system. It should also be recognised that implementation of a true O&D RM system involves major changes to an airline's business and organisation processes, as well as a heavy resource commitment. The difficulty of this is reflected in the relatively small number of carriers currently using a true O&D system," says Rose.

Key drivers

"Many legacy systems are highly integrated with the respective legacy inventory systems, so that increasing the importance of networks and decreasing the relevance of pricing restrictions are the key drivers," says Büermann. "In RM

these have been the availability of disk space, the speed of computation and the capture of passenger-specific data. The internet has greatly facilitated the amount of knowledge an airline may now acquire about its passengers. Airlines today are in a position to understand their passenger base in greater detail than ever before. Of course the challenge of RM systems has been to find ways of using that new knowledge to increase revenue," says Pernice at Manugistics.

"Increased IT capabilities enable more advanced forecasting and optimisation algorithms (O&D). New distribution channels empower the passengers and enforce more intelligent and more specific control of availabilities, such as Dynamic Pricing approaches," adds Büermann.

Internet's role

The internet is the catalyst for all these technology developments. "The internet has resulted in major, immediate and ongoing changes. First, many traditional carriers have realised that distribution is one of their greatest costs within the sales cycle, and is often out of their direct control. Moving to a direct sales model, which can be easily achieved via internet sales either on their own website and/or through an intermediary website, can reduce time to ticketing, revenue leakage and abuse, and reduce the cost of sale dramatically," says Rose.

"Traditional carriers have also realised that their biggest threat, the LCCs, do not distribute their products through the traditional channels, and so their market prices are not obtainable through the usual sources: ATPCo and SITA's public fare-filing databases,"

continues Rose. "This has resulted in the more pro-active carriers utilising robotics to capture fare and availability from LCCs' websites, as well as traditional carriers' sites, to see what is the lowest fare in a particular market. These data could be integrated into the carrier's RM system. SITA and its RM venture partners SH&E have already started to progress in this area to utilise data from their new Airprice products, following the acquisition of the leading airline pricing monitor solution provider SMG, into the SITA RM solution. There is much interest among carriers for this data integration over the next 12 months, rather than using it in isolation or having to use two separate solutions to gain an overall picture of the market place."

Benefits

"Systems evolve together with work processes. The interface with, and even full integration of, inventory control, price management and market analysis processes require both system replacement and the re-design of business and organisation processes," says Büermann. "Our customers expect us to tailor our systems exactly to their specific business requirements, while at the same time using the efficiency of ready-made product components. They expect us to cover not only their requirements in terms of IT systems, but also to accompany and support them as they transform organisations and processes. They also expect us to deliver integrated services covering all the processes involved in revenue maximisation, including availability management, pricing and revenue integrity."

IT providers' reactions

Ten years ago Manugistics' RM systems carried out inventory data feeds of sales for each booking class on each flight at midnight capture time. They had one snapshot of booking data per day. The RM system would compare historical bookings, consider accumulated advanced bookings and then adjust its forecast of future bookings in each class on every flight. Recommendations would be generated as per the control mechanism of the carrier. RM analysts would then review these recommendations, based on the previous night's booking levels, and either approve the recommendation and send it off to the inventory control system, or adjust it before sending it off. The recommendations would be loaded on a scheduled frequency throughout the day.

Today's Manugistics systems include more than just booking data: PNR data, fare data, competitive intelligence, and more. Manugistics' RM system forecasts passenger demand at a specific price with sensitivity to the competitive position in the market. This system can understand demand from PNRs, and include in that passenger demand description all the elements found in a PNR. Refreshing booking positions may be done dynamically.

"The ProfitLine system underlines the evolution towards further exploring additional potential in maximising our customer's revenues over recent years. It supports a full PNR-based O&D, a varied set of low-fare tools, integration of competitor fare information from the internet, flexible reporting tools and a user-friendly GUI," says Büermann. **AC**