Minimising lost revenue due to passenger spill has always been a major challenge for revenue managers. IT systems are now available that can accurately predict spill, and advise airlines how to best manage schedules, capacity and availability of fare classes to minimise losses.

Gauging & managing passenger spill

Passenger spill is the amount of demand which, for a particular time period, exceeds the capacity offered. Simply put, spill is lost demand. This is not simply lost passengers, but loss of passengers at different fare classes. Several software companies have developed sophisticated revenue management systems to help manage spill. Sabre Airline Solutions' systems and Lufthansa System's ProfitLine and Netline product series are prominent examples.

Some airlines have developed their own revenue management (RM) systems to manage and minimise the lost demand, among which KLM's is regarded as one of the most advanced. To manage spill, and gauge when to increase capacity correctly with a RM system, an airline needs to thoroughly understand four issues: the statistical model behind spill; an airline's specification; the factors influencing the reduction in spill; and the spill problems that the existing RM systems cannot settle perfectly.

The first issue explains how a revenue system can forecast spill. The second issue concerns the RM system's applicability to: whether the airline is a low-cost carrier or a traditional airline, if the airline is based at a regional or hub airports, and the market in which the airline operates. The third issue is the factors an airline should consider when increasing capacity to reduce spill. The fourth issue is the benefit delivered to airlines by improving RM systems.

Statistical models

All RM systems gauging spill are based on some assumptions about passenger demand. "Traditionally, passenger demand has been assumed to be normally distributed in the spill models employed by manufacturers and airlines," says Joel Antolini, senior vice president at Seabury Airline Planning Group. This means demand for a series of departures has a normal distribution about its mean.

The most central case is the distribution of demand for a particular flight number. The amount of variation in the distribution can be measured by the the standard deviation to the mean.

Several years ago, Boeing carried out a research into demand distribution, using data from US, European, and Asia Pacific airlines for both domestic and international routes over a time scale of 15 years. Most data collected were for daily on-board loads, but analysis was also done on reservation system bookings. The primary conclusion is that the demand distribution is as close to normal as anything else.

"For all practical planning purposes, spill models based on normal distributions are still the most widely used," says Antolini. "This model could tend to overstate spill when demand variation increases, as some research studies have already indicated. Obviously, Boeing's conclusions have been widely adopted by the airline industry in how it intends to understand and manage spill."

"From a forecasting and planning perspective, Air New Zealand uses the Boeing spill model to estimate the number of spilled passengers. While it is a theoretical model, we find that it does a good job of estimating spill when used correctly," says Pete Yap, network strategy manager at Air New Zealand.

Predicting spill

Predicting spill with a RM system is based on statistics and historical data. "Very detailed databases of specific passenger data and passenger preference data must be collected, calibrated and used for the forecasting to get the predicting result as accurate as these systems can," says Shane Batt, consultant at Sabre. "The quality of spill gauging is primarily based on the specifics of the airlines' network structure and its product portfolio. The application of origin and destination- (O&D) based techniques and a high degree of process automation are prerequisites for a full understanding of the market and demand, and for fast and reliable processing," says Thomas Bueermann, head of RM systems at Lufthansa Systems.

Sabre Airline Solutions' model not only uses its system's substantial data sources, it also frequently 'self calibrates' to ensure it keeps the highest possible level of accuracy.

KLM's approach to minimising passenger spillage and spoilage starts off in the network planning phase: allocating correct seat capacity to the different network routes. Quality Service Index (QSI) is used by KLM as a technique, and market volumes and schedule scenarios are also employed.

The resulting schedule information forms part of the RM system. The system also takes into account historical revenue, including envisaged rate of exchange, for determining expected net value per passenger. Expected passenger volumes are based on schedule information and determined by the O&D level. Assessing correct net value per passenger is carried out on the lowest possible level and is used as input for the O&D RM system.

A RM system simply helps airlines identify spill and manage it. Understanding and satisfying the prerequisites cannot guarantee that the airlines will harvest the expected outcomes. When an airline intends to manage spill with a RM system, three issues related to spill and the applicability of the RM system need be borne in mind: low-cost versus legacy airlines; hub versus secondary airports; and emerging markets.

While passenger spill occurs for several reasons, legacy carriers have been forced to change their revenue management philosophies in recent years and accept high levels of spill as a consequence of increasing passenger load factors in order to optimise revenue per flight.

Low-cost vs legacy airlines

With low-cost carriers emerging as a main stream in North America and Europe, the spill experienced by low-cost airlines attracts researchers' and RM system manufacturers' interest. The key issue is whether low-cost airlines' level of spill differs from the legacy airlines? Can low-cost airlines benefit from building or purchasing a RM system to manage spill?

"Spill occurs for three primary reasons for all airlines. The first is that there is insufficient capacity available at a particular time when passengers wish to fly. The second is that there is sufficient capacity, but the RM system prioritises higher fare classes which are not sold. Third, there is a high amount of 'no-show passengers' on flights that are not compensated for by over-booking. This leaves empty seats that could be sold at lower fares," explains Batt.

"It is interesting to note that low-cost airlines do not have a great amount of spill associated with the second and the third reasons," continues Batt. "Low-cost airlines do not tend to overbook because their ticket conditions mean that if a traveller does not show up for the flight the traveller forfeits his fare. Spill is therefore a larger issue for traditional network carriers, particularly with relaxed ticket conditions.

It is possible that low-cost airlines will begin to experience spill at particular fare levels as passengers shop around and choose an alternative carrier."

Hubs vs secondary airports

Airlines should also consider the airports they operate from. As a rule, the level of spill at hub airports should be different from the spill at secondary airports due to the different levels of flight connectivity and availability they offer. Airlines tend to prefer connecting passengers to those originating at a hub, because connecting passengers generally provide more total revenue. This means there is frequently more spill on hub-to-hub flights than on connecting flights, since airlines' RM systems give preference to connecting flights.

On the other side of the Atlantic, American legacy airlines are going through the process of de-peaking their operations and even de-hubbing. How will these measures affect passenger spill?

"Recent actions by the legacy carriers have resulted in overall system capacity decreases. This is either because of fleet simplification or just a reduction in the number of aircraft flying," says Antolini. "This action predominantly increases the level of spill, because the airlines are flying at record load factors. De-peaking does not have a direct effect on the spill, although if it causes reduced connectivity between flights at hubs, it could reduce spill because it would reduce overall demand."

Emerging markets

Another factor that an airline should be aware of is the market where it operates. Spill theory and RM systems are based on the theory and practice in the mature air transport markets, such as North America and Europe. In the emerging and fast growing markets, such as China and parts of the Asia Pacific, airlines are facing inflating demand, recording double-digit growth rates, and experiencing rapidly increasing load factors. Will the level of spill occurring for the airlines based in the emerging markets differ from that in mature markets because of high growth rates?

"The passenger spill model needs to be recalibrated because of different demand characteristics. An intelligent guess here would be that the changes might not be that drastic to result in the evolution of new spill models, since the airlines mainly tend to use spill models which have already been developed, employed and proven in the industry. However, spill models do have inputs to them like the market demand variation, which will change in a developing market and it will be important to keep it updated for the best forecasting results," says Antolini.

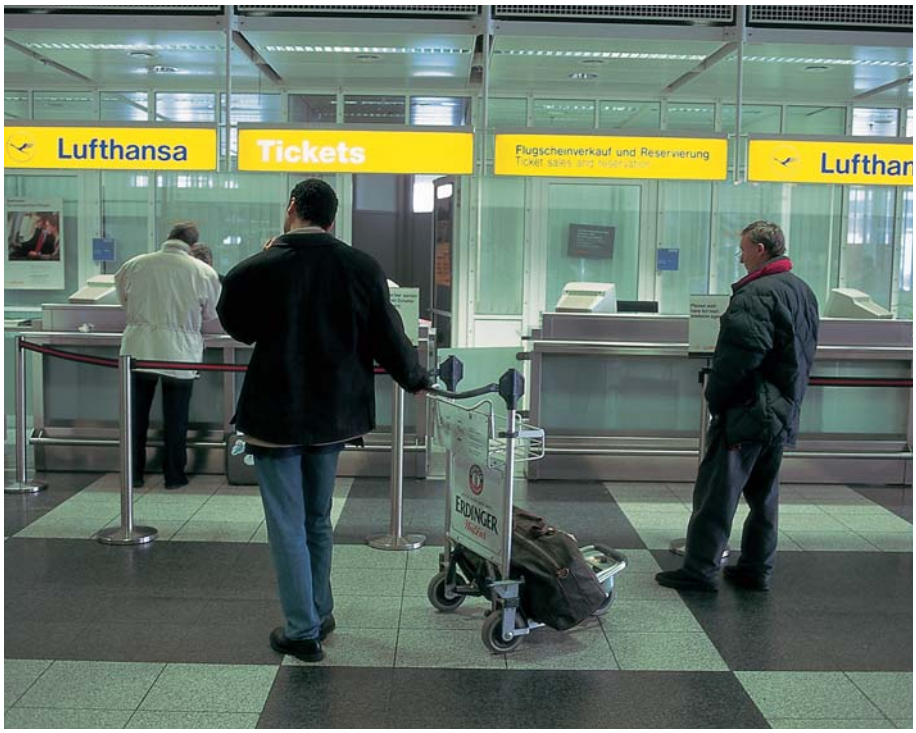
Increasing capacity

After considering the factors addressed above, an airline trying to manage spill better will need to address the following questions: what factors should be considered when it wants to increase capacity to reduce spill? Can the existing RM systems assist it to gauge the timing to increase capacity?

"Reducing passenger spill in an environment which is characterised by fare wars and more sophisticated RM has become a critical business issue. Reducing spill by making seats available to lower fares and increasing load factors do not guarantee route profitability. Airlines should tend to focus on keeping the right kind of passengers and give preference to spilling the lower-fare-paying passengers to the competitors, which can be achieved with the right kind of planning and RM integration," says Antolini.

"The biggest issues to consider when deciding to add capacity to reduce spill include: passenger demand; demand stimulation; future market growth; forecast spill; elasticity of demand; and recapture," says Batt.

"In light of limited capacities and increased operational cost coming with any schedule change, any capacity increase on a certain flight has to be measured in terms of additional revenue versus additional cost, which is compared to the current schedule and other scenarios. This complex decision-making process is supported by our integrated Netline and Profitline products. Finally the increase of capacity is automatically



Lufthansa Systems has two products that assist airlines with the decision of analysing how revenues and costs change with changes in capacity that are made in response to rising levels of spill. These products are Netline and Profitline.

reflected in according bid prices and seat availabilities, leading to new overall revenue forecasts," says Bueermann.

In practice, when KLM intends to increase capacity to reduce spill, it first determines the quantification of spill or spoil by using market shares and fare share gap analysis. Then it considers the methods to increase capacity, including increasing frequency, converting to larger aircraft or increasing seat capacity per aircraft type. It will also take the cost-to-benefit ratio into account and strike a balance between increased production cost and decreased spillage.

The systems manufactured by Sabre and Lufthansa Systems can assist airlines in gauging when to increase capacity.

Sabre Airline Solutions' systems work together to help airlines set capacity, prices and discount allocation levels. The system has two specific products inside its Airflite product: Profit Manager and Fleet Manager.

Profit Manager is a forecasting tool that forecasts passenger demand, spill, recapture, revenues and costs. Fleet Manager is an optimising model that determines the optimal profitability from a set of equipment in a network. These two tools working together can provide a clear indication of when airlines should add capacity in a market, either through adding frequencies or increasing gauge. The two tools can also analyse all possible competitive responses at the same time. To reduce spill, airlines can increase frequency or increase aircraft size, or adopt the two measures at the same time. By trying the two options, including increasing gauge and frequency, Profit Manager can test each schedule and determine which is more profitable.

Passenger spill is also relevant to an airline's pricing policy. Airprice, Sabre Airline Solutions' pricing system, in conjunction with Airmax, its RM system, can provide suggestions to the airline on how to improve its pricing policy.

"Efficient management of spill with maximum revenue generation requires forecasts of O&D-based demand and the smooth integration with fleet assignment," says Bueermann. Lufthansa Systems' Profit/Yield system includes a sophisticated model of O&D attractiveness, thus allowing reliable forecasts of passenger behaviour in case of managing spill and network changes.

Identifying which choice is better to reduce spill is one practical example of the day-to-day tasks to be handled by Lufthansa Systems' integrated ProfitLine and Netline products and their scenario management capabilities. Also, competition monitoring is an essential part of the ProfitLine and NetLine solutions over the whole planning period, starting from market models in long-term planning and ending up with the automatic analysis and match of competition pricing in the final sales stages. In the course of evaluating a possible capacity change, the related revenue effect is calculated by Lufthansa Systems' product as a key decision factor. The accuracy of this revenue forecast is directly related to the accuracy of the underlying demand forecasts.

Challenges ahead

The airline industry continues to evolve and airlines continue to diversify their pricing. These present airlines with new expectations for the future generation of RM systems. "I would think that future RM systems would manage capacity at an O&D level rather than on a sector, leg or flight level," says Yap. "Such a system could determine what O&Ds provide the least value to an airline's network." Airlines' expectations mean challenges to the current RM systems.

"Spill can now be measured accurately after a flight has departed, but it is more difficult to forecast spill for flights that are in the future. The hardest issue is not predicting spill, but predicting demand at different fare levels on a flight before and during the process of selling. The ultimate goal is to be able to predict the amount of spill and sell the last remaining seats at the optimum fare level.

Once demand is known and the capacity allocation is understood, spill is pretty simple to predict. The biggest challenge to RM systems is that the past few years have seen widely fluctuating levels of demand. Since forecasting models rely on historical data, there is a real concern among RM professionals about the accuracy of forecasts of demand and related spill," says Batt.

Sabre consequently spends millions of dollars each year on research and development into new forecasting and optimisation techniques to maximise forecast accuracy. This research and development directly improves the accuracy of Sabre's systems with each new released version.

KLM's current RM systems are trying to meet the same challenges. The carrier's spill is managed by an accurate demand forecast for different fares on every route in KLM's network. Fare rules (conditions) are being used to segment the passengers for different fare types. However, under the pressure of the market from low-cost airlines' competition and the customers who want transparent fares, fare rules tend to disappear. Due to greater fare transparency, customers are able to find the lowest prices and buy a fare below their maximum willingness to pay. Current optimisation models do not take into account the possibility that a passenger buys below their maximum willingness to pay. Hence, KLM's main innovation to manage the spill will be the incorporation of the buy-down behaviour of passengers in RM systems. AC