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The New Generation of Revenue Management: A Network Perspective

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Over the past decade, revenue management as practiced at most airlines can be characterized as "one-dimensional." That is, airlines have viewed revenue management as a means unto itself, a discipline sometimes lacking support from the rest of the company but always charged with the revenue performance of the airline. Since the revenue management department is responsible for controlling the inventory of seats on every flight, one can easily point back to this department when the monthly revenue results are revealed for better or for worse. Furthermore, if the airline is equipped with an automated revenue management system, the prevailing misconception is that the system singularly defines the revenue results. Too often when missteps occur the tendency is to put the spotlight on revenue management or even on the system it uses; on the other hand, when the results are glowing, the credit gets spread throughout the airline (for example, profits may be attributed to better planning, improved operations or aircraft utilization, increased market share through sales efforts, stable pricing actions in the marketplace, favorable currency exchange, lower fuel cost, or better revenue management). The point is, when all is not well, the problems (their cause and the blame) should not necessarily be placed solely on revenue management. After all, revenue management does *not* work in isolation and is heavily dependent on its interactions with other processes in the airline. Likewise, when things are going well, the results should be attributed to the contributions of other departments working in harmony with revenue management.

As the art and science of revenue management continues to evolve, there is maturing recognition that it is a multidimensional discipline, encompassing a broad

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spectrum of functions and departments that can "make or break" an airline's success. Hence in the new generation of revenue management, revenue management will expand and will even more closely integrate automation with business process. For the practice to be successful, the following processes need to be incorporated into revenue management:

- network origin & destination (O&D) inventory control,
- group management,
- sales planning,
- pricing (published and unpublished),
- schedule planning, and
- operations planning.

Although these functions within an airline's organization seem diverse, they are, in fact, complementary when departments are working toward the goal of maximizing revenue for the airline. As such, the objective of revenue management must be refined to be more macrofocused than the myopic perspective observed today at most airlines. In order for the multidimensional approach to take form, an airline must shift to a network revenue management orientation that transcends traditional organizational thinking and gridlock.

Network-Oriented Revenue Management

One of the missions for a reformed network revenue management organization should be to maximize revenue opportunities for the airline as a whole. Hence the goals of the five functional departments involved (revenue management, sales, pricing, scheduling, and operations) should be cohesive and in line with this mission.

Although the *function* of revenue management is just one facet of network management, the *philosophy* of revenue management should be the unifying focus of that process. Within such a framework, the revenue management department could be the center point from which the information and the business process of the various parties/departments are coordinated. Although the implementation of network revenue management can vary from one airline to another, its fundamental elements are presented in the following sections.

Network Origin & Destination Inventory Control

The revenue management systems in operation at most airlines have been primarily leg based and segment based, because their inventory control systems and parameters are leg and/or segment based. This setup, however, is incongruous with the rest of the airlines' operations, since they plan, schedule, and price their products on an O&D (rather than leg or segment) basis. Nonetheless, for the better part of the past two decades, these same airlines have operated hub-and-spoke networks but have practiced using leg- or segment-based revenue management to attempt managing O&D flows. Through technical advances made in reservations systems (CRSs) and global distribution systems (GDSs) in the past several years, airlines are now able to pursue O&D revenue management in their business practice. Hence airlines are now able to align their tactical inventory control methods with their strategic planning, scheduling, and pricing—all on an O&D basis. Therefore O&D revenue management becomes the fundamental building block of network revenue management.

Leg- or Segment-Based versus Origin & Destination Revenue Management In an inventory control system that is leg or segment based without O&D control parameters, an airline allocates inventory by setting sales authorization (AU) levels by booking class for each leg and/or segment of a given flight. Subsequently, the availability of each individual flight/leg (and/or segment)/booking class is periodically conveyed to the CRS and GDS via availability status messages (AVS) and availability numeric messages (AVN) transmitted through interline communications channels. An airline refreshes and resends these AVS and AVN messages after there is a reallocation of AU levels or after there is significant sales/cancelation activity on the given flight/leg (and/or segment)/booking class.

Following is an example of availability inquiry for a single-flight O&D itinerary from Hong Kong to Frankfurt (conveyed by leg-/segment-based AVS or AVN) wherein all booking classes in the economy cabin are available (note that the number following each booking class represents the seats available for sale):

ZZ 731 HKG–FRA M7 B7 K7 L7 V7

Here is another example of a single-flight O&D itinerary from Frankfurt to Madrid (based on leg-/segment-based AVS or AVN) wherein B, K, L, and V classes are not available:

ZZ 4730 FRA–MAD M1 B0 K0 L0 V0

If a travel agent, in turn, inquires about availability for a multi-flight O&D itinerary (say from Hong Kong to Madrid, made up of the above two independent flight sectors, HKG–FRA and FRA–MAD), these two flights

are conveyed as a single itinerary but show the same availability as the independent sectors:

ZZ 731	HKG–FRA	M7 B7 K7 L7 V7
ZZ 4730	FRA–MAD	M1 B0 K0 L0 V0

In this example, B, K, L, and V classes are not available for the HKG–MAD O&D owing to the lack of availability on the short-haul sector FRA–MAD. Also M class is limited to one seat for the HKG–MAD O&D owing to the more restrictive availability on the FRA–MAD sector.

The above examples demonstrate that revenue management based on traditional leg- or segment-based inventory controls is relatively static. In other words, the availability status on each sector does not dynamically consider the revenue implications of the complete itinerary, and thereby a potentially lucrative long-haul itinerary is sacrificed.

In an O&D revenue management environment, an airline no longer needs to rely on relatively static leg and/or segment availability. Instead with "seamless connectivity" (that is, the highest level of GDS availability participation) between the airline's hosted CRS and the GDS, potentially each and every O&D itinerary request/availability inquiry from anywhere in the world could be directly routed to the airline for dynamic evaluation and response (and bypassing relatively static availability displays based on AVS and AVN). The evaluation would involve analyzing each requested itinerary's economic worth to the airline. In turn, the corresponding availability for each requested itinerary would be constructed (based on economic viability) and returned to the requesting party on a real-time basis.

An O&D revenue management system serves as a decision support tool that performs real-time economic evaluation of each O&D itinerary of the airline. That evaluation consists of two steps. The first step is determining a particular itinerary's minimum acceptance value (bid price). The itinerary's bid price reflects the minimum price that must be paid to offset the economic displacement of forecast demand yet to come. In the second step, availability will be shown only for those booking classes whose net-net market fare (for that itinerary) is greater than that itinerary's bid price. Conversely, those booking classes whose net-net market fare is less than the itinerary's bid price will display closed/no availability.

The economic evaluation will consider, for example, the network revenue effect of accepting a multi-flight long-haul itinerary over two (or more) competing single-flight, shorter-haul itineraries (or over another long-haul itinerary that may compete on one of the same flights). In other words, if viewed from an international airline's perspective, should a sixth freedom request be favored over competing third, fourth, or fifth freedom requests (or vice versa), or over another sixth freedom request?[1] These instances are explored in the following examples.

Example 1 Based on the information below, the economic evaluation/constructed availability of a sixth freedom (multi-flight long-haul) itinerary may be preferred over that of two third or fourth freedom itineraries (two single-flight shorter-haul itineraries):

HKG–MAD	ZZ 731	HKG–FRA	M7 B7 K7 L7 V4
	ZZ 4730	FRA–MAD	M7 B7 K7 L7 V4

versus

HKG–FRA	ZZ 731	HKG–FRA	M7 B7 K3 L0 V0
or			
FRA–MAD	ZZ 4730	FRA–MAD	M7 B7 K0 L0 V0

Note: The above information assumes "ZZ" airline with five booking classes (M, B, K, L, and V). The number following each booking class corresponds to the seats available for sale in that class.

This example implies that the net-net market fares of HKG–MAD in all booking classes are greater than the bid price (minimum acceptance price) of the itinerary; hence all classes show available, although V class is limited to four seats.

In contrast, the HKG–FRA request shows that the HKG–FRA O&D net-net market fares are greater than the itinerary's bid price in M, B, and K classes only; hence they are available.

In the FRA–MAD request, only the net-net market fares in M and B classes are greater than the itinerary's bid price; hence, they are available.

Example 2 Alternatively, following is an illustration wherein the economic evaluation/constructed availability of two third or fourth freedom (two single-flight, shorter-haul) itineraries may be preferred over that of a sixth freedom (multi-flight, long-haul) itinerary:

HKG–FRA	ZZ 731	HKG–FRA	M7 B7 K7 L7 V4
or			
FRA–MAD	ZZ 4730	FRA–MAD	M7 B7 K7 L4 V3

versus

HKG–MAD	ZZ 731	HKG–FRA	M7 B7 K7 L0 V0
	ZZ 4730	FRA–MAD	M7 B7 K7 L0 V0

Example 3 Alternatively, the following is an illustration wherein the economic evaluation/constructed availability of a sixth freedom (multi-flight, long-haul)

itinerary may be preferred over that of another sixth freedom itinerary competing on one of the same flights:

HKG–MAD	ZZ 731	HKG–FRA	M7 B7 K7 L0 V0
	ZZ 4730	FRA–MAD	M7 B7 K7 L0 V0

versus

NRT–MAD	ZZ 715	NRT–FRA	M7 B7 K7 L7 V7
	ZZ 4730	FRA–MAD	M7 B7 K7 L7 V7

Tactical Implementation of Business Strategies As shown in the previous section and in Figure 25-1, an O&D revenue management system provides the decision support that enables revenue managers to perform real-time economic evaluation on every O&D availability request. But given that dynamic capability through seamless connectivity can manipulate the availability of any request, it is possible to incorporate tactical implementation of specific business strategies into the economic evaluation. Depending on the specific business objectives that the airline desires to achieve, a series of tactical parameters (represented by algorithms, criteria, rules, and/or guidelines) can add to, modify, or supersede the economic calculation to enhance the decision process. Therefore, rather than just focusing on the pure economic merit of a request (its minimum acceptance value), the following commercial considerations may also be factored into the process.

Marketing Strategy To compete effectively (for instance, when adding new frequency or new markets, or when pursuing market share), specific bias could be applied to any request that pertains to the targeted markets, flights, and/or points of sale. Furthermore (if pursuing market share in the distribution channels of a particular sales area or if targeting corporate chains or accounts), through seamless connectivity, the identity of any travel agent initiating an availability inquiry could potentially be known by the airline. With this level of intelligence, marketing tactics can be directly implemented by manipulating availability displays to the requesting party in ways not previously possible.

Currency Variation Airlines that operate in international markets can appreciate the havoc or the positive effect that currency fluctuations can have on the bottom line. But mitigating the problem or capitalizing on the opportunity requires dynamic intervention (given the fast response necessary to react to variations of monetary exchange). By storing up-to-date currency rates in an O&D revenue management system, economic evaluations of itinerary requests can be favorably biased toward those points of sale with stronger exchange rates favored by the airline.

Pricing Initiative With nonstop action in the pricing arena (published and unpublished), a dynamic O&D revenue management system is better equipped to cope with pricing changes in the marketplace. In addition to initiating (or responding to) a pricing action, an airline can manipulate the inventory to support the in-

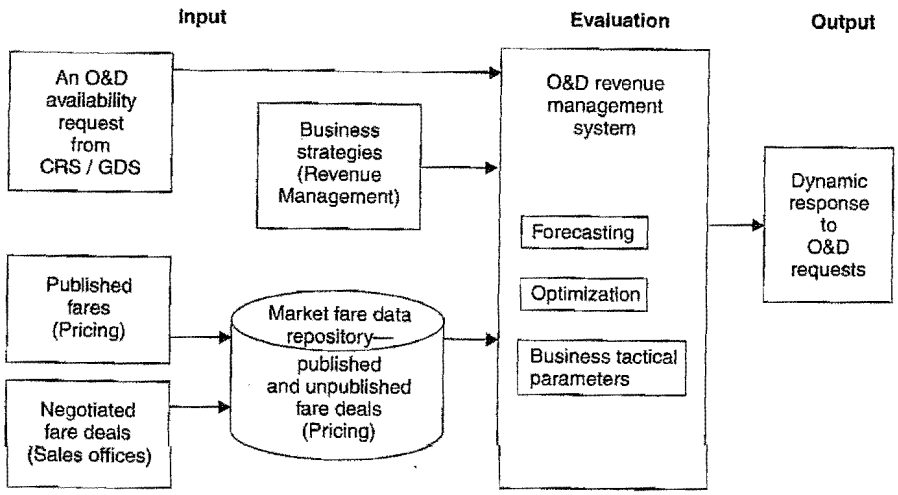

Figure 25-1 The Day-to-Day Process of Network Revenue Management

tended strategy. Since pricing initiatives are based on O&D (rather than on flight leg and/or flight segment), incorporating the pricing parameter into an O&D economic evaluation allows a revenue analyst to home in on any specific itinerary and bias availability to support the pricing strategy. Therefore with an O&D system, pricing tactics can be implemented with far greater precision than is possible with traditional leg- or segment-based inventory systems. Leg- or segment-level controls are too generic and would undesirably affect other O&Ds that traverse the sector but bear no relevance to the pricing initiative.

Quality of Customer In the current business process, as practiced by reservations clerks and travel agents, the passenger's name is seldom identified when an initial inquiry is made. It is often the case that the only question asked of the prospective customer is his/her desired O&D and the date of travel. But if the passenger's identity were known, and if the request were initiated through seamless connectivity, then this information could potentially serve as additional intelligence for the airline in its economic evaluation of the requested itinerary. Potentially, the airline's frequent flyer database could be automatically linked to the O&D revenue management system to attain specific information about the prospective passenger (for example, Is the customer a premium flyer? How many trips has he or she flown during a specified period? and so forth). Based on this information, the airline could incorporate some quantification of the long-term potential value of the customer into its economic analysis. Subsequently the airline could bias availability and respond accordingly (giving last-seat availability to a premium frequent flyer rather than to the general public, or favoring the passenger by granting him or her a particular discount class even when pure economics may dictate otherwise *and* the displacement cost differential is marginal). Only through a business process change in the way airlines and travel agents conduct their prospecting can information about the potential customer be used to the strategic marketing benefit of the airline.

Clearly, incorporating commercial intelligence into the decision process of O&D revenue management will significantly enhance an airline's competitive edge.

Origin & Destination Group Management

Another element befitting network revenue management involves managing an airline's group business. This is one particular area where the current business process of most airlines actually undermines their ability to maximize revenue opportunities. With a change in focus and process, airlines can reap substantial benefits and enhance the bottom line through proper group management, even if groups represent only a small portion of their core business. For more information, see the article entitled "Group Revenue Management: Redefining the Business Process" (Yuen).

Sales Planning and Revenue Management/ Pricing

Another process essential to network revenue management is sales planning. Traditionally, at most airlines, the business process interaction between the revenue management department and sales offices becomes mired in conflict due to contradicting objectives.

The way revenue management sees it, inventory allocations should be controlled and refined to "balance" the goals of revenue maximization with the commercial considerations of sales. But in the quest to perform this balancing act, revenue management may be continuously at odds with sales, because the former can never fully satisfy the allocation needs of the latter.

The way sales sees it, sales targets are established often even before inventory allocations are initiated. Sales targets tend to be driven by load factor rather than by the quality of revenue. Furthermore sales targets are established in gross terms while the inventory allocations set for each flight are at a micro level on a departure-by-departure basis. Hence the allocations established by revenue management may be and often are inconsistent with the needs of sales and their important travel agent clients. As time passes, sales targets may be refined to account for marketplace dynamics (for example, competitive pressures, new fares, new unpublished pricing deals being negotiated especially in the international marketplace). Then, case-by-case, as flight departure dates draw closer, sales continually negotiates with revenue management for additional inventory.

When post-analysis is done, both parties may ponder, "What happened?" Sales may find that its sales budget reconciliation reveals missed targets; revenue management may find that its own performance is lackluster (because, against their own better judgment, revenue managers may have acquiesced to the "load factor" needs of sales offices). This scenario exemplifies the business process disconnect between sales and revenue management. Unfortunately this process disconnect often repeats itself in untamed cycles.

In examining the above situation, the reason for the conflict between revenue management and sales is that there is *no coordination* between the budgeting process of sales and the business process of revenue management. Furthermore, with the sales department's load factor mind-set, its budgeting process may

be more regional-, flight-, and/or sector-oriented than O&D- or network-focused. After all, if the sales targets are flight-sector based, then sales is ignoring the network effect of O&Ds and their revenue mix.

To solve this problem, and in keeping with the objective of network revenue management, the sales department should provide its annual (or semiannual) sales budget projections on an O&D/fare (ODF) basis. These projections should feature details by month, by quarter, or by any other period that is meaningful. In addition, these projections should be complemented by historical ODF data reflecting actual materialization (information that can usually be furnished by the airline's revenue accounting department), along with unconstrained demand estimates provided by an O&D revenue management system. Once all these inputs are provided, a network optimization program could be used to analyze and propose the proper mix of ODFs that would maximize revenue for the airline as a whole. Only by defining the problem and solving it from a network perspective can the airline fully understand its total revenue opportunities.

From this analysis, each ODF could be prioritized based on its level of revenue contribution to the airline's network by point of sale. With this prioritization, sales could establish the optimal sales targets for any given budget period. Or, using these targets as the baseline, each sales office can refine them to account for commercial constraints (for example, the need to maintain or increase market share). These refinements can serve as inputs to a subsequent network analysis run, which provides a second round of recommendations for new optimal sales targets. Through this approach, the intent is to refocus and reorient an airline toward the network and toward looking at the "big picture"—rather than allowing any particular factional/regional interest of sales to overwhelm the company's overall interest.

Once the sales targets are finalized by the sales department, the revenue management and pricing departments must supplement that effort by establishing a multi-class booking hierarchy that *facilitates* the achievement of those targets. In fact, in the current business environment of most airlines, it is highly questionable whether their booking class hierarchy is properly rationalized and stratified from a network perspective. An effective multi-class structure would have those ODFs with the highest net-net values grouped together, filed, and booked out of the highest-positioned selling class (while the next highest group of net-net ODFs would be filed and booked in the next highest-positioned selling class, and so forth). But when airlines manage inventory on a leg or segment basis, the fare rationalization process tends to emphasize just that: leg or segment stratification. Under such a scenario, since ODFs may traverse multiple flight sectors, what is "properly rationalized" on one flight sector may not be "properly rationalized" on another sector, which means that the ODFs across the network are not *truly* stratified. Therefore, the emphasis should be network-based rationalization to ensure that the multi-class hierarchy facilitates the network flow of the airline. To accomplish this, the pricing and revenue management departments must undertake the class rationalization exercise via a *network optimization process, which, not coincidentally, can be the very same process by which the sales targets are established.* This very process can be the bridge that connects sales with revenue management/pricing. By employing the same problem-solving perspective and the same data source, which in itself would be a leap forward in business process integration, both sales and revenue management/pricing will attain synergy greater than the sum of their own parts.

After optimal ODF sales targets are established and *prioritized* through the network optimization process, a rational multi-class hierarchy can be established based on this same *prioritization.* In essence, those ODFs that provide the greatest network revenue contribution would be nested higher within a given flight's inventory hierarchy (hence, enabling greater opportunity to access inventory) than those providing lower network revenue contribution. Also with a better stratified ranking from high-value ODFs to those of low value, rationalization in the multi-class structure is further achieved by the clustering of those ODFs that are fairly homogeneous in their revenue contribution. After all, the objective of network class rationalization is to *maximize* the differentiation in network ODF values *between* adjacent booking classes in the hierarchy while *minimizing* the variance of network ODF values *within* any single class. This, in turn, produces better ODF data sample groupings from which to forecast passenger demand in the day-to-day operations of a revenue management system. Of course, better forecasting leads to maximizing revenues for the airline.

On an ongoing basis, to ensure that the airline's multi-class hierarchy remains rationalized amidst dynamic changes that occur in the marketplace, it is important to reevaluate the network's stratification of ODFs periodically. In fact, this should be a routine exercise, since the creation and deletion of ODFs is a continuous process. Another benefit of this exercise is that it may reveal that the original sales targets established may no longer be feasible to pursue, given that the network dynamics may have changed. Hence an airline can be in a position to proactively analyze the potential variance between the original and the modified sales targets. See Figure 25-2 for an illustration of the network revenue management planning process.

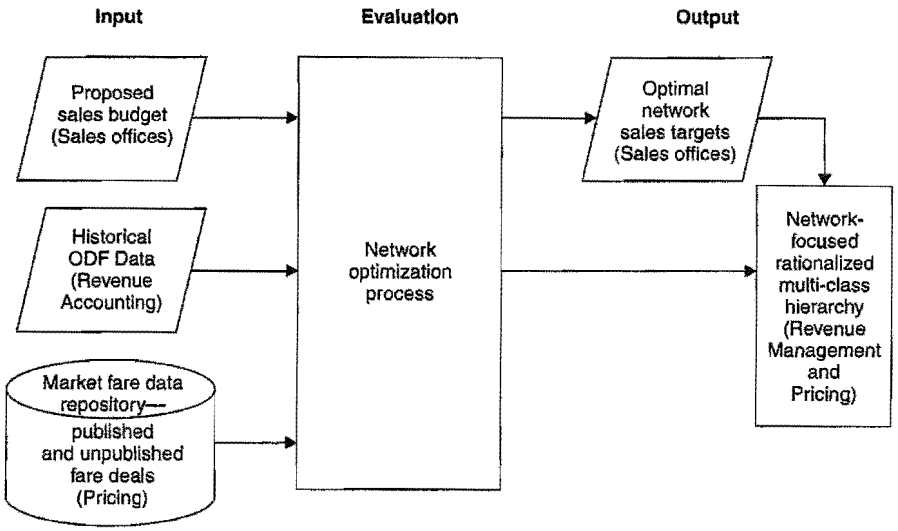

Figure 25-2 The Planning Process for Network Revenue Management

Pricing and Revenue Management

Although the previous section discussed the coordination of processes between sales planning and revenue management/pricing, there are also specific issues between pricing and revenue management that must be addressed when creating the infrastructure for network revenue management. These issues pertain to the incorporation of real-time pricing information into the day-to-day operations of O&D revenue management.

As a brief background, the pricing function at airlines can vary in its organizational structure. At the majority of airlines, the administrative activities associated with the filing and distribution of fares and tariffs are the primary responsibility of the pricing department at headquarters. But the analysis and decision-making process of pricing can vary from one airline to another. At most carriers, this process takes place in the central pricing department; at other airlines (primarily those in the international arena), the sales offices play a more significant role. Prevalent in markets such as the Far East, where unpublished fares (also called market fares, or net-net fare deals) are sold, the sales offices gather market intelligence from travel agents on other airlines' competitive deals; subsequently the sales offices negotiate private deals directly with the travel agents, on behalf of the airline, on their own specific net-net rates, terms, and conditions. Although the degree of negotiating flexibility granted to the sales offices varies from one airline to another, sales nonetheless can influence the outcome of pricing decisions in certain markets.

Since changes in pricing (published and unpublished) are dynamic and pervasive in any airline's environment, it is essential to have up-to-date and accurate information on market pricing activity. This is of even greater importance when airlines are operating in a dynamic O&D revenue management environment. The reason is that the real-time availability display by itinerary class is dictated by the calculation of bid price (the minimum acceptance price) and the comparison of bid price to the *actual market fares* in each class. In other words, any itinerary class whose market fare (applicable to the requested O&D) is greater than the itinerary's minimum acceptance price will show available; otherwise it will show not available.

An O&D revenue management system, therefore, must be linked to some market fare database that stores published fares (for those markets that primarily sell filed tariffs) as well as unpublished fares (for those markets that primarily sell negotiated net-net fares); see Figures 25-1 and 25-2. The sources of up-to-date fare information to populate this market fare database are varied. For published fares, the data can come electronically from industry-standard fare databases (for example, ATPCO, SITA). For unpublished net-net fare deals (which are predominant with most international carriers), the accessibility of data may be limited at most airlines. The reason is that these deals are usually negotiated "on the spot" by the airlines' sales offices. Relaying the details of each deal back to headquarters (and ultimately to the revenue management department) requires time and manually intensive paperwork in today's environment; hence this

process does not fit the bill for "timely" information on market pricing activity.

Given the proliferation of net-net pricing deals in the international marketplace, many airlines find it difficult to keep up with all the transactions taking place. One potential way to make the business process smoother is to incorporate a net-net pricing database as part of an airline's sales force automation enterprise. Such a net-net pricing database could encompass the following features/processes:

A Central Repository of Deals With portable laptop PCs available to sales making on-site visits to travel agents, the details and terms (agency IATA ID number, value, conditions, routings, and so forth) of any negotiated fare deal could be input into a preformatted file with the use of a specially developed program. The file could be subsequently sent (via the Internet, CRS links, or any other communications means) to a central repository of deals located at the airline's headquarters. Then the net-net fare deals would be registered electronically rather than on paper.

A Link to Revenue Management/Pricing From the central repository, a link could be established to the revenue management system so that unpublished net-net fare deals could be incorporated into the real-time evaluation of O&D requests. Since seamless connectivity could potentially identify which particular travel agent is initiating a request, the specific net-net fares and terms *applicable to that agent* (along with routing match, travel period match, and so on) could be summoned and compared with the minimum acceptance price of an itinerary when the O&D revenue management system generates a response to an O&D request.

A Link to Revenue Accounting There could also be a link between the central repository of deals and the airline's revenue accounting system. With every deal that is made by sales, revenue accounting could be automatically informed of that deal and its terms—all encoded into a unique deal identification code. Subsequently, with every deal ticketed by a travel agent, the deal code would be included on the ticket for the airline's revenue accounting department to identify the net-net remittance associated with that deal. The flown materialization of each deal could then be fed back to the central repository for the purposes of tracking, reporting, and reconciling sales budgets. In fact, this utilization data should be made available to sales offices as background intelligence for when they conduct further negotiations (for new deals or modifying existing deals) with travel agents.

The Scheduling/Operations/Planning Process and Revenue Management

In today's environment, the sales and revenue management departments are handed a schedule from which to sell inventory and maximize revenues. The presumption is that the airline's planning, scheduling, and operations departments have already optimized the schedule and considered the economic interplay of demand and capacity. But this presumption may not hold true at most airlines, since the planning/scheduling/operations functions and the sales/revenue management functions are not integrated in their business process. Rather than revenue management maximizing revenue *within* the constraints of an airline's schedules, the goal should be to maximize profit through the combined planning efforts of all of these functions. After all, consider the purpose of planning and scheduling—to search for new opportunities and for more profitable ways to deploy aircraft within the airline's route network. This work naturally complements the objectives of network revenue management.

As discussed in the previous sections, only a network optimization analysis can truly assess the revenue opportunities for the airline as a whole. An airline can create a multi-class structure that not only facilitates capturing these opportunities but also produces better ODF sampling entities from which more accurate day-to-day passenger demand may be forecast. In translating this exercise into the realm of profitability planning, the airline's scheduling realities and opportunities must be at the forefront. See Figure 25-3. The integration of revenue management systems with both the scheduling and planning systems will provide what is missing at most airlines—a way to achieve a more accurate profitability analysis, which can then become the primary driver of the scheduling process.

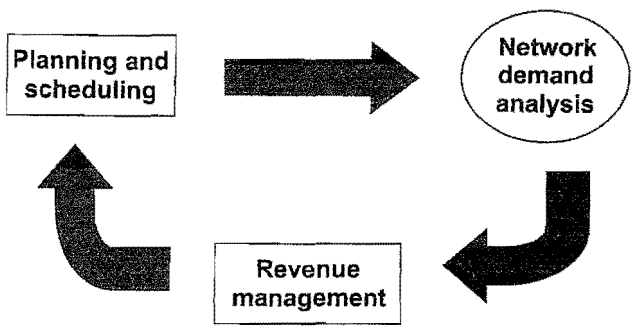

Figure 25-3 Revenue Management and Scheduling

A fundamental weakness in the marketing division of most airlines is that scheduling and planning are treated as if they are totally separate functions, as detached from one another as they are from the rest of the airline. The two functions are often performed by different units, using different software systems. Scheduling and planning only avail themselves of revenue management information when they occasionally use various revenue management summary reports. Also, neither function has any tie to day-of-operations functions.

This thorough separation of planning and scheduling from revenue management and from one another is all the more remarkable when one considers that, in fact, the only real difference between planning (on its six-month to five-year planning cycle), scheduling (for flights one week to six months prior to departure), or operations activities (taking care of day-of-departure extra sections, change of gauge, and so forth) is the time horizon.

In examining these functions further, the questions that must be addressed in the planning process can be generalized into the following:

- If a route is added or deleted, what are the financial implications, and how will it impact other routes?
- When adding aircraft to the airline's fleet, where should they be deployed to generate the greatest incremental profit?
- Which markets should be abandoned or opened?

The questions that are being addressed in the *scheduling* process can all be generalized as follows:

- If a flight is added or deleted, what are the financial implications, and how will it affect other flights? How will it affect other routes?
- When adding flights, where should they be scheduled to generate the greatest incremental profit?
- When adding flights, what will be the financial opportunity, and how will other flights be affected? Which markets should be subject to frequency increase or reduction?
- If flight times are adjusted, how will this affect profitability? Are there opportunities to increase revenue by changing flight times?
- Are there financial opportunities associated with change of gauge? In what routes/markets should such changes be considered?

Note the parallels between the planning and the scheduling process. Clearly, the planning process leads into the scheduling process, and scheduling has an even greater need for accurate revenue management data.

Today's scheduling and planning systems both lack a dynamic tie-in to revenue management forecast data that can provide revenue-based decision-making. Despite the fact that an effective revenue management system can address many of these questions, most airlines try to map out the answers in isolation from revenue management. There is no feedback between the revenue management system and the schedule/planning process. Although revenue management is predominantly tactical, it can provide substantive input to the planning process. The alternative explored in the next section promotes a more integrated business process.

A New Scheduling Process

The following steps can be helpful in aligning revenue management systems and the scheduling processes.

1. Using the network ODF optimization output (as presented in the section entitled "Sales Planning and Revenue Management/Pricing"), establish a network perspective of the airline's unconstrained demand and optimal traffic mix. *Unconstrained demand* is defined as excess demand that may be unfulfilled by an existing flight or flights. Unconstrained excess demand can often exist even when load factors are between 80 and 90 percent.
2. Using unconstrained demand information from the revenue management system, accurate net-net fares, and cost data, generate a profitability model for the airline on a flight-by-flight basis. In constructing the cost database, exercise great care in deciding which costs will be treated as incremental and which will be allocations of bulk aggregate costs.
3. Using QSI (Quality of Service Index) data combined with load factor data (available from OAG, IATA, and/or other industry periodicals/databases), approximate an estimated load factor on each route for all competitors' flights.
4. Extract unconstrained demand data from the revenue management system to create fully dated demand models/scenarios for each route on your own flights.
5. Algorithmically derive demand for all shifted, canceled, or inserted flights and gauge changes.
6. On each route, generate a spill/recapture model based on the spacing and demand for all flights (that is, the airline's and its competitors').
7. Sort all options for network profitability.
8. Flow a schedule, based on the planned fleet and

maintenance requirements, eliminating low-profitability or nonstrategic flights.

9. Repeat steps 6–8 until you attain the best schedule that maximizes revenue.

This process is illustrated in the diagrams below, beginning with the QSI model from Step 3 of the process (Figure 25-4). The QSI model must be the fundamental starting point for analyzing schedule changes—especially for the addition of new flights. There are different ways of deriving a QSI model, based on the importance of the market, availability of data, and so forth. Factors that can be incorporated into a QSI model can include frequency, equipment type (including age of equipment), level of in-flight service, scheduled flight times, and other typical "quality" features. Or the QSI can be derived merely using the number of seats offered by each carrier in the market. In this example, the implication of the QSI index in a market is that if demand in the market increases by 100 seats and the airline has a QSI of 46 percent, then the airline may get approximately 46 of those passengers, provided that all other factors remain equal.

Subsequently, in Figure 25-5, the demand curve for flights (the airline's own as well as the competitors') on a given route is estimated. The demand is based on the current schedules and, for competitors' flights, estimates of load factor based on industry public information and any available market analysis. For the airline's own flights, the revenue management system can also provide considerably more detailed analysis, including an estimate of unconstrained excess demand.

Figure 25-6 reflects a modification made to the schedule based on the airline's proposed adjustment. With the schedule modification, the approximated demand curve on the route may be relatively unchanged, and it is still going to apply to any modified flight (see Figure 25-7). In other words, one can assume that the existing demand curve in the market applies to any new or changed flights. Figure 25-7 would apply for modifying (adding, deleting, or shifting) flights when

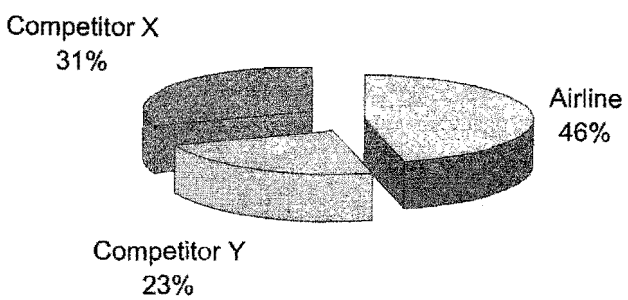

Figure 25-4 The QSI Model

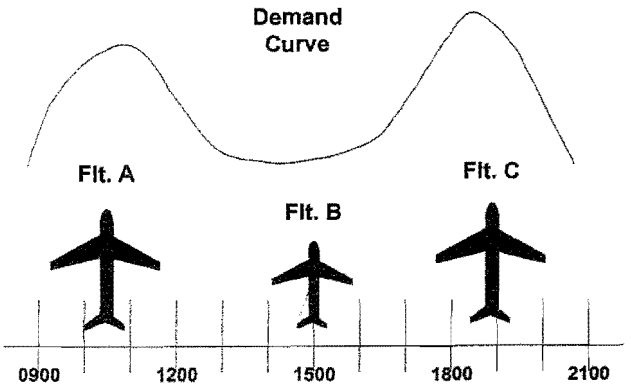

Figure 25-5 Demand Curve and Flights on a Route

there is either excess capacity, or the capacity level is appropriate, but not if there is unfulfilled excess unconstrained demand.

Note that one cannot assume which of these three capacity conditions exists merely by examining load factor. Considerably more analysis needs to be done by the revenue management system in order to comprehend the demand/capacity relationship. Of course, the demand picture can only be completely understood for the airline's own flights, since the revenue management systems cannot yet analyze the competition. Thus, this entire process is by nature iterative over time, since the understanding of the market is constantly shifting, based on the airline's degree of dominance at peak periods in a particular market.

The airline's revenue management system can identify where there is unsatisfied demand for its own flights in a market by doing an unconstrained demand analysis; conversely, excess capacity can also be derived. In the case of excess demand, adding new flights will have the effect of modifying (increasing) the demand curve.

Figure 25-8 illustrates that any addition, deletion, or shifting of flights would be subject to a spill/recapture analysis to determine how much demand may be spilled over from the airline's own flights or competi-

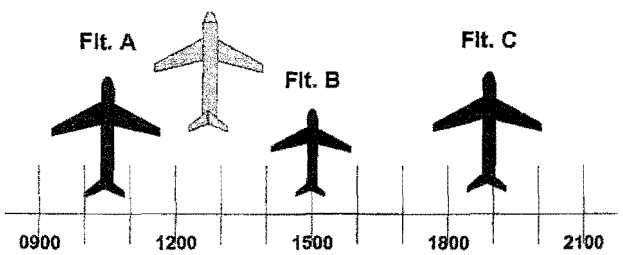

Figure 25-6 Schedule Modification

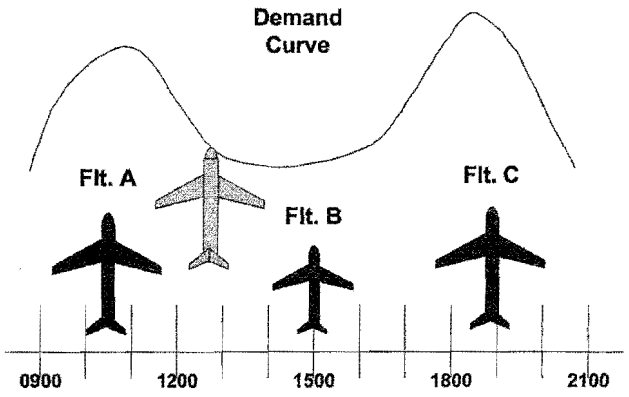

Figure 25-7 Unchanged Demand Curve Applied to Modified Flight.

tive flights (or, conversely, how much incremental demand may be generated). A spill/recapture model assumes that current demand is tied to the timing of current flights and that it will be spilled (lost) based on a normal Gaussian distribution as the time of the flight changes. But as the next flight of any carrier is approached on the timeline, demand will be recaptured. Hence insertion of a new flight will recapture demand from other flights, as well as potentially capturing new demand, on the same normal curve basis. (Note that the total available demand is not "zero sum"; in other words, insertion of a new flight captures demand not presently fulfilled by current flights in the market.) In essence, using revenue management data to assess the financial opportunities associated with a schedule adds a level of analysis that results in a considerably more effective scheduling process.

The planning process can be a slightly modified version of the scheduling process described above. The same approach can be used to add new routes or markets, employing high-level estimates of the potential market share and the ODF demand, which the airline can synergize through the rest of its network. This approach can produce a reasonable model on the effect of entry into a new market. After entry, the revenue management system can produce micro-level forecasts by date, which could be used to refine the schedule in the new market. The only real differences between the scheduling and the planning processes are the flexibility of the fleets being planned/scheduled and the degree of resource utilization.

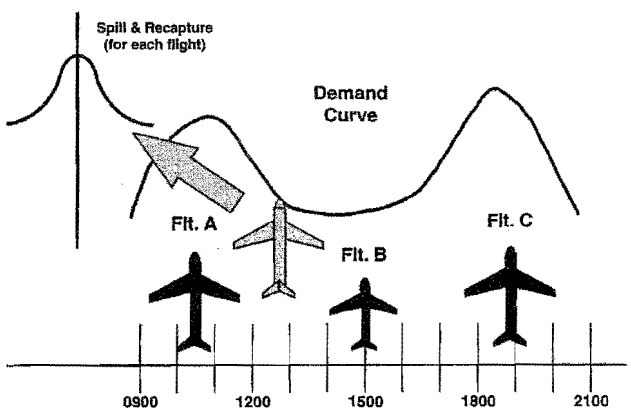

Figure 25-8 Applying Spill/Recapture to Flight.

Potential for "Dynamic" Revenue Management and Scheduling Operations

The concept of the new scheduling process can also be applied to the day-of-operations process. The approach would be essentially the same, but the tolerances for aircraft availability may be tighter when one is dealing with real-time operations. In other words, there is greater allowance for spare aircraft capacity or maintenance check overruns in long-term scheduling than when one is dealing with near-term operations. Nonetheless, unconstrained demand forecast data from the airline's revenue management system can be given to the operations department for use in the same type of scheduling analysis but for the near term.

Providing revenue management input to the near-term scheduling process, and in turn to the operations process, will augment an airline's ability to capitalize on a number of opportunities, such as

- the scheduling of extra sections,
- creating schedules for special holiday periods, and
- opportunistic changes of gauge based on extra capacity from the early release of aircraft from maintenance checks.

Opportunities abound during peak-travel and holiday periods. Again, using demand forecast input from the airline's revenue management system, the network-profitability ranking approach from the scheduling process can be applied to these special periods. Of course, the objective is to maximize network revenue by methodically reallocating aircraft capacity from low-demand flights to extremely profitable flights without diminishing the operational integrity of the base schedule.

The airline's revenue management system can forecast any opportunity of unfulfilled excess demand and can integrate that information with a network analysis of the current schedule. In airline operations, it is generally accepted that extra aircraft capacity does not need to take the form of a discrete aircraft unit located in a particular port, but rather it can be treated as a

means of "pooling" resources. Such an integration of systems could recognize and respond when, for example, completing a DC-10 "C" check in London on Monday may allow the aircraft to be substituted for a normally scheduled 747 that, in turn, could be better utilized as an extra section from Hong Kong to Seattle on Wednesday.

As can be seen in the above discussions, the integration of the revenue management systems and databases with the scheduling, planning, and day-of-operations processes offers many new opportunities for enhancing revenue and profitability.

A Network Organization

Beside the business process and systems automation, an airline must also have the proper organizational infrastructure to support a network revenue management environment. Since there is no steadfast rule on how a network revenue management organization should look, the reporting layers and the framework of an organization chart are not strictly defined. Rather, senior management support, organizational objectives, team interaction, and the business flow are deemed more critical. For instance, it is less important that revenue management and scheduling report to the same division chief; it is, however, vital that their business practices and interactions respect the same objective—*maximizing revenue for the airline.* That is the creed of network revenue management.

At most airlines, the traditional organizational structure of the revenue management function tends to be divided by route or market. The organizational level at which this division occurs can vary (that is, it could be at the analyst level, the manager level, the director level, and so forth). For the purposes of efficiency and focus, the practice of setting up divisions is certainly worthwhile and essential, but when an airline is putting the concepts of network revenue management to work, these divisions should not be seen as "glass walls" with segregated objectives. Otherwise, since the sought-after resource of revenue management is seat inventory, the result may be one division blocking inventory on its own sectors for its own use to enhance *route (or regional)* revenue and profitability at the expense of *network* revenue and profitability. To ensure that the overall mind-set is redirected from regional to network thinking, the following issues should be addressed.

Senior Management Buy-In Unless an airline operates in distinct markets wherein there are no network synergies to be attained, it should never treat route divisions as sub-airlines in their own right. In order for the network premise to be embraced at the working level, senior management must acknowledge, support, and enforce it from the top.

Network Targets and Measurements The traditional measures of market share, sector yield, and sector profitability should no longer be the *primary* benchmarks for measuring route/market performance. Instead, the primary measure should be network viability. By viewing the network process and the prioritization of network flows (as described in the section entitled "Sales Planning and Revenue Management/Pricing"), the airline is in a better position to clearly understand exactly how each region, sector, and O&D interact to contribute to the overall financial health of the airline. Also by using data that are entire and whole (encompassing complete itinerary ODFs) instead of partitioned and splintered data (for instance, regional or sector loads and/or prorated revenues) to measure revenue performance, an airline will gain much greater insights into what, why, and how results are attained. The airline can look at the big picture and subsequently focus on what attributes are poor or good—and then assess the reasons behind them.

It is worthwhile to mention that just because an airline may want to adopt a network revenue management approach does not mean that accountability will be relinquished at the regional or division level. For instance, regional or divisional market targets would still be established, but they could now be set using a *top-down* approach. That means, first and foremost, that the airline would identify revenue opportunities from the network perspective, and only then probe further to establish regional or division targets that are components supporting the network-level opportunities. This practice is in sharp contrast to the *bottom-up* approach employed at most airlines today, wherein revenue opportunities are identified separately among all the regions and route divisions first, and then, subsequently, the disparate parts are aggregated up to the network level to establish the airline's overall revenue target. The *bottom-up* approach tends to focus on sector measures to build up to the network level, which means that network synergies may be forsaken while regional interests are supported. With the more appropriate *top-down* approach, one can truly say that the separate regions and divisions are working in concert to support the goals and objectives of the airline as a whole.

Coordination at the Working Level Once the network revenue management concept is adopted and implemented, it is important that awareness, education, and training be provided to the staff who are responsible for putting it into practice every day. The regions or route divisions must be aware of the objectives of the

whole revenue management process in order to work as converging units rather than as diverse/opposing entities. Accordingly, the role of inventory controllers may have to be adjusted from micro-administrators of flight inventory to macromanagers of the network. Their day-to-day work flow should shift from manipulating specific flight allocations to studying the markets within the network and directing the operations of the revenue management system at a higher level. This focus on "the whole rather than the parts" throughout every aspect of the department's day-to-day functions) will ensure the integrity of network revenue management.

Although the above three considerations were discussed in the context of the revenue management department, they pertain equally to the other departments that interact with the revenue management department—planning, scheduling, pricing, sales, and operations.

As previously stated, to effect the practice of network revenue management, it is not important whether these departments directly report to the same single authority. To the extent that these functional units are separated organizationally, however, the concept behind each one of the above three considerations must be fully applied to ensure cross-department "network" thinking and action. As long as the requisite business process associated with network revenue management is coordinated and integrated as closely as possible among these functional units, the overall interest of the airline will be well served.

Conclusion

When an airline practices network revenue management, the functions of revenue management, sales, planning, pricing, scheduling, and operations are focused toward the same goal of maximizing network revenue for the airline. Although an airline can implement just some or all of the business and systems processes presented here, the benefits to be derived are commensurate with the level of participation the airline enlists from the relevant departments.

With network revenue management, O&D information and control become the centerpiece of the process. The decision support capabilities complementing the process are real time and enable business strategies to be implemented with greater precision. Greater intelligence regarding the customer is now accessible and can be exploited by the airline. Overall, the airline can significantly enhance the quality of its business decisions when maximizing revenue opportunities in an O&D environment.

In this new environment, the sales revenue target planning process is optimized from a network orientation rather than arbitrarily established from a route or regional perspective. From this same network optimization process, revenue management/pricing can establish a rationalized multi-class ODF hierarchy that facilitates the achievement of the sales targets. This, in turn, produces better ODF data samples from which passenger demand is forecast for day-to-day network revenue optimization by the revenue management department. Also, on a daily operational basis, the pricing department can maintain a comprehensive database on published fares as well as unpublished net-net pricing deals (as negotiated between sales and the travel agent community). This timely pricing information can be linked to the revenue management department for real-time use by the O&D revenue management system. Furthermore, the business process of the scheduling, planning, and operations departments could also be coordinated with revenue management; the objective is to maximize dynamic revenue opportunities by methodically matching demand with the appropriate capacity whenever possible.

Network revenue management intrinsically links one department to any other via the interconnected automated systems and by the very nature of the design of the business process. The results of this coordination and integration are harmony across the departments and revenue maximization for the airline, which make network revenue management a highly leveraged endeavor.

Endnote

1. The "Five Freedoms" were defined at the Chicago Conference of 1944. Freedom 3 provides the right for an aircraft belonging to Nation A to set down traffic from Nation A in Nation B. Freedom 4 provides the right for an aircraft belonging to Nation A to pick up traffic in Nation B and return to Nation A. Freedom 5 provides the right for an aircraft belonging to Nation A to carry traffic between foreign territories; e.g., the aircraft belonging to Nation A has the right to drop off traffic from Nation A in Nation B, and then it can pick up traffic in Nation B and continue on to Nation C. Unlike Freedoms 3, 4, and 5, which were defined in Chicago, Freedom 6 is a result of typical commercial airline practices. Freedom 6 provides the "right" for an aircraft belonging to Nation A to carry traffic between two foreign countries, via its own country of registry. The "sixth freedom" can also be viewed as a combination of third and fourth freedoms secured by the country of registry.