ABSTRACT

Although the number of passengers being transported by U.S. commercial airlines has rebounded to pre-9/11 levels, a corresponding return to profitability has not taken place. This paper describes, and discusses the application of, a number of technologies that can help airlines address issues impacting their profitability, including those relating specifically to passengers, to individual air carriers and to the commercial airline industry as a whole.

Introduction

In 2000, U.S. scheduled commercial airlines transported over 666 million passengers and made a combined net profit of nearly $2.5 billion. In 2001, the year in which terrorists used commercial airliners to attack the U.S. on September 11, the total number of passengers dropped to 622 million and the previous year’s net profit quickly became a net loss of over $8.27 billion. In 2005, the number of passengers had rebounded to over 738 million, but the combined bottom line, a net loss of over $5.67 billion, had not shown a similar recovery (ATA).

While shocks to the passenger airline system like the 2001 terrorist attacks and the rapid, steady increase in the price of crude oil that began in early 2002 have negatively impacted its ability to maintain profitability, the fact that an increase in annual passengers of more 116 million between 2001 and 2005 hasn’t resulted in a return to profitability demonstrates that additional measures need to be undertaken to help move the industry back toward profitability. This paper addresses a number of technologically oriented measures that can help persuade airline passengers to continue flying in sufficient numbers while enabling the airlines to gain some cost savings. Although the technologies addressed could be categorized in a number of ways, it seems logical to discuss them according to the segment of the industry they most directly impact – passengers, individual air carriers and the overall airline industry.

Passenger Oriented Technologies

Because passengers must be persuaded to fly in sufficient numbers before airline profitability can even be considered to be possible, the various wants and needs of those passengers, and the technologies that deal with them, are addressed first. In general, passengers want flights that are reasonably priced, convenient and secure.

Reasonably priced. Because it is quite relative in nature, one passenger’s definition of “reasonably priced” is unlikely to agree with that of another passenger. However, providing prospective passengers with the ability to use one or more of a wide variety of Internet-based search mechanisms designed to compare and select from among a variety of flight options significantly increases the likelihood that the selected flight will be considered to be reasonably priced.
priced by an individual passenger. Although the technologies behind currently available on-line flight search mechanisms are relatively well developed, enhancing their ease-of-use, availability and reliability will help turn more prospective passengers into actual passengers, thus helping keep airplanes full. In addition, inclusion of the widest range of possible alternatives regarding airline companies, flight schedules, seating classifications and even area airports in the relevant databases and possible search criteria (Smith) significantly increases the likelihood that passengers will believe they are paying reasonable prices to fly.

**Convenience.** There are two major issues that contribute to a passenger’s perception of convenience, flight schedules and the smoothness and speed with which the passenger flows through the actual transportation system.

**Flight Schedules.** In the context of flight schedules, passengers generally prefer non-stop, or at least direct, flights between their origination and destination locations. Of course, they may be open to considering alternative itineraries that include changing airplanes and/or airlines, and even significant airport layovers, if substantial differences in ticket prices exist. A group of technologies collectively known as business intelligence is particularly useful in providing the kind of detailed analysis of available customer and competitor information that an airline needs to engage in effective yield management – an effort to fill every seat on every flight with passengers who have purchased their tickets at the highest price possible (Netessin and Shumsky). Because large airlines have built hub-and-spoke systems under which passengers are carried from smaller “spoke” airports to larger “hub” airports and then on to either another spoke on the same hub or another hub, those airlines are faced with an additional level of complexity in their efforts to develop effective yield management systems.

By its very nature, the hub-and-spoke system significantly limits the ability of an airline to address passengers’ desires for direct flights, even when those passengers may be willing to pay a somewhat higher price for that convenience. Passengers who would prefer to have direct flights, but are forced to make connections, generally expect to pay less for the inconvenience. At the same time, it must be recognized that some passengers are more interested in low prices than convenience. This means that to successfully compete in what is generally a more lucrative short-to-middle distance direct flight arena, large airlines must integrate additional direct flights into their overall schedules to create an optimum mix of direct and hub-and-spoke flight schedules. Although creating such a schedule is a rather complex task, the business intelligence technologies that a number of airlines employ should be particularly well suited to such an effort.

**Smoothness and Speed.** As noted above, a second dimension of convenience is the smoothness and speed with which passengers flow through the actual transportation system, including checking in for flights, moving through security checkpoints, boarding in the departure terminal, deplaning and moving through the arrival or transfer point terminal, and claiming baggage. The application of technology to each of these facets of a passenger’s movement through the system, along with making associated changes to relevant business practices, can significantly improve the passenger experience.

Enabling passengers to check in early via the Internet has proven to be an excellent first step in smoothing the check-in process by allowing the passengers to accomplish part of the process
prior to their arrival at the airport. The creation of self-service check-in kiosks in the general vicinity of the ticket counters can also improve the flow of passengers in those areas by separating those who have already purchased their tickets from those who haven’t. Baggage check kiosks, with a relatively high self-service component, are a logical next step in reducing congestion in the ticketing area and improving passenger flow through the initial check in process.

Although the security check activity is in the hands of the government, the application of new technologies can speed the movement of both passengers and their baggage through the necessary security checks. Enhanced scanners that both “sniff” for explosive material and quickly evaluate x-ray images using intelligent software will increase both the accuracy and speed of the security checking process.

Although aircraft boarding procedures vary from one airline to another, increased use of intelligent systems that consider family groupings, special needs passengers, carry-on bags, etc. when setting the boarding order can both reduce the total boarding time and smooth the process for individual passengers. While in flight, the integration of wireless technologies into various passenger audio/video systems can significantly reduce the number of problems, and related passenger complaints, related to those systems, and can even help smooth the arrival/connection process by providing up-to-date gate and baggage claim information tailored to individual passengers.

While the use of machine readable bar codes on boarding passes and baggage tags are reasonably effective in moving passengers and baggage through the system, they generally require human intervention to ensure that they are read correctly. Radio frequency identification (RFID) technologies can perform the same function, but with significantly less human intervention (Wyld et al.). In fact, applying RFID tags to boarding passes and creating passenger information kiosks with RFID tag reader capability can make it possible for passengers to check on gate information, updated flight information, and even the location/status of their baggage anywhere in the terminal simply by presenting their boarding passes to an RFID reader in a kiosk. The use of RFID baggage tags can make it possible to increase the level of automation in moving baggage from the check-in point to the correct aircraft. Because increased automation in the handling of baggage means reduced opportunities for human error, baggage is much less likely to be misrouted, and any rerouting of baggage required because of late gate changes can be accommodated much more readily. Tying baggage tags to boarding passes, can make it possible for passengers to check on the status of their baggage at any time.

**Air Carrier Oriented Technologies**

While the technologies mentioned above were discussed in the context of improving the passengers’ experiences within the air transportation system, some of those same technologies can also positively impact the airline industry’s bottom line. For instance, improving the business intelligence capabilities of airline information systems, and integrating the resultant knowledge into the yield management systems, can significantly improve the financial situation of the airline industry by increasing the number of aircraft seats that are filled with passengers who purchase their tickets at the highest price possible.
As described above, the hub-and-spoke systems used by larger airlines were designed to take passengers from anywhere to anywhere else. These systems, however, have a number of built-in inefficiencies that drive up the cost of operations. Large numbers of employees, gates, baggage handling equipment must be maintained to ensure that peak volume service requirements can be met. Also, significant numbers of aircraft often sit for hours waiting for the next set of scheduled connections to take place. From an income point of view, the hub-and-spoke system cannot adequately address the preferences of those passengers who would willingly pay a somewhat higher price to have direct flights to their destinations. Again, increased use of business intelligence can provide an airline with the necessary information to develop a combination of direct and hub-and-spoke flight schedules that will improve the airline’s yield management, and help make more efficient use of the airline’s employee, gate and equipment resources. Believing that passenger demand for point-to-point travel will ultimately cause airlines to increase the number of routes serviced in this manner, Boeing has recently concentrated on the development of highly efficient aircraft designed to address that demand (McNerney).

Within the terminal, the deployment of passenger and baggage check-in kiosks can reduce the number of employees needed in and around the ticket counter; even the number of ticket counters needed may be reduced. The application of RFID tags to both boarding passes and baggage tags can, when tied into flight and boarding gate scheduling systems and baggage handling systems, can also reduce the number of employees needed to answer passenger questions and help ensure that passengers are where they need to be at the proper time. They can also help speed up both the boarding process and the baggage unloading/loading process, thus decreasing the time individual airplanes spend at the gate.

Replacing the wired passenger audio/video systems currently used on aircraft with wireless systems can help reduce overall aircraft weight, thus saving on fuel costs. In addition, it is easy to envision the development of additional revenue generating entertainment systems that take advantage of the flexibility of digital wireless connectivity.

**Industry Oriented Technologies**

At present, all but a few airports allow individual airlines to “own” a specific set of gates and maintain their own telecommunications infrastructures that schedule those gates and handle their check-in counters, video feeds, baggage handling and other such systems. In those airports in which it has been implemented, the common use of the available facilities, including all gates, the telecommunications infrastructure and the various facilities it controls, means that each individual airline no longer needs to install and maintain its own infrastructure. This also means that an airline does not have exclusive use of a particular set of gates, but is assigned gates as they are needed. By increasing the utilization of individual gates, fewer total gates are needed, overall facilities costs are lower and the related costs each airline incurs are also reduced. With the entire airport telecommunications infrastructure owned and operated by the airport authority, each airline no longer needs to maintain its own flight schedule displays and information kiosks. The total number of employees engaged in baggage handling related activities can be reduced because of the improved labor utilization that results from their centralization (Briody).

The introduction of computing technology into the cockpit can help speed the pre-flight preparation process. Providing the flight crew with wireless portable computing devices can
significantly reduce the time it takes to get a flight off the ground by enabling them to retrieve flight manuals, perform required load calculations and submit flight clearance data electronically.

While a number of infrastructure and regulatory changes must be forthcoming before it can be adopted for general use, the use of the global positioning system (GPS) for navigation in the airline industry can have a significant impact on the use of fuel. At present, aircraft must fly along paths designated by the ground-based radar system instead of along the most efficient path between the origination and destination points. GPS, used in conjunction with a system that constantly broadcasts each aircraft’s location to all other aircraft, can both improve safety and reduce the flight time and fuel used by an aircraft.

Conclusion

Properly implemented, technology can have a significant impact on the airline industry. Technologies that improve a passenger’s experiences from the point where they enter the system as a prospective passenger to the point where they exit it at their destination significantly increase the likelihood that they will view future opportunities to fly positively and, over the long term, will tend to increase the ticket price amount they consider to be reasonable. From better use of business intelligence and improved flight scheduling to the use of passenger and baggage check-in kiosks to the use of RFID technologies in boarding passes and baggage tags, the introduction of such technologies into the airport terminal environment can significantly reduce the number of employees needed to provide the same or improved levels of service to passengers. Industry wide, common use air terminal facilities and their infrastructures can reduce the airlines’ cost of doing business and, at the same time, smooth the flow of passengers through those facilities. The adoption of GPS navigation systems can free individual aircraft from having to follow flight paths that waste fuel and flight time, resulting in a reduction in the overall cost of each flight.

The airline industry must embrace new technologies if it is going to survive in a form that we would recognize. Per unit labor and fuel costs are not expected to go down significantly in the near future. This means the number of actual units of labor (employees) and fuel used per passenger mile flown will have to be reduced to lower related costs. The application of technology in ways that will allow those reductions to be made, while maintaining an acceptable level of customer service, must be undertaken.

REFERENCES


