Navigating the Airport of Tomorrow

TRAVEL TECH CONSULTING

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Foreword

The travel industry continues to strive to deliver a seamless traveller experience. All of us that travel, whether it is for business or leisure, look forward to a day when we enjoy the journey almost as much as the time at our destination.

At Amadeus, we believe the airport experience is one of the last frontiers in the quest for this seamless travel experience. It is clear from the passengers that we surveyed when compiling data for this report, that we are still some way off this goal. Frustrations still exist around check-in, security and baggage. Lots of these frustrations stem from a lack of information and poor communication between the airline, airport and the passenger.

But whilst the impact on the passenger is clear – extended journey times, too much complexity, lack of information – the impact on the airport and airline is equally clear. For airlines, a poor airport experience significantly impacts how its brand is perceived, as passengers do not view the airport experience as separate to the services provided by the airline directly. For the airport itself, lack of passenger information and integration with airlines can lead to lost revenues and reduced productivity.

Through a combination of passenger insights and expert opinion, this report paints a picture of the airport of tomorrow.

We are committed to working with our customers and partners across the sector to break down the barriers to delivering this vision. We believe that by embracing new technologies and with greater collaboration between airlines, airport and partners that an easier, quicker and more responsive airport experience is within reach.

We hope that *Navigating the Airport of Tomorrow* will help to stimulate new thinking and new innovations that will both transform the passenger experience and deliver value to airports and airlines.

Julia Sattel

VP Airline IT, Amadeus IT

1 Executive summary

At one point in time air travel was considered a luxurious experience. Today, the airline passenger often encounters long lines, crowded spaces, lost baggage and service delays. To the customer, the airport experience is viewed as a single continuous part of their trip, unaware that airport operations actually involves different stakeholders, the airline, the airport and the ground handlers, all working together to deliver a seamless passenger flow. Although today technology is at the heart of airport operations, a critical factor in the future successes of an airport and airline is how they harness emerging technologies to enhance the customer experience, improve customer loyalty and empower their employees to achieve greater operational efficiencies.

The age of passenger centric technology

The growth of personal mobile technology is ushering in a new era of passenger centric services. In today's environment of instant information, consumers expect to be constantly informed by connecting to a variety of sources whilst maintaining contact with their social networks. To keep pace with the expectations of the customer, airlines and airports must take concrete steps to take advantage of these emerging devices and technologies. As personal technology continues to evolve, they must also keep pace with customer expectations and utilise these new platforms to improve loyalty and travel efficiency.

At the heart of this enriched passenger experience is knowledge of the customer. To effectively deliver personalised services based on that knowledge, sharing information internally and proactively communicating to the customer are a must. This requires a re-thinking of the airline/airport relationship with the goal to provide passenger insight to all members of the value chain.

Market pain points

Research on passenger dissatisfaction reflects the obvious issues that make air travel difficult. Three main areas represent the majority of passenger complaints: service disruptions, long check-in lines and baggage issues. Through the adoption of new communication techniques and internal systems that take advantage of advanced technology and shared information, airlines and airports can improve their delivery of services focusing on these three primary passenger pain points.

Airlines and airports are challenged with updating their operational systems to eliminate unnecessary manual steps whilst interconnecting existing information silos to better manage the entire passenger experience. Integration between Departure Control Systems (DCS), Passenger Service Systems (PSS), Baggage Reconciliation Systems (BRS), and airport services can provide improved passenger processing. Delivering services on advanced mobile devices will help all entities be more efficient and operate with lower costs.

The airport of tomorrow

To fulfill the vision of the airport of tomorrow all stakeholders, the airline, the airport and the passenger must be interconnected with electronic communication driving greater efficiencies and customer satisfaction.

- A new age of passenger self-service is being driven by the adoption of smartphones and tablets. The always connected traveller will expect to receive information and promotions (on an opt-in basis only) based on their status, location, personal needs and specific situation.
- Airlines will utilise this new self-service age by redeploying airport resources to areas of specific operational challenges.
- Airlines will embrace new interconnected DCS and PSS technology and share critical passenger information with the airport.
- Airports which need to drive greater profitability and enhance the user experience will adopt merchandising strategies promoting airport shops transforming the airport into a modern shopping mall experience.
- Technologies such as Near Field Communication (NFC), RFID tags and the use of tablets to enable roaming agents will have a dramatic impact on airport operations.
- At the heart of this technological revolution is the more informed passenger. The always connected passenger will demand information and services delivered on their preferred personal computing device at all points of their journey.

All sectors of the industry share a common vision of a more automated, efficient airport experience. This paper will explore the steps necessary to bring this vision to reality. We will look at this transformation from the short term view, identifying the key building blocks being implemented today and in the near future to improve the passenger airport experience.

2 The passenger centric model

Over the past 50 years global air travel has become accessible to millions worldwide. Despite tremendous improvements in passenger comfort, convenience and price; excessive crowds, service disruptions and lost baggage still plague the industry. We are at the dawn of a new era in passenger processing. Mobile technology and new integrated systems are transforming the airport experience enabling personalised communication and services to aid the customer on their journey. This paper looks at the airport experience from three perspectives – the airline, the airport and of course the passenger, providing a roadmap to the airport of tomorrow.

At the heart of the changing airport experience is technology. Silos of standalone automation are being replaced with integrated systems that allow the exchange of information between the airline, airport ground handlers and customer. The airline is embracing self service technology to improve passenger processing and differentiate its services. Airports are investing in next generation technology to automate the security, baggage handling and check-in process. Meanwhile, the customer continues to embrace powerful mobile technology that provides a platform for new airline and airport services.

We are truly at the age of passenger-centric mobile computer devices. The smartphone in your pocket is more powerful than the super computers of the 1970s. We are also in an age of instant information. Mobile computer devices provide an always connected traveller who expects to be constantly informed about their travel plans.

The industry has been awaiting the mobile revolution for decades. During the 1990s and early 2000s mobile phones became a standard accessory for the frequent traveller. With the introduction of the iPhone in 2007, a permanent change hit the mobile device market. No longer would travellers be happy with a mobile phone, but would require the ability to browse the Web and download innovative applications which shifted the focus from mobile telephony to mobile computing. The introduction of the iPad in 2010 is having a similar impact resulting in a flood of tablets hitting the market in 2011. These tablets represent a new platform that brings powerful computing, formally confined to the laptop, with touchscreen interfaces and downloadable apps similar to the smartphone. (Fig 1)

Figure 1 Timeline of personal mobile technology

Source: Travel Tech Consulting, Inc.

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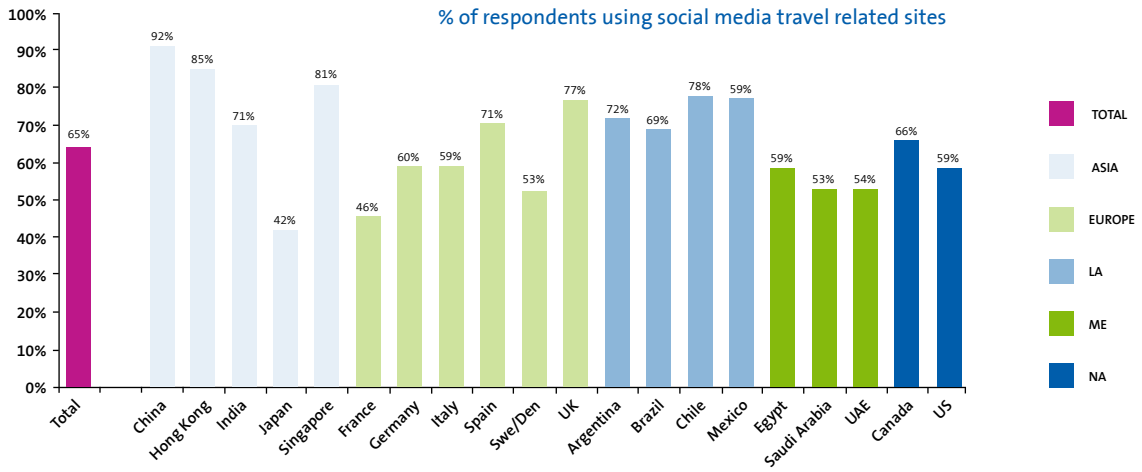
Figure 2 Passenger-centric mobile computing devices

Source: Travel Tech Consulting, Inc.

For airlines and airports the emerging mobile computing platforms provide a new way to communicate and control passenger flow. This includes more accurate and instantaneous information on flight arrival and departures, self-service check-in, baggage tracking and overbooking and disruption management. These mobile platforms also provide a new opportunity for passenger merchandising of airline and airport ancillary services. (Fig 2)

Whilst the mobile revolution is in full swing, a simultaneous revolution is occurring in respect to the influence of social media. With Facebook now the top website in the U.S.[1] and with over 500 million users globally representing 1 in every 13 people on earth, the impact of social media cannot be ignored. The relationship between mobile devices and social media is clear with more than 200 million active users currently accessing Facebook through their mobile devices.[2] This is a global phenomenon impacting travellers worldwide. According to a recent study by JD Powers commissioned by Amadeus, and which covered respondents across five regions, over 60% of travellers worldwide use social media travel related sites. (Fig 3)

Figure 3 Social media: Total and country - use social media for travel related purposes



Source: 2010 JD Power's 'Global Airline Traveller Survey' commissioned by Amadeus

1 Tsotsis, Alexia December 29, 2010 "Hitwise: Facebook Overtakes Google To Become Most Visited Website In 2010" TechCrunch http://techcrunch.com/2010/12/29/hitwise-facebook-overtakes-google-to-become-most-visited-website-in-2010/

2 Facebook Press Room : http://www.facebook.com/press/info.php?statistics

For airlines and airports, understanding the impact of mobile use of social media is essential. One customer complaint is now amplified across the traveller's social graph impacting the carrier's brand and influencing other customers. With instant feedback, airlines and airports must implement comprehensive mobile social media strategies to identify influential unhappy travellers and implement immediate action to better manage passenger frustration and improve customer satisfaction.

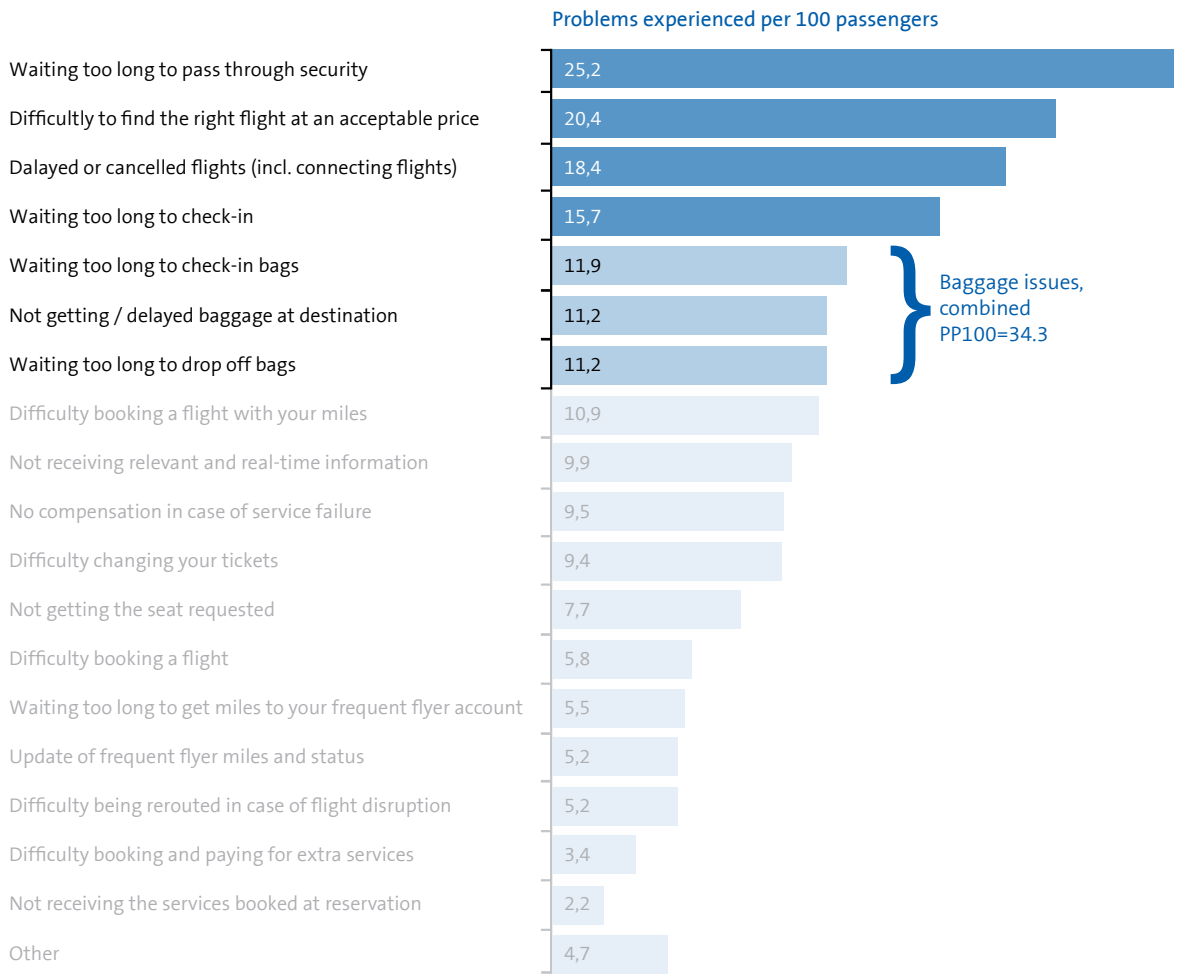
3 Understanding market pain points

To better understand the roadmap for the airport of tomorrow, it is essential that each market segment's pain points be identified. We will look at market challenges from three perspectives: the passenger, the airline and the airport (including ground handlers).

The passenger perspective

In the JD Powers study passengers cited three airline operational issues as having the most severe impact on their travel experience: baggage issues, disruption management (delayed or cancelled flights), and check-in time delays. The number one issue of airport security wait times clearly presents challenges for airlines and airports based on individual country and city requirements and thus beyond the control of both these entities. Managing baggage delays, cancelled flights and improving the check-in experience are all areas where airlines and airports can work together to better manage the communication and services delivered around these issues. The JD Powers study indicates that 18.4 out of 100 passengers experienced delayed or cancelled flights and 15.7 out of 100 passengers complained about wait times during the check–in process. Clearly, from a passenger perspective there is a need for improvement in these areas. By far, baggage was the most significant issue citied in this survey with 34.4 passengers per 100 experiencing some delay in baggage handling. (Fig 4)

Figure 4 Problems experienced on most recent flightS



Source: 2010 JD Power's 'Global Airline Traveller Survey' commissioned by Amadeus

Baggage issues

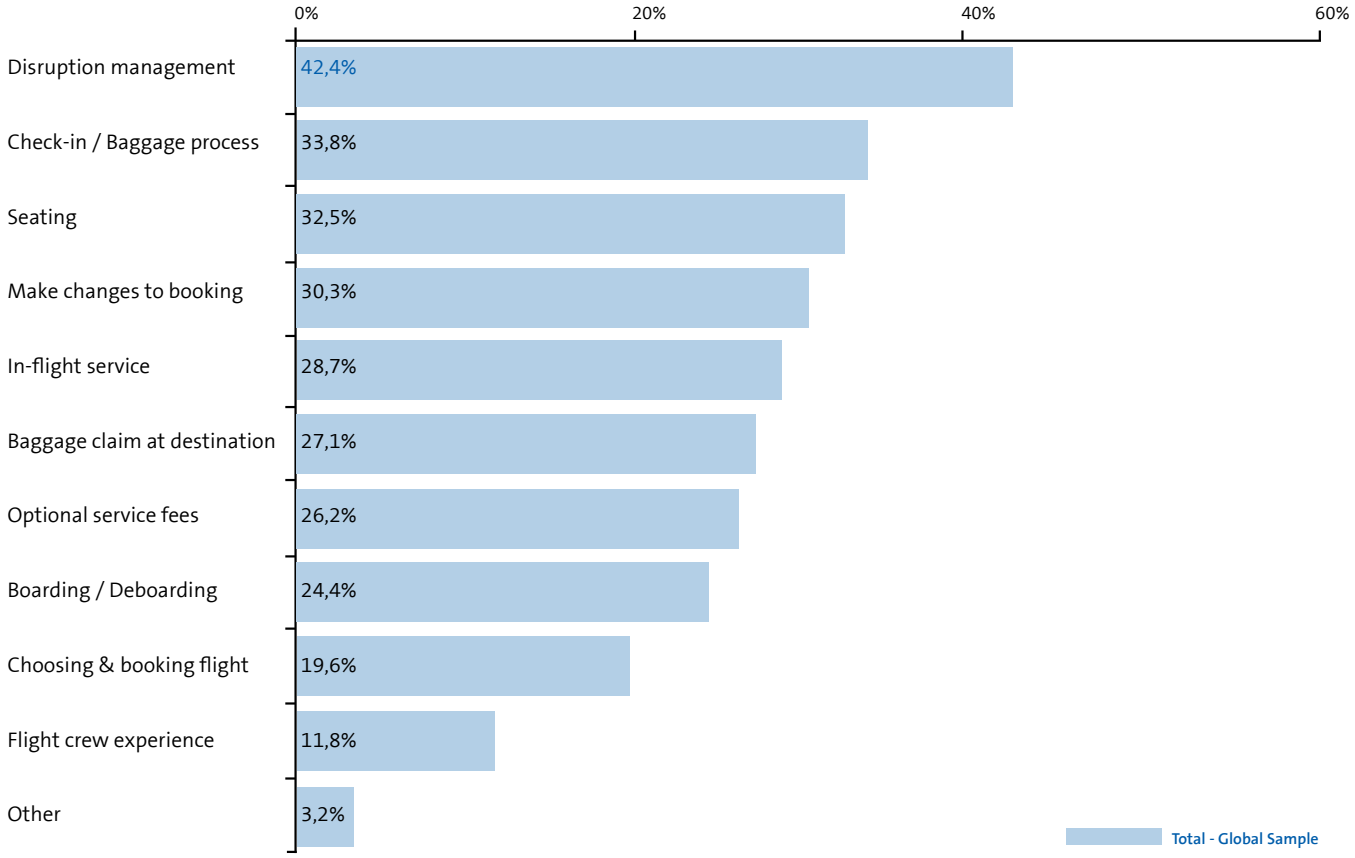
All aspects of baggage handling represent serious issues to the customer. The baggage check-in process is plagued with long lines and often requires physical strength and agility just to keep your baggage together whilst waiting for the next available agent. Waiting at the luggage carrousel for your baggage to arrive can seem endless. Losing your bag can impact a long planned holiday or an important business trip. Now that most airlines are charging for checked baggage, this has become an even more sensitive subject with passengers. According to a SITA/Air Transport World Passenger Survey, in 2009 airlines reported that about 1% of total baggage was mishandled, equating to slightly more than 25 million bags globally.[3] Clearly, baggage handling is a prime area for improved processing and customer communication.

Service disruptions

Nothing is more stressful for the traveller than delayed or cancelled flights. Some delays are controllable whilst many are not. It is immaterial to the customer whether or not the cause is within the control of the airline or airport. A delay can impact the entire travel experience. 2010 was particularly severe with last winter's European volcanic ash disruption as well as this year's heavy winter snowstorms putting a strain on airline operations worldwide. The eruption of the Eyjafjallajokull volcano in Iceland on April 14, 2010 led to massive closure of airspace in Europe for six days. The financial impact to airlines was estimated to be US$1.8 billion of revenue loss with 10 million passengers and 100,000 flights impacted during the six day period.[4] **(Fig 5)**

Solving service disruptions is a priority for all airlines but will require an investment in improved airline systems, the ability to distribute workload through roaming agents and the automation of communication of changes and electronic vouchers to the passengers on their personal mobile devices.

Figure 5 Aspects of travel for improvement



Source: 2010 JD Power's 'Global Airline Traveller Survey' commissioned by Amadeus

3 IATA Press Release October 2010 "Baggage Management: Behind the Scenes" http://www.iata.org/pressroom/airlines-international/october-2010/pages/06.aspx
4 IATA Fact Sheet "Volcanic Ash" http://www.iata.org/pressroom/facts_figures/fact_sheets/Pages/volcanic-ash.aspx

The check-in experience

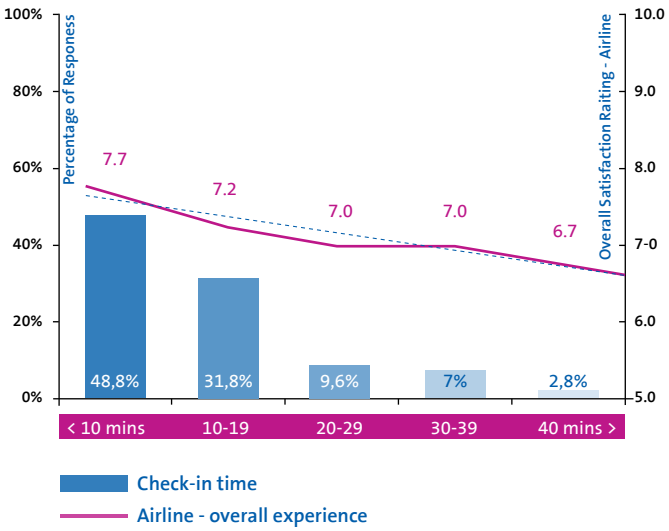
With the introduction of kiosks and the print-at-home boarding pass now in full implementation by a majority of the world's airlines, the entire check-in experience is becoming simpler, but customer frustration remains significant the longer the passenger waits in line. **(Fig 6 & 7)**

Even with the paper or electronic boarding pass, long lines persist. Can the entire check-in process be further simplified? Technology such as Near Field Communication may hold the answer to more automated check-in. As airports install NFC stations and more mobile devices come loaded with NFC readers, passengers will be able to check-in by simply swiping their phone against a reader. The introduction of permanent boarding passes and luggage tags as showcased by Qantas for domestic Australian flights will make the process more efficient. Ultimately lines cannot be eliminated entirely, but roaming ticket agents using emerging tablet technology may hold the key to reducing line waits and improving the check-in experience. Qantas has installed NFC readers at the Sydney and Perth airports allowing the easy self-check in using NFC enabled smartcards.

The role of communication in easing customer frustration

In the 1990s many airlines implemented a basic process that helped ease customer frustrations with delays. That process was simply to make frequent announcements providing an update on the status of the flight. This simple operational change did not eliminate passenger frustration, but does demonstrate the role simple communication plays in lowering passenger stress levels.

Figure 6 Average check-in time



Source: 2010 JD Power's 'Global Airline Traveller Survey' commissioned by Amadeus

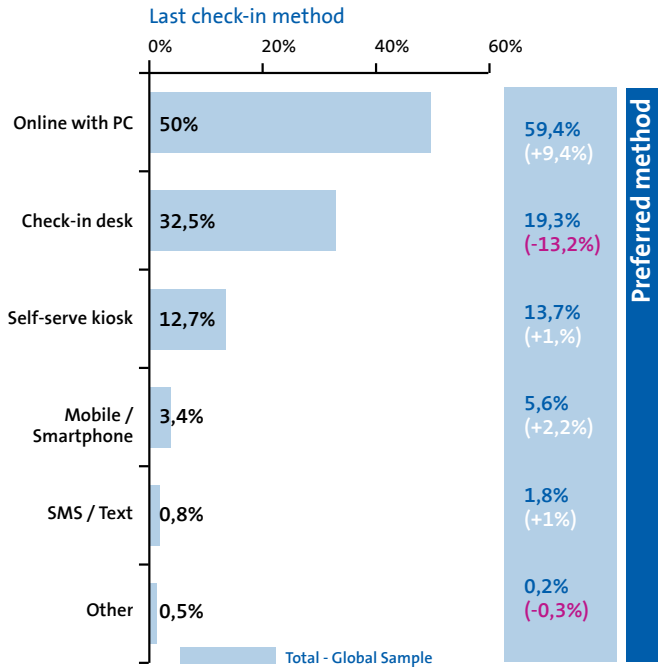
Passengers are looking for additional communication from the airlines as evidenced by the JD Powers survey results.

With our current era of instant information, airlines must utilise mobile channels to better communicate service issues particularly with their best travellers. Providing flight updates have become a standard offering for most carriers, but insuring that the communication is timely and personalised represents the next frontier for passenger communications.

Meeting the needs of different passenger segments

Not all travellers are created equal. This may sound like a cliché, but when it comes to airport operations, providing different services to various customer groups particularly based on status has long been standard operational procedure. But product differentiation has to go beyond simply having a dedicated check-in area for top frequent flyers. Airlines have embraced the concept of lifetime customer value. There are many factors that influence the value of the customer to the airline beyond simply the price they paid for the ticket. Factors such as their travel patterns (domestic versus international), class of service habits, and the distribution channel where the customer purchased the ticket all go into the calculation of customer value. As communication becomes more automated, airlines need sophisticated tools that work across operational systems to ensure that the airlines' most valuable customers receive the best service. This is particularly true during times of service disruption.

Figure 7 Check-in method



Source: 2010 JD Power's 'Global Airline Traveller Survey' commissioned by Amadeus

Mobile/smartphone boarding passes are in their infancy, but customer acceptance is growing.

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The airline perspective

Few passengers are aware of the information infrastructure needed to support an airline's airport operations. Unfortunately, silos of information, technology and function exist at many airlines. Systems have been built and deployed to handle specific functions. This is particularly true when it comes to departure control systems (DCS). Given the operational realties of the airline, it is truly challenging for a carrier to embark upon a change in systems due to the level of disruption caused by new training and revised procedures. This represents a legitimate obstacle to change, but also represents the biggest opportunity for improvement.

Legacy DCS systems often present unique challenges particularly during times of extended service disruptions. In some airports the DCS is based on Common Use Terminal Equipment (CUTE) that provides a platform across multiple airlines, but has limited or no connectivity to the airline's PSS. Even where an airline is using a dedicated system, this technology was often created many years ago and lacks comprehensive capabilities requiring manual processes and work arounds. Newer departure control systems have entered the market to solve these limitations, but integration with the airline passenger service systems (PSS) is still needed to seamlessly handle passenger requirements.

Airlines are faced with the need to balance a reduction in staff made possible by increased self-service techniques with the need to staff appropriately during times of service disruption. Depending on the severity of the service disruption, providing sufficient staff during these times continues to be a challenge for most airlines. The key to managing service disruption is more integrated systems and enhanced client communication.

Passenger information is viewed by many airlines as proprietary. The issue boils down to who owns the customer relationship. Airlines want to maintain and enhance the relationship, particularly with their best customers. As a result the willingness to share passenger information with airport partners is often limited. With the passenger embracing self-service check-in, the interaction between the airline and customer often does not occur until the gate. As a result, the passenger's perception of the airline can be influenced by their interaction with airport based services, that have limited knowledge of passenger requirements. This new self-service reality means that the airline needs to consider a more flexible policy on sharing customer information with their airport partners in order to improve passenger processing and enhance the customer experience.

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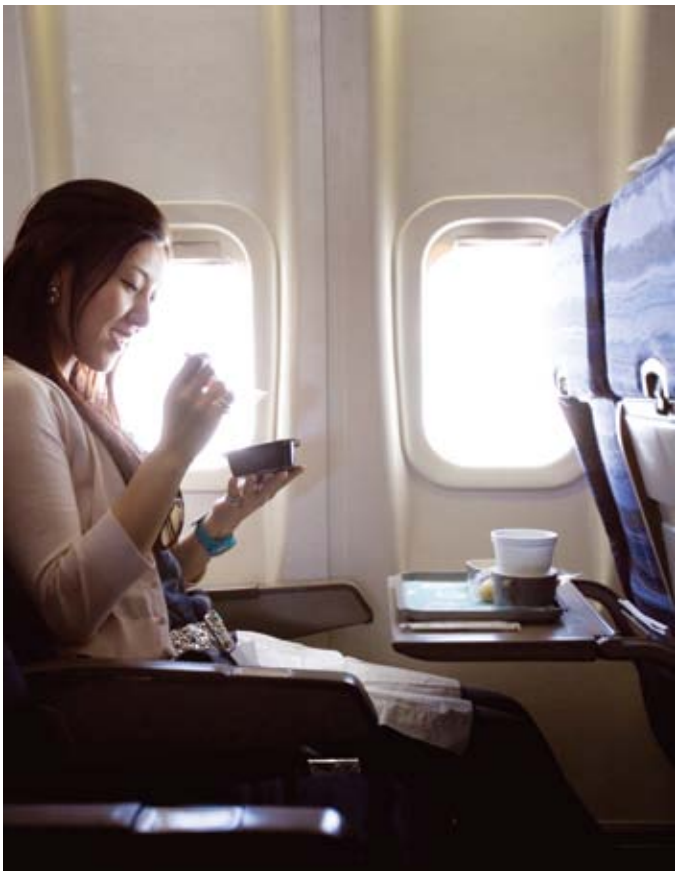
Airlines have long battled the customer view of the airline as a commodity, where airline choice is based solely on price. Investments in aircraft amenities and ancillary service offerings are ways the airlines are fighting this perception. Ultimately airlines want to offer services to passengers based on the value of them as a customer. This goes beyond a simple loyalty status, but encompasses the ability to offer different services based on the traveller's historical travel pattern, purchasing method, trip persona (e.g. travelling on business versus with the family) and ultimately impact on incremental revenue. Understanding the particular persona of the passenger is important as needs on a business trip differ from the needs of the same passenger travelling on holiday with their family. To truly match the appropriate ancillary offerings to the right customer and match their particular trip persona, it is essential that a total 360 degree view of the passenger be known throughout every step of the trip including their interaction in the airport with self-service technology or airline personnel. For example, the business traveller may benefit from purchasing a lounge pass, whilst this may be impractical if they are travelling with their family. Personalising the ancillary purchase experience to match not only customers' preferences, but aligning with the particular customer persona can lead to greater up-sell opportunities. The persona of the individual is directly related to the level of relevance of the offer and must be part of the targeting process. With the introduction of ancillary services, the airlines are using items such as seat pitch, boarding priority, and club room access to target specific travellers with amenities that influence traveller loyalty and help differentiate the airline from their competitors.

Ultimately it comes down to having the right technology in place to manage operations whilst satisfying passenger requirements. The lack of system integration can be severe when the DCS system is not integrated with the PSS. A traditional disconnected DCS lacks the customer insight and reservation detail to match the right services for the right passenger at the right time. The lack of integration of booking information with the check-in process causes additional manual steps as changes in one system are not reflected in the other. This becomes a serious problem during times of severe service disruptions when re-accommodation may take days due to airport closures. At the heart of the change needed is a re-evaluation of existing business processes and the implementation of technology to eliminate manual steps and provide greater insight into customer value at every point of customer interaction whether through airport agents or electronically. To accomplish this goal the airline must work with the airport, ground handlers and even complimentary services such as ground transportation to deliver a common positive experience across the entire travel eco-system.



With the introduction of ancillary services, the airlines are using items such as seat pitch, boarding priority, and club room access to target specific travellers with amenities that influence traveller loyalty and help differentiate the airline from their competitors.

The airport perspective

Airport automation has always involved significant investment in infrastructure. Airports strive to balance passenger comfort with operational efficiency whilst striving for a unique experience that reflects the specific destination. A growing global trend is the privatisation of airports. This may entail a complete shift to private ownership or a government industry hybrid model where investment from private equity firms is combined with government support. This has created a more business-centric focus on return on investment for any airport IT expenditure. As Low Cost Carriers continue to grow and embrace secondary city airports it puts added pressure on traditional airports to modernise to effectively compete.

Airport technology is often locally deployed. This approach has been chosen by airport executives because of the perceived value and control of locally installed software. With the IT industry moving to cloud based computing, the idea of installing software at the airport for individual functions is both antiquated and inefficient. This local focus not only impacts the airport's ability to execute common processes across airlines and terminals, but also does not allow airports to share best practices by using a common platform.

The reality is that today's airport technology is highly fragmented. For example, a key component of baggage automation is the Baggage Reconciliation System (BRS). In some airports a BRS does not exist, in other airports a different BRS exists in different terminals and in most cases the BRS is not integrated with airline systems. This standalone nature of the BRS is symptomatic of the bigger problem of lack of system integration within airport systems and between airport and airline technology.

Airports suffer from a lack of customer insight. This takes the form of both operational weakness as well as limitations on customer centric services. To counteract this lack of customer knowledge some airports have launched loyalty programmes. As with similar programmes at retailers such as supermarkets, the loyalty effort is more about gaining insight into customer requirements and preferences rather than simply rewarding the passenger for their airport usage. In order to increase profitability, merchandising of airport shops and services is critical. To effectively promote relevant airport services to the right customer at the right time, customer insight is mandatory. Products and service offers need to be customised to fit specific traveller preferences encouraging greater spend at airport shops and restaurants.

Whether or not the airport decides to invest in new systems to improve passenger processing and merchandising, passengers themselves will increasingly demand enhanced services that they receive from other transportation providers and retailers. For example, as rail companies embrace Near Field Communication (NFC) to simplify and improve the passenger boarding process, the customer will expect the same type of experience at the airport. Retailers such as Best Buy and Macys have implemented sophisticated mobile marketing platforms offered by innovative start-ups such as Shopkick. By implementing Shopkick, the retailer can target specific mobile promotions based on the customer's precise location in the store. As retailers offer specific targeted mobile promotions to shop visitors, passengers will come to expect this same type of one-to-one marketing at the airport. In fact, the airport could be viewed as a shopping mall and thus consumer behaviour which is being shaped by technology such as Shopkick will be expected by the always connected traveller. Without passenger insight this type of electronic merchandising will not be possible.

To effectively promote relevant airport services to the right customer at the right time, customer insight is mandatory. Products and service offers need to be customised to fit specific traveller preferences encouraging greater spend at airport shops and restaurants.

The ground handler perspective

Given the fact that airlines outsourcing has transferred ground operations to third party providers and self-service technology, the airline staff may not see the passenger until they are on board. Therefore the quality of service and the ultimate satisfaction of airlines passengers are often influenced by the interaction with these third parties providers. This presents a challenge for all airlines and airports. For airlines to ensure consistent quality of service in a worldwide network, they must find a way to manage a series of diverse third party providers often not linked to each other. This is complicated further as these ground handlers often service several competing airlines.

With the baggage process often outsourced to third party ground handlers, the lack of integrated technology impacts the ability to share information between the ground handler, airline and airport. The ground handler has no insight into the number of bags being checked-in for a given flight, the overall load factor of the flight or the actions required to reconnect the passenger with their bag during service disruption. This impacts the company's ability to staff and deliver the highest quality service thereby influencing the passenger's perception of the airport and airline. This segment of airport operations is historically a low margin business. In the end the luggage needs to be tracked in the same way as the passenger. Understanding where the baggage is located at all times is critical and technology such as RFID tags can play an important role in this process. Again this information must be seamlessly integrated with ground handler operations, airline DCS and PSS technology and airport systems. Centralised systems controlled by sophisticated business rules can help airlines 'impose' their specific procedures regarding passenger treatment on ground handlers even if the same third party company is servicing competing airlines.

Understanding where the baggage is located at all times is critical and technology such as RFID tags can play an important role in this process.

4 Enhancing the travel experience

Given current challenges faced in passenger servicing and IT investment, how can the airport/airline experience be improved today and what technologies should we expect in the next five years and beyond?

Managing passenger expectations with mobile technology

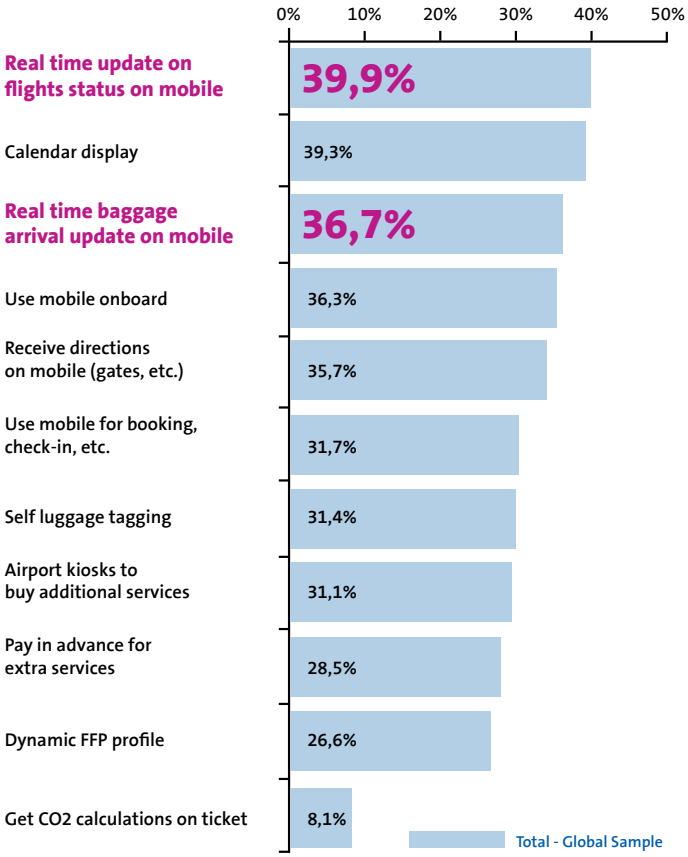
The mobile revolution presents both opportunities and challenges for airlines and airports. The growth of self-service capabilities has allowed airlines to reduce staff, but the same technology that is driving greater efficiency is creating an environment where passengers expectations for instant information and knowledge is heightened, forcing the airline and airport to provide dynamic information to the mobile computing platforms that inform and enhance the airport experience. These expectations are already set as evidenced by the JD Powers survey which showed that close to 40% of respondents would use real-time updates sent to their mobile whilst 37% want real-time baggage updates. (Fig 8)

This is only the beginning of the passenger-centric mobile evolution. Mobile devices are extremely personal and thus passengers expect not just generic updates that distribute the same message to all customers, but personalised communication that addresses their specific concerns. In order to achieve this goal, the real time information must be personalised, location sensitive and context aware. (Fig 9)

Personalised

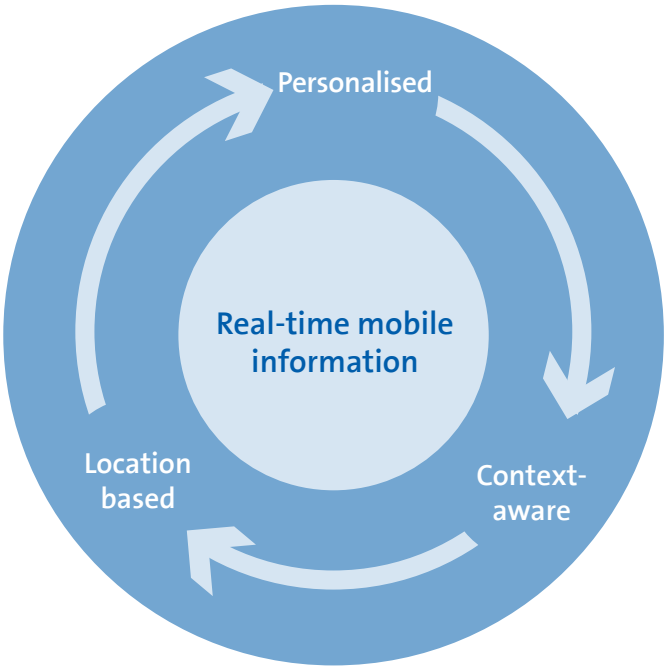
Information needs to be filtered to reflect personal preferences. It is also essential that the specific persona of the passenger be part of the messaging. A frequent business traveller on holiday with their family needs to be treated differently to when they are travelling on a company trip. A challenge faced by all sectors is the ability to collect personal information. Whether through explicit means or implicit tracking, developing a holistic view of the passenger is essential. This is where integration with an airline's PSS is critical to gain additional customer knowledge.

Figure 8 Innovative features / services total: would use?



Source: 2010 JD Power's 'Global Airline Traveller Survey' commissioned by Amadeus

Figure 9 Real-time mobile information



Source: Travel Tech Consulting, Inc.

Passengers expect not just generic updates that distribute the same message to all customers, but personalised communication that addresses their specific concerns.

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Location based

The location of the passenger in the airport provides essential information to the airport and airline. Although GPS equipped mobile phones have become standard, the ability to use satellite location tracking indoors is still a challenge.

Near Field Communication (NFC) will ultimately provide location within the airport. NFC involves two pieces of hardware. One is an RFID (radio frequency identification) chip in a mobile phone (or other device) and the other is an NFC reader at a merchant or transportation facility. However, NFC requires a significant infrastructure investment and will therefore take many years to become common place in airports around the world.

Figure 10 highlights a passenger named Gary Gale who is being tracked all the way to the international gate. It illustrates how passenger tracking could be enabled through NFC monitoring of passenger location. Passenger location based tracking can help airlines better anticipate their passengers' expected arrival at the boarding gate and allow them to send reminder messages to the ones who are missing.

In the near term, an alternative solution to passenger location tracking available today is the use of Wi-Fi based tracking. Rather than simply thinking of Wi-Fi as a passenger service for Internet connectivity, airports need to recognise that Wi-Fi provides the infrastructure for more precise real time passenger location tracking.

Figure 10

Source: http://telink.mobi/sfo/map.jpg

Context aware

Understanding the real time needs of the passenger is essential to delivering effective communication. Is the passenger running to make their flight or able to spend a few hours at airport shops having arrived at the airport three hours early? Mobile communication is all about relevance. Understanding the specific situation of the passenger is crucial to delivering meaningful information.

As the pace of technology innovation continues to accelerate, the expectations and needs of the passenger will expand. The challenge for the airline and airport is that increased use of real time mobile communication may not solve the needs of all passengers. Connecting customer service fulfilment with passengers who require human interaction will be further enabled by allowing agents to roam the airport providing more flexible solutions as required. The tablet revolution provides a new mobile capability for the airline agent which will change the paradigm from the traditional queue to a more passenger specific customer service approach.

Many airlines already offer ancillary services through self service kiosks. Offering ancillary services at the point of mobile check-in or through targeted promotions can help sell extras such as priority boarding, club room access or enhanced seating.

Implementing airline priorities

In an effort to better differentiate their offerings and provide improved customer service, airlines are implementing customer recognition strategies. Airline marketing is evolving beyond simple loyalty status to developing a better understanding of the value of every customer to the airline's bottom line. Sophisticated PSS technology can provide the underpinnings for this customer value calculation, but executing on this strategy requires a multi-pronged approach ensuring that consistent communication is sent to the passenger at all points of contact. Various market segments have differing requirements as well. Just as airlines execute marketing programmes to address specific segments such as groups, seniors, business travellers and families, so must the evolving communication structure reflect the specific requirements of these segments.

The need to more precisely match communication with customer value is particularly relevant during times of service disruptions. By automating tasks such as delivering electronic vouchers, notifying the passenger of an automated rebooking activity, and proactively providing the real time location of the passenger's baggage, queue waits can be reduced and passenger frustration eased. Comprehensive and interconnected passenger information is critical to achieve this vision. From the passenger perspective the airport experience is a single activity. As such, airlines must recognise the value of sharing information with the airport in order to provide integrated customer service delivery.

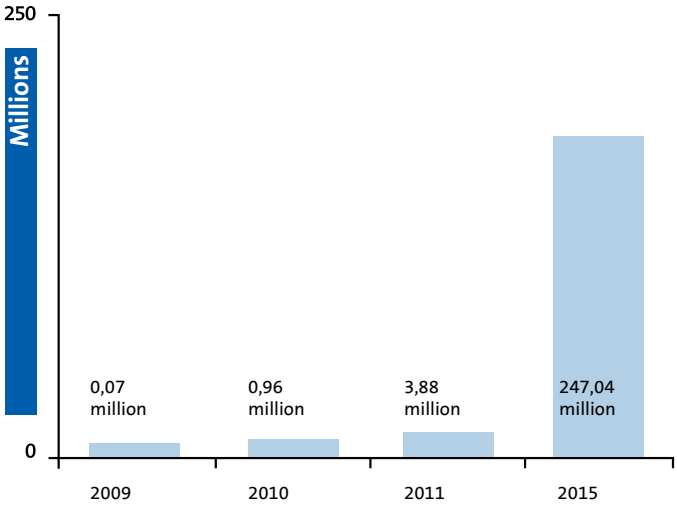
Whilst the passenger is at the airport, the airline also has the opportunity to sell ancillary services and products whilst the customer waits for their flight. Many airlines already offer ancillary services through self service kiosks. Offering ancillary services at the point of mobile check-in or through targeted promotions can help sell extras such as priority boarding, club room access or enhanced seating. It is important to note that any customer communication needs to be on an opt-in basis, reflecting privacy concerns and avoiding the perception of spam. Airlines may also take greater ownership of airport transportation options helping the passenger locate taxi, train, bus and other options when they leave the plane.

Enhancing the airport experience

NFC

The main goal of the airport is to ensure the safe flow of passengers from the airport entrance to the gate. Along the way, the opportunity to merchandise airport products and services represents an essential revenue opportunity for the airport. Technology such as NFC will likely play a critical role in the airport experience but requires a significant investment in infrastructure and a critical mass of smartphones with NFC readers. By 2015, 247 million smartphones will be NFC enabled. (Fig 11)

Figure 11 **NFC-enabled handsets worldwide**



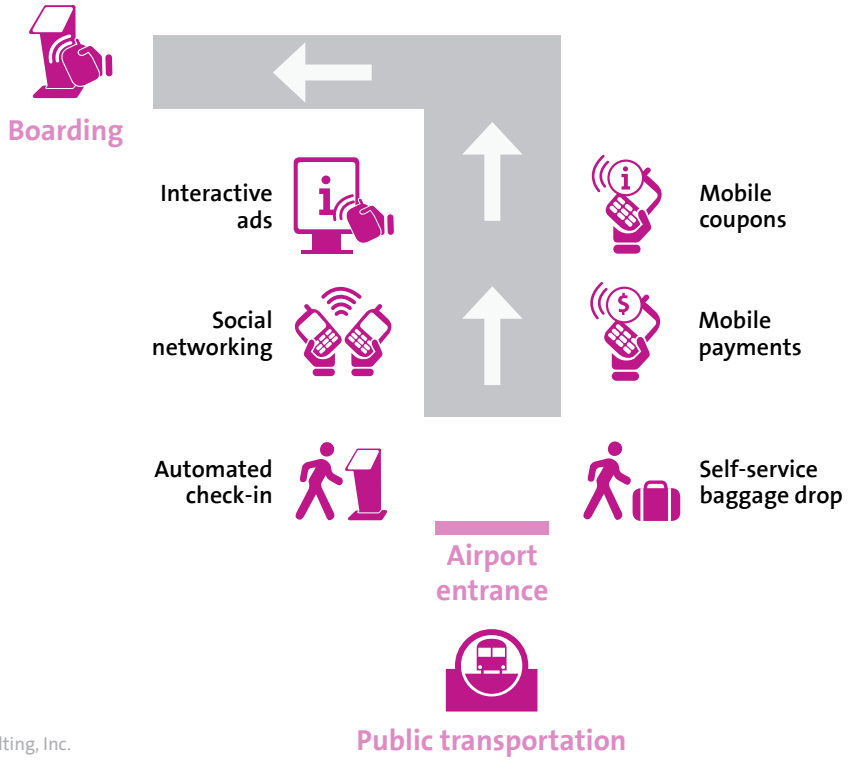
Source: http://www.totaltele.com/

NFC technology has the potential to change every aspect of the airport experience. As NFC enabled smartphones become more common the same process will be enabled by simply swiping the phone against the airport reader. By dispersing NFC readers throughout the airport, passengers will be able to: (Fig 12)

- Check-in with their mobile phone
- Receive coupons for airport shops
- Pay with their mobile phone
- Interact with NFC enabled advertisements
- Exchange information with other travellers by simply bumping their NFC enabled phones
- Use the phone for boarding
- Use the phone for public transportation

NFC does require a significant infrastructure investment and a critical mass of NFC mobile phone penetration, and as a result, the move to NFC will be evolutionary. Pilot tests at airports around the world have begun, but full implementation of NFC at airports is likely to take 4-7 years.

Figure 12 NFC at the airport



Source: Travel Tech Consulting, Inc.

The importance of sharing passenger information

Key to this effort is the ability to collect and utilise passenger data to gain insight into customers' profiles and needs. For example, understanding where the passenger is located and when they need to arrive at the gate can dictate the services offered to the traveller and the ability to notify the airline of serious passenger delays.

To gain access to this data the airport and airline must work together. Gone are the days when airlines needed to protect their customer data from the airport. With the increase in self service, airlines themselves may have little or no direct human interaction with the customer until they arrive at the gate. To achieve the vision of common passenger information, systems need to be connected to share pertinent customer data at each point of the airport process.

For the airlines and airports the key to improved processes are highly integrated systems. With cloud computing being the primary IT focus over the next five years, airlines and airports need to revamp their systems to connect all operational functions such as flight operations and resource management with customer communication and merchandising, all in turn connected to an enhanced airport operational database. This new infrastructure needs to be integrated with airline DCS, PSS and BRS. Airports need to abandon their traditional focus on locally installed systems and embrace integrated software as a service (SaaS) applications that can be accessed from any connected device and allow implementation across terminals and even across airports. This will result in an untethered workforce able to respond to unforeseen events and process passengers more efficiently by having connectivity between all systems.

With an integrated system, gate management can be improved for the airline allowing the proper manpower to be deployed in order to support a delayed flight. Integration with airport systems could deliver information on gate assignments and changes to the airline, enabling carriers to communicate higher quality information to their passengers. Integration with BRS can proactively notify ground handlers when a flight is cancelled and baggage needs to be removed from an aircraft. The possibilities are endless and sharing information between systems can benefit all parties.

Combining mobile technology and integrated airport systems has the potential to transform the travel experience into something to look forward to rather than dread. As the airport of tomorrow emerges, the ability to provide better communication, more efficient check-in and merchandising offers will transform the airport experience easing passenger frustration and providing new opportunities for revenue for the airport and airline.

5 Forecasting the airport of tomorrow

Self-service and mobility are the key themes of the airport of tomorrow. Ubiquitous connectivity means the passenger is always online and thus expects real time communication. Simple advances such as verifying that the passenger's baggage is on board the aircraft can help minimise frustration and uncertainty. Automating responses to periods of service disruption where vouchers are generated automatically and delivered to mobile devices is a key opportunity to shift this activity to a more self service mode. Roaming agents handling severe disruptions, coming to the passenger rather than making the passenger stand in an extended queue helps manage limited resources and improve overall efficiency.

To achieve this vision of the airport of tomorrow, airlines and airports must invest in new systems that automate manual tasks, share information and provide proactive communication to the passenger. Airlines need to provide airports critical passenger data so they may better plan manpower needs. Baggage systems need to provide real time awareness of location to all parties to reduce loss and accelerate the reuniting of the baggage and passenger. At the centre of all this technology is customer information. With comprehensive customer information all stakeholders can improve service to the passenger and use customer insight to market ancillary airline services and airport products and services.

The airport revolution has already begun. The revolution is actually an evolution continuing today's efforts to increase self service capabilities for the passenger and communicating to the traveller the status of their flight, and bag in real time whilst enhancing and improving their in airport experience. (Fig 13)

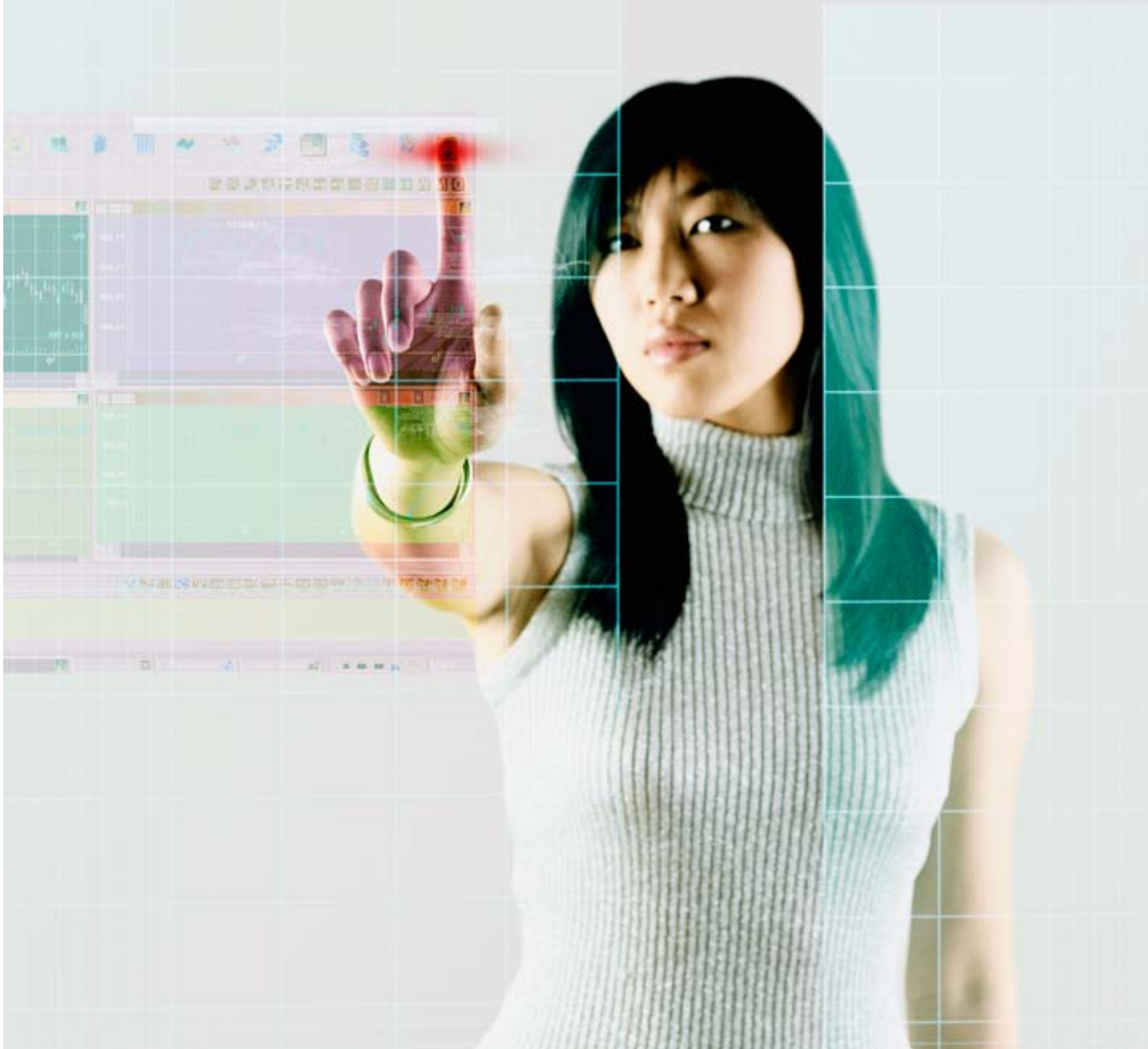


Figure 13 Forecasting the airport of tomorrow

	Widespread now	Widespread 2011 - 2014	Widespread 2015 - 2020
Passenger self-service	Print at home boarding pass	Mobile boarding pass and ancillary service offers	NFC boarding swipe
		Self-service baggage drop	Mobile payments
	Kiosk	Electronic airline voucher	NFC promotions
Airport operations	Long queues	Mobile roaming agent	NFC automatic check-in
		Permanent boarding pass and bag tag	Location aware baggage
		Indoor location tracking	
Airport & airline systems	Standalone DCS	Integrated DCS/PSS	Integrated DCS/PSS
	Standalone BRS	Airport electronic promotions	Integrated airport platform
	Standalone PSS		

Source: Travel Tech Consulting, Inc.

Widespread Now

Today, the majority of passengers are printing their boarding passes at home or through a kiosk. Drop off stations for customers who check-in online help reduce traditional long queues, but despite these enhancements over the last 3-4 years, long lines still persist during peak times. With most airlines still using a legacy DCS, manual steps still plague the check-in process. Automation adoption faces a number of barriers. Airline personnel may resist new systems that eliminate manual steps but require a change in process. Airline management need to take a more holistic view of their airport operations and recognise that any significant improvement must involve their airport employees adopting new improved processes as well as systems. Duplicating poor processes based on legacy DCS systems will not solve inherent problems.

Airports need to understand that control over technology and housing the system locally, are no longer tied together. Computer visualisation techniques have matured to the point where the issue of where the technology is physically housed has been eliminated. The connecting of these disparate airport systems must be a priority to enable the future passenger airport experience. BRS technology also needs to be fully integrated into this new airport eco-system, providing visibility on bag location to all those who interact with the baggage.

Widespread 2011-2014

There are examples today of the short term changes we will see in the airport passenger experience. The use of mobile boarding passes will gain additional acceptance and become a standard for a large segment of the travelling public. Self service baggage check-in will also gain greater acceptance allowing the faster processing of passengers.

Over the next few years we will see the growing adoption of electronic airline vouchers. Advanced airline systems will automatically re-accommodate impacted passengers and delivery vouchers electronically to their smartphone or tablet. These vouchers will handle overnight hotel accommodation and provide additional amenities for stranded passengers based on their value to the airline.

On the airport operational side, over the next few years we will see the increased use of tablet computers to allow airline agents to roam, reducing lines and addressing specific passenger needs. With Qantas implementing permanent bag tags and boarding passes for domestic Australian travel, a new era in check-in has arrived. This will free up airline agents to handle areas of congestion or deal with passengers experiencing problems with the check-in process. To gain better insight on specific location, airports may consider using their Wi-Fi networks for indoor location tracking capabilities allowing the passenger to receive specific promotions based on their location and to enable the airline to know exactly where the passenger is within the airport.

For airport operations the most important advancement is the implementation of new integrated DCS technology which connects seamlessly with PSS to allow the re-accommodation of passengers, particularly important over long periods of service disruptions. Over the next few years we will see the implementation of electronic promotions delivered to the customer's mobile device. The passenger will opt-in to receive these promotions and delivery and payment will all happen electronically through their mobile device.

Widespread 2015-2020

To support the airport of the future, an integrated technological eco-system must be created. This would allow all airport functions to be unified under an integrated airport system that is tightly aligned with the airline systems to deliver a comprehensive airport experience.

The self service trend will continue with the widespread adoption of Near Field Communication. NFC will be used for boarding, payments and personalised promotions. Once the majority of passengers own a NFC enabled smartphone, the creation of methods to automatically check-in the passenger is possible. Today, NFC requires the passenger to swipe their mobile phone against a NFC reader. As NFC becomes more widespread, any interaction the passenger has in the terminal could trigger a check-in. Airports may consider installing NFC readers throughout the terminal to sense the passenger's presence and provide an automated check-in notice to the

Airports will adopt integrated IT solutions that provide seamless connectivity between flight operations, resource management, baggage systems and merchandising efforts.

airlines. NFC may be combined with location based social networking applications such as Foursquare which enables automated check-in[1] for favourite places. Clearly the future airport experience will track the passenger's location (with their permission) enabling a more productive experience, reducing the need to wait in line.

By this time all baggage will be location aware. Passengers will know that their bag is on the airplane and airline and airport personnel will be able to easily locate lost bags, or offload baggage when required improving departure times. If a flight is cancelled the passengers will know when their baggage is offloaded. Improved baggage passenger notification will save the airline, airport and ground handlers time and money reducing staff needed to track and deliver lost bags.

Underlying these new services is a fully integrated airline/airport ecosystem. Airports will adopt integrated IT solutions that provide seamless connectivity between flight operations, resource management, baggage systems and merchandising efforts. At the centre of this new airport infrastructure is an operational database that manages all customer information. This new infrastructure will be connected to next generation DCS and PSS airline systems exchanging key passenger information to help both airlines and airports manage passenger flows.

At the heart of this technological revolution is the more informed passenger. We are already in the age of ubiquitous connectivity. The 'always connected' passenger will demand information and services delivered on their preferred personal computing device that is personal, location sensitive and contextually relevant. By improving the efficiency of the traveller and informing them of all facets of the airport experience, airlines will be able to deliver a differentiated enhanced experience that corrects many of the passenger issues present today.

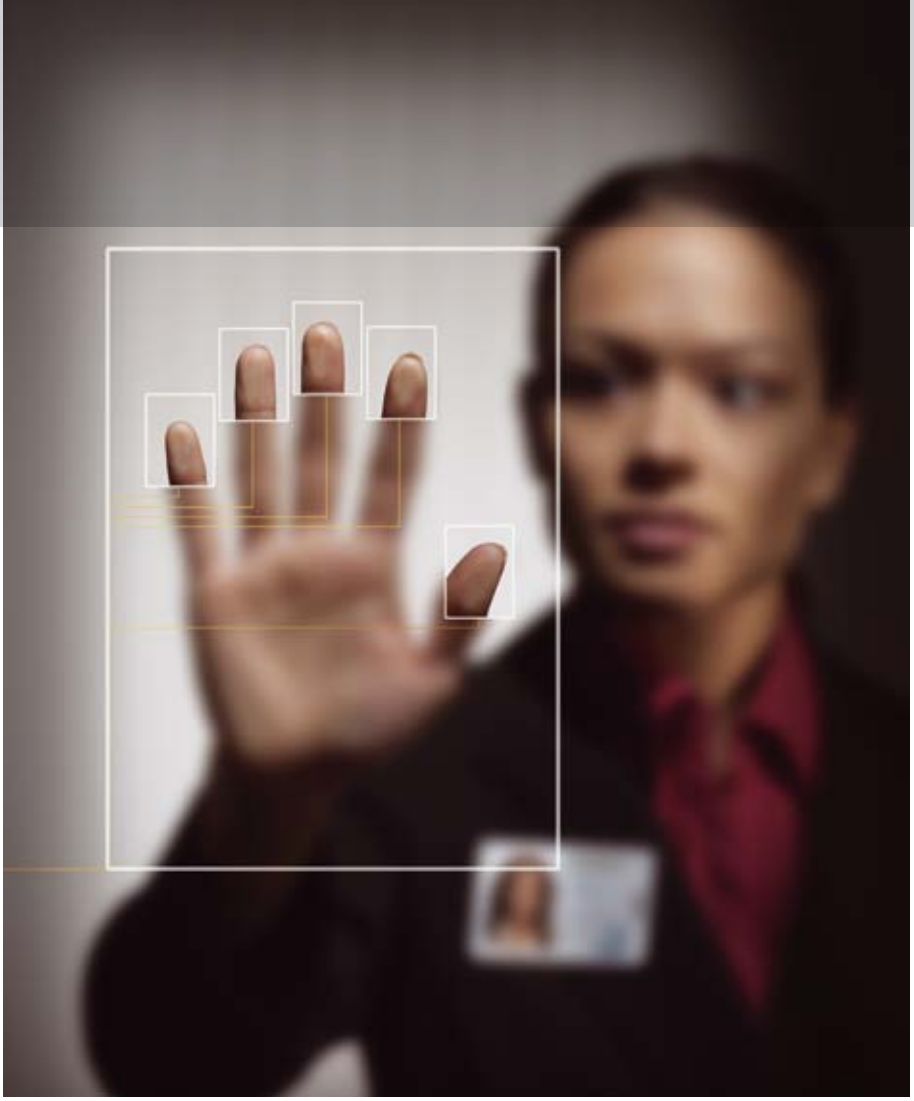
By improving the efficiency of the traveller and informing them of all facets of the airport experience, airlines will be able to deliver a differentiated enhanced experience that corrects many of the passenger issues present today.

1 Tsotsis, Alexia December 29, 2010 "Hitwise: Facebook Overtakes Google To Become Most Visited Website In 2010" TechCrunch http://techcrunch.com/2010/12/29/hitwise-facebook-overtakes-google-to-become-most-visited-website-in-2010/

6 Technology current usage, projections and industry implications

Mobile computing		
Technology	**Current usage and projections**	**Industry implications**
Smartphones	According to comScore smartphone adoption rates in the U.S. reached 27% of the market by December 2010, up 10 percentage points from the previous year. Across all global regions, mobile Web access increased 7-9%[5]. Nielsen predicts smartphones will overtake feature phones this year[6]. 73% of airports plan to invest in mobile-based services for increased customer convenience[7].	Smartphones provide a unique platform for customer interactions. All airlines need to optimise their websites for the mobile Web, but also create innovative applications that take advantage of location, situation and personalisation to deliver unique services to an airline's best customers. For the airport environment, the smartphone is becoming the preferred platform for customer communication.
Tablets	NPD Group predicts that total annual tablet PC sales will soar threefold from around 19 million in 2010 to 55.7 million in 2011, then another 209% to reach 172.4 million by 2014. By then, tablet and slate-style computers will make up about 35% of the total PC market (forecast to reach 503.8 million by 2014)[8].	With over 100 new tablets coming to market this year, these new devices are rapidly becoming a staple of the frequent traveller. Given the tablets ability to integrate multiple sources in an immersive user experience, airlines need to develop specific apps that take advantage of the capabilities of this new platform. Tablets will also have widespread operational use, enabling roaming agents and providing flight crews with more complete customer information.
Broadband wireless networks	Starting in 2011, wireless carriers in industrialised countries have begun to deploy 4G in order to attain faster speeds and to unclog the heavy data traffic generated by the exploding use of smart phones. This 4G-driven growth in capital spending will continue at least through 2014[9].	Ubiquitous computing is here. As 4G networks are implemented, the speed of connectivity and the ability to interact with large amounts of data over the wireless eco-system will result in new levels of customer information.
Augmented reality	Market projections for augmented reality on mobile devices predict revenues of $2 million in 2010, rising to several hundred million by 2014[10].	Augmented reality overlays location specific information over the smartphone or tablet screen. It can be used to improve passenger navigation, provide personalised offer or display other passenger feedback.
Social media	Facebook has more than 500 million active users.People spend over 700 billion minutes per month on Facebook[11]. During the average 20-minute period in 2010, there were: 1,5870,000 wall posts, 2,716,000 photos uploaded and 10,208,000 comments posted[12]. 57% of airlines are considering using social media to provide passengers with flight information[13].	Social media provides the passenger with the ability to instantaneously comment on customer service influencing their entire social graph. Airlines can use social media to promote specific airport service or even organise meetings with key customers.

5 Baar, Aaron, February 14, 2011 " Comscore Enter the Golden Age of Mobile" Media Post News http://www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=144956
6 Nielsen Research Press Release March 26, 2010 "Smartphones to Overtake Feature Phones in U.S. by 2011 http://blog.nielsen.com/nielsenwire/consumer/smart-phones-to-overtake-feature-phones-in-u-s-by-2011/
7 SITA 2010 Airport IT Trends Survey http://www.sita.aero/content/airport-it-trends-survey-2010
8 Sass, Erik Feb 14, 2011 "Tablet Sales to Hit 242 Million by 2015" Media Post http://www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=144983
9 Smartphonebiznews.com July 28, 2010 - http://smartphone.biz-news.com/news/2010/07/28/0002
10 2010 Horizon Report January 6, 2010 - http://wp.nmc.org/horizon2010/chapters/simple-augmented-reality/#0
11 Facebook Press Room Statistics http://www.facebook.com/press/info.php?statistics
12 Hanson, Arik, January 31st, 2011 "16 Social Media Statistics That Might Surprise You" http://www.arikhanson.com/2011/01/31/16-social-media-statistics-that-might-surprise-you/
13 SITA 2010 Airport IT Trends Survey http://www.sita.aero/content/airport-it-trends-survey-2010



Airline systems		
Technology	**Current usage and projections**	**Industry implications**
Next generation DCS	For airlines passenger management remains the priority, with nearly 80% of airlines confirming this as their top IT investment area[14].	New generation DCS technology eliminates manual processes. New DCS technology integrates PSS information with the check-in process improving the ability to manage passengers during service disruptions.
Integrated information systems – DCS, PSS	The IT spend outlook for 2011 among airlines is positive, with a clear sign of rising business confidence globally. 56% of the respondents expect an increase in IT spend in 2011 with only 10% expecting a decrease[15].	The integration of DCS and PSS allows for greater efficiency with passenger re-accommodation during service disruptions.
Expanded airline ancillary services	Ancillary revenue reached €18.4 billion in 2010 according to the Amadeus guide to Ancillary Revenue by IdeaWorks.	Self service technology allows for the marketing of airline ancillary services to specific customer segments.
Roaming agents	50% of airports expect to implement mobile services for staff to allow remote updates to aircraft/gate and 41% expect to manage ramp/apron operations by 2013[16].	The growth of mobile computing technology such as tablets untethers the agent from the ticket counter allowing a more efficient processing of passengers and the deploying of additional staff during service disruptions.

14 SITA 2010 Airline IT Trends Survey http://www.sita.aero/content/airline-it-trends-survey-2010
15 Ibid
16 Ibid

Airport systems		
Technology	**Current usage and projections**	**Industry implications**
Integrated passenger data	32% of airports have already implemented shared airport operation control centres, with another 22% planning implementation by 2013[17].	With enhanced passenger data, airports can plan staffing better to handle flights and distribute information on baggage and airport services to the airlines for distribution to the passenger.
Connected BRS	Airports and airlines are implementing baggage resource management but many are still standalone systems.	Creating a truly interactive mall environment can help airports maximise the sales of airport merchants through personalised promotions based on passenger time, needs and preferences.
Near field communication	A third of all mobile phones will be NFC equipped within three to five years[18]. ABI Research project that 450 million mobile phones will be NFC enabled by 2011, representing close to 30% of handsets shipped worldwide that year. [19]	As the price of RFID tags continues to come down, the practical use of RFID technology as baggage tags will make the location of missing bags much easier.
RFID tags	In 2007 IATA produced an RFID Transition Plan that considers a realistic move to RFID at 80 airports, covering 80% of the baggage claims. The study predicted that the transition plan would take 5-6 years to deliver with the reduction in baggage mishandling being in the order of 20%.[20] RFID tags costs have fallen steadily over the past few years and will decline further as adoption ramps up.	Augmented realty overlays location specific information over the smartphone or tablet screen. It can be used to improve passenger navigation, provide personalised offer or display other passenger feedback.
Quick Response (QR) codes	28% of smartphone users are already scanning mobile bar codes. 48% of Android users and 39% of iPhone users have scanned tags with their smartphone[21].	2D bar codes that can be read by current mobile phone technology allows new avenues of marketing and could even be used for check-in at airport merchants.

17 Ibid
18 Frost and Sullivan Research: http://www.frost.com/
19 ABI Research http://www.abiresearch.com/home.jsp
20 RFID Business Case for Baggage Handling IATA 2007 http://www.iata.org/whatwedo/stb/Documents/RFID%20for%20baggage%20business%20case%202%201.pdf
21 Compete research January 15, 2011 http://www.whatsyourdigitaliq.com/2011/01/17/how-many-people-use-qr-tags/

7 Conclusion

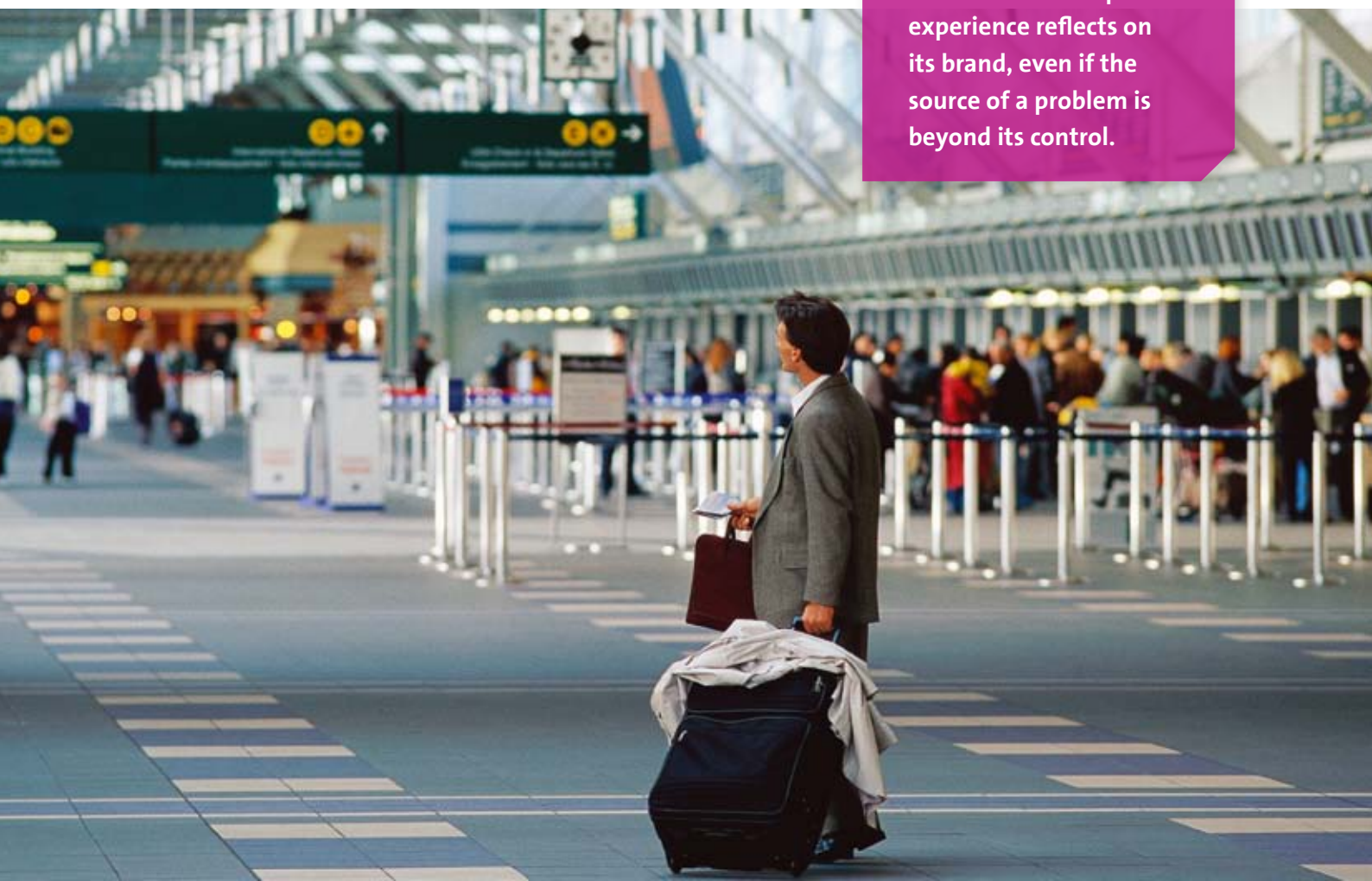
We are at the dawn of a new age in airport passenger processing. Mobile technology is providing a new platform to help airlines and airports transform the travel experience into something to look forward to rather than dread. Portable technology is also poised to enable mobile agents to roam the airport, and relieve congestion during peak periods and times of service disruptions.

We have entered an era of the always connected traveller. Passengers are becoming conditioned to access information from anywhere and share that information with their social networks. In this environment every passenger complaint becomes magnified, but communication is a two way process. Airlines and airports need to proactively use this new technology to provide information on flight status, baggage and airport facilities to anticipate a passenger's needs and provide solutions before the problem becomes severe.

For the airline, it is essential to recognise that the entire airport experience reflects on its brand, even if the source of a problem is beyond its control. As mobile platforms increase their penetration and self service technology continues to be adopted, the airline may not actually have human interaction with the passenger until they are on board. This presents a whole new set of challenges particular to customer support.

In order to achieve this vision of the airport of tomorrow, airlines, airports and ground handlers must invest in next generation systems that share passenger information and enable the entire airport ecosystem to be more efficient and passenger friendly. Sharing information across all the major airport service providers can yield surprising results. What if an airport was aware that a significant number of flights would be late and that the crew was unable to adequately serve meals? Perhaps the airport could inform restaurants and ask them to stay open an extra 30 minutes. Ground transportation could be better coordinated with passenger arrivals. Even the airport car park or local hotels could be notified when a large number of passengers would be arriving in order to deploy additional shuttle buses. All this requires an integrated solution where all the airport stakeholders have a vested interest in sharing critical passenger information in order to provide a more complete solution to the traveller.

For the airline, it is essential to recognise that the entire airport experience reflects on its brand, even if the source of a problem is beyond its control.



8 About Travel Tech Consulting Inc.

Founded in 1995, Travel Tech Consulting, Inc. is the recognised leader on how emerging technologies impact the global travel industry. Their knowledge reaches across all industry segments including airlines, online travel agencies, corporate, leisure, hospitality, and government with a particular focus on emerging technologies such as mobile and social networking.

Founded by Travel Tech Consulting President, Norm Rose, the company works with a global network of travel industry experts who join forces to meet the needs of specific client engagements worldwide. Travel Tech's consultants are experts in all sectors of the travel industry including airline reservations & loyalty systems, online travel booking & wholesale technology, global distribution systems , travel agent point of sale & distribution platforms and booking & voucher automation amongst many others.

About the writer

Norm Rose is world renowned for his travel technology expertise, particularly his analysis of the impact of emerging trends such as mobile and social media. From 1982-1988 he held sales and marketing management positions at United Airlines and from 1989 -1995, Norm was corporate travel manager for Sun Microsystems. At Sun, he worked with a number of third-party developers creating client/server software for the business travel market. This included early prototypes of self-booking tools and expense management systems. He is also the author of numerous publications and articles including Mobile: the Next Platform for Travel (March 2009) Corporate Travel Technology Today and Tomorrow (Fall 2007); Selling Complex Leisure Travel Online: Focus on Dynamic Packaging Technology (December 2004), Emerging Trends in Wireless Technology and The Global Travel Industry (October 2003) and Corporate Travel: Technology Trends and Market Analysis (Spring 2002).

9 About Amadeus

Amadeus is a leading transaction processor and provider of advanced technology solutions for the global travel and tourism industry.

Customer groups include travel providers (e.g. airlines, hotels, rail, ferries, etc.), travel sellers (travel agencies and websites), and travel buyers (corporations and individual travellers).

The group operates a transaction-based business model and processed 850 million billable travel transactions in 2010.

Amadeus has central sites in Madrid (corporate headquarters and marketing), Nice (development) and Erding (operations – data processing centre) and regional offices in Miami, Buenos Aires, Bangkok and Dubai. At a market level, Amadeus maintains customer operations through 73 local Amadeus Commercial Organisations covering 195 countries.

Amadeus is listed on the Madrid, Barcelona, Bilbao and Valencia stock exchanges and trades under the symbol "AMS.MC". For the year ended December 31 2010, the company reported revenues of €2,683 million and EBITDA of €1,015 million. The Amadeus group employs over 10,270 people worldwide, with 123 nationalities represented at the central offices.

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