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Maximizing and Monetizing the Digital Opportunities at Airport

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1. Introduction
In our aviation industry, revenue expansion and safety/security are the two most essential elements forming the core of our business. Successfully achieving and balancing these two poses an endless challenge to us. And that is where digital technology comes in to play a prominent supporting role.

In today's society, digital technology represents a field that keeps changing every minute, while growing fast. Consequently, we encounter opportunities for digitization almost every day of our lives. The fact that we encounter such opportunities so frequently seems to mean that there are just as many opportunities for us to be influenced by them. This is true of the aviation industry, too, where digital technology has brought many significant benefits to us. With the advancement in digital technology, so many more things have now become commonplace.

This paper attempts to examine in depth digitization in the aviation industry, make observations and offer suggestions for maximizing and monetizing the digital opportunities at the airport.

2. Digitization in the Aviation Industry
As noted earlier, recent trends in digitization have had a great impact on the aviation industry. In particular, the benefits of IoT (*1) have been many and significant. The writer will examine this aspect from the perspectives of passengers and of airport workers.

*1. Internet of Things: Advanced interconnection of devices, systems and services that are embedded with communication functions to connect the internet or to communicate with each other, enabling automatic recognition, automatic control and remote measurement, among others.

2.1 Benefit to Passengers
For passengers, the greatest benefit of digitization is that it has made air travel more accessible. The ability to purchase airline tickets online and the ability to find a multitude of information on the digital signage screens are just two examples of such benefit.

2.1.1 Purchasing Airline Tickets on the Internet
Prior to technical innovations, customers had to go through the cumbersome process of visiting a travel agency or an airline counter to check availability and obtain their tickets. Unless they lived near the airline office or a travel agency, even the initial step of checking booking availability and buying tickets required a considerable effort. Today, however, customers can check availability and purchase tickets online from travel agency or airline websites whenever they want and can also select or change their seats. This has brought air travel a lot closer to home for everyone.
2.1.2 Information via Digital Signage
Unlike train stations, visiting the airport is a special and novel experience for many people since it is not a facility they use very often. However, thanks to the digital signage, it is now possible for customers to easily obtain easy-to-understand information even if they are not frequent airport users. Furthermore, because digital signage allows contents to be modified flexibly according to usage patterns and needs, we can now provide such information that passengers really require, rather than information that is simply selected from the information provider’s perspective.

2.2 Benefit to Airport Workers
It would not be an overstatement to say that today’s airport operation and management is built on digital technology. The connection between various forms of digital technology and airport operation is evident when we observe the passenger/baggage processing flow at the airport.

Diagram 1. Passenger/baggage Processing Flow

As we can see from Diagram 1, digital technology always plays a key part in various aspects of airport processes. For those working at the airport, it helps to streamline the work flow and thus brings economic benefits in the form of reduced costs.

According to the Future Travel Experience conference, by 2025, passengers will likely be able to check in with their baggage not only at the check-in counters but also at train stations, hotels, car parks and other
locations outside the airport.

As these examples illustrate, digitization has not only resulted in improvements to services for passengers and other customers, but also improvements to operational safety and efficiency for the airport and airline workers. This is the latest standard of today's aviation industry, and we can see how important digitization has become. This will continue to be the case with the aviation industry of the future, where digitization will become even more of an important factor.

3. Maximizing and Monetizing the Digital Opportunities at Narita Airport

IATA (The International Air Transport Association) launched its SPT (short for Simplifying Passenger Travel) program in 2000 and in the following year, Narita Airport was selected as a model for advanced airports to be showcased by the Japanese government under its e-Japan Strategy to extensively publicize Japan as one of the world's leading IT nations. Narita has since actively promoted various initiatives to make use of a diverse range of digital technologies.

3.1 Use of Apps

Presently, the so-called “i-Airport” project is being implemented at Narita Airport under the concept of providing convenient, advanced airport services that are "easy to understand", "fast" and "user-friendly", which will eventually result in a revenue expansion. With the recent growth in popularity of smartphones and tablet computers, applications and other contents are likely to be considered as one of the most influential to our customers. At Narita Airport, we provide the following four apps:

(a) NariTra
A multilingual audio translation application in 8 languages (Japanese, English, Chinese, Korean, Indonesian, Thai, French and Spanish) which were selected by taking into consideration such factors as the nationalities of visitors to Japan and the extent of English use in their respective countries.

(b) NRT_Airport Navi
An app for obtaining directions to destinations within the terminals using wireless LAN access points at the airport.

(c) NariCo
The world's first airport audio concierge app, which responds to requests and questions spoken into the smartphone.

(d) TABIMORI
A hospitality application to assist and cater to the needs of foreign visitors during their stay in Japan, containing information on flights, tourist spots, use of public transport and other essential details.
Besides improving services, these apps greatly benefit in terms of staff deployment, helping to reduce labor costs.

3.2 Multilingual Support for Information Services

Airports are like an intersection where a wide variety of people meet. The languages used there are many and varied. This is particularly true of Narita Airport, which operates a large number of international flights.

Diagram 2. Ratio of Passengers by Country

Diagram 3. Ratio of Inbound Passengers by Language

Narita Airport is a huge facility, used by 36.04 million passengers in fiscal 2013. As readers can see from Diagrams 2 and 3, it is used by people of various nationalities speaking different languages. Any inquiries or problems these customers may have are handled at 19 information counters located in Terminals 1 and 2.

One issue arising in this respect is the matter of the counter staff allocation. Due to limitations in space and budget, it is practically impossible to assign multilingual staff at all of the 19 counters. Even so, one can hardly say that the service levels are adequately high when assistance only in Japanese is available or when assistance in other languages is provided at only selected locations, regardless of the customers’ needs. If such is the case, we are not even close to our goal of becoming the airport of popular choice, which is a common objective for our rival airports as well.

That is where the multilingual audio translation app mentioned earlier and assistance via videophone may come in. As a basic rule, we assign bilingual agents who can speak Japanese and English to all information counters at Narita Airport. When there are no service agents available to speak Chinese and Korean, which are often the most commonly used foreign languages at Narita, then the customers are automatically connected via videophone to other counters with agents who can speak those languages by selecting the language on the screen. As a matter of fact, video phones are used 20 to 30 times a day on an average, and even as many as 40 to 50 times on some days. Through these digitization initiatives, Narita Airport is striving to reduce its operational costs without compromising its service levels, with the aim of becoming the customers’ preferred airport.
3.3 Use of Digital Signage

The digital signage system at Narita Airport is one of the largest in Japan (100 display terminals comprising 336 panels), and incorporates three keywords in the system concept: i.e. "Seamless & Stress-free", "Price Value" and "Frontier".

Most importantly, these display terminals have been strategically positioned so that passengers can obtain necessary information, wherever in the airport they may be, as they need it. To achieve this, we began by observing the individual behavior of the passengers and by asking them directly about what was on their mind and what requirements they had at each stage prior to their departure. We then transferred the information thus obtained into a chart as shown in Diagram 5, to illustrate the basic idea in a simple manner to show us how we should provide optimum information according to the diverse needs of passengers of different categories in different stages of processing. Based on this, we have attempted to provide information seamlessly by setting up devices with appropriate contents in the right locations, taking into account the passenger behaviors, specific structural features and design objectives.
Diagram 5. Providing Information Tailored to Passenger Needs

On the information retrieval terminals, which represent part of digital signage, we have limited the functions and the contents that can be displayed to ensure trouble-free searching. These terminals have a simple 3-tier structure comprising the top page, category selection page and the shop information page. The languages supported are Japanese, English, Chinese and Korean, the native languages of the majority of customers using Narita Airport.

It is important to identify essential elements for the signage to meet passenger needs from the customer experience point of view, and then to collate and give shape to these items. This is what we did with the digital signage system at Narita Airport, using the three concept keywords to define the next-generation in digital signage.

Besides being a source of information for the customers, digital signage is also a large source of revenue for the airport company. A big difference between digital signage and advertising signboards is the ability to display video data or information in motion. This widely expands the scope of expression available to the information provider, bolstering its ability to attract customers and generate income in the form of advertising revenue. Narita Airport actually generates a significant amount of advertising revenue from digital signage. With conventional signboards, if an advertiser cannot be found, the advertising space would probably be left unused and end up as a dead space. With digital signage, on the other hand, the space can be used to provide contents and information to suit the time and location, generating results over an extended period, which is very cost effective.
3.4 Introduction of Video Integration System

Needless to say, it is the responsibility of the airport operator to maintain safety and security within the airport, but ensuring this basic task often represents an endless challenge. Regrettably, since the 9.11 terrorist attacks in the US in 2001, acts of terrorism targeting air and other mass transportation systems have occurred in various parts of the world. In the aviation sector in particular, since many of these incidents are indiscriminate, sometimes using the aircraft itself as a weapon, greater emphasis has been placed on aviation security. Airport operators are required not only to maintain the airport, but also to review and achieve greater efficiency in its operations and management.

3.4.1 Existing Conditions at Narita Airport

Currently at Narita, cameras are placed at 100-meter intervals on the outer perimeter of the airport which stretches over a distance of approximately 46 kilometers. Together with those installed throughout the terminals, there are a total of around 1,600 cameras to ensure there are no blind spots. The following three measures in particular are used on the airport perimeter to prevent unauthorized entry: protection through installation of fencing and intrusion detector sensors; visual monitoring and monitoring via surveillance cameras linked to intrusion detection sensors; and security patrols. This system of security has been rated very highly on a global level, both in the ICAO audits of 2005 and 2007, and in the TSA (Transportation Security Administration) assessments carried out in 2007 and 2009.

3.4.2 Issues and Improvement through Digitization

As described earlier, the security system at Narita Airport relies on a large number of surveillance cameras. When the need arose to install additional cameras, we could only use cameras from the same manufacturer because of compatibility reasons. This narrowed down our options and created a monopoly situation which eventually drove up the costs.

Our video integration system was considered and introduced as a solution to this problem. This system enables the use of cameras from multiple manufacturers by assimilating the differences in specifications
on the central control unit, so that the images can be checked on the monitoring terminals. This has made it possible for us to compare several companies when replacing old cameras or installing new ones, and, as a result, keep the prices down through competition among manufacturers. We have also established mechanical perimeter security and facial recognition systems which, in combination with the video integration system, create an efficient framework which has enabled us to curb personnel and other operational and administrative costs.

![Diagram 6. Video Integration System](image)

The air transport industry is a gigantic process industry and, as its core component, the airport has numerous significant functions. Accordingly, the operational and administrative costs involved are enormous. Furthermore, dealing with many people from all over the world entails huge expenses in terms of personnel and other operating costs. Because Narita has a large number of equipment and devices that are essential for the operation and management of the airport, small ideas can lead to big results.

As the saying goes, "Many a little makes a mickle". This concept is very important for the operation and management of an airport, and actually forms the basis of Narita Airport’s performance.

4. Suggestions

For an airport that already has a relatively steady flow of aeronautical revenue, the challenge and objective is how to increase non-aeronautical revenue and achieve cost savings through operational efficiency. This paper will now offer observations and suggestions on the theme of "sales promotion and efficient operations using big data and iBeacon", focusing specifically on the use of such technologies at airports. To begin with, let us take a closer look at these two technologies.
Big data refers to a collection of various data which is accumulated in the course of using computers, communications equipment and other digital devices. The analysis of large data has a long history and was already drawing attention back in the 1990's. With recent technical innovations and the emergence of low-cost analysis systems, sophisticated analysis systems, which were not very cost-effective in the past, have become more common. Furthermore, because of improvements in technology allowing them to handle a wider range of data, methods were devised to uncover new laws and principles, and big data has once again become the focus of attention. In spite of these benefits, as described earlier, although big data systems are already in use in other industry segments, they have not yet been widely used at airports. This has a lot to do with the risks they pose in terms of unauthorized access and leakage of information. With recent developments, however, systems are now available that can analyze data in its secure, encrypted form, where analysis may be carried out without disclosing the actual contents of the data. This will infinitely alleviate the concerns mentioned earlier, soon to be eliminated altogether.

Next, let us consider the characteristics of iBeacon. iBeacon is a technology which enables locations to be determined and confirmed accurately within a range of a few dozen centimeters to a meter, using a BLE (Bluetooth Low Energy) network for short-range wireless communication. This technology has three main features.

The first feature is the accuracy of its indoor location information. When we speak of location information, GPS will probably come to the minds of most of people. Today, car navigation systems and location information systems on mobile phones that use GPS have become an indispensable part of our lives. However, because GPS relies on satellite signals, which cannot penetrate concrete and wooden structures, geo-fencing inside a building has been a difficult task. On the other hand, iBeacon communicates with smartphones and similar devices equipped with relevant apps by setting up a BLE network inside the building, so the entire system is contained within that building. Therefore, it enables users to obtain accurate location information even if they are indoors, and facilitate geo-fencing. Furthermore, because the system uses BLE technology, it consumes less power for communication than GPS.

The second feature of the iBeacon is the scope of its data transfer range. It has the edge over its rival, NFC (Near Field Communication), which is also used for short-range communication, in various ways. For example, whereas NFC is theoretically said to be usable within a range of 20 cm, its actual range is less than 4 cm. In contrast, the theoretical range of an iBeacon is 50 m and its recommended range is 10 m. Therefore, a single iBeacon can cover a range of 100 sq. m.

The third feature of the iBeacon is that it is cheap and easy to install, and thus offers benefits in terms of initial and running costs. A set of 3 iBeacon transmitters is sold by one particular manufacturer at
around 100 dollars, and cheaper products can be bought for just a few dollars. Since there is also no need for conduits and wiring, the system can be set up inexpensively. The power consumption will depend on the signal transmission intervals, but two AA size alkaline batteries will be enough to power a transmitter for around a year.

As a downside, there are no systems available for using iBeacon with Android and other non-iOS devices. However, since these iBeacon uses BLE which is a universal technology, similar systems to an iOS can be set up as long as the device uses a BLE-compatible operating system (Version 4.4 or later for Android) and there are already examples of where such systems have been built. In Japan, the smartphone penetration and usage rates are growing rapidly. Since the usage rate is already close to 50%, the opportunities for the use of iBeacon are expected to rise as smartphones become more common.

Based on the above consideration into the respective technologies, we can conclude that there are three main advantages in introducing these systems: revenue expansion, improvement of operational efficiency and high feasibility. In light of the foregoing, this paper will now offer specific suggestions for their utilization.

### 4.1 Specific Suggestions for Monetization

As a specific suggestion for monetization, the author would like to recommend the use of big data for analyzing customers’ purchasing behavior as a scheme that is most likely to produce positive results in terms of revenue expansion.

More specifically, this will involve the use of big data and iBeacon highlighted in this paper, in addition to more conventional POS and camera systems. The POS system will be used to collect data on the type and quantity of products purchased by the customers; the cameras for determining customer type; and iBeacon to collect data on their behavior. The big data collected can be used to analyze the purchasing behavior of the customers (including those who do not make a purchase), and to accurately identify and estimate the needs for specific times or seasons. It can also be used for formulating new marketing strategies and various other applications at the airport.

If POS systems and cameras are already available to some degree, all that is required will be to newly install iBeacon transmitters. As already explained, iBeacon is cheap to install and hardly entails any running expenses, so the system is simple to set up.

The airport operator can bear the initial investment cost and, once the system is up and running, provide the shop tenants with the information for a small fee, based on the size of each shop for instance, to obtain revenue. The amount of revenue generated per shop may only be small, but multiplied by the number of
tenants in a huge airport, the initial investment can be recouped with ease. Even if the information was requested by only a few shop tenants, by installing the system along the passenger flows and creating a mechanism to lure customers into the shops, the airport operator can help shops to increase their sales, and by extension, expand its own non-aeronautical revenue. Let us now examine this mechanism for luring customers into the shops.

A possible method for this is the automatic display of product information and coupons using iBeacon. By installing transmitters in or around the shop, the app will display product and sales promotion information automatically when the customer comes into the proximity of the shop. Transmitters can also be installed on advertising boards inside the airport. Not only will this enhance the value of these advertising media, it will also contribute to the shop's sales promotion efforts. This function can be used to automatically display recommended items for sale, selected based on the results of customer trend analysis carried out by using iBeacon and big data, to boost sales.

In Japan, we do not have to go far to find a prime example of a system that utilizes accumulated information. Vending machines equipped with cameras and facial recognition functions have been installed in railway stations since around 2011. These vending machines estimate the age and gender from the customer's facial features, and analyze and collate this information with data it has accumulated relating to purchasing time, season, location and so on to offer an appropriate lineup of products. Digital signage is used on the front of these machines to display commercials and other contents depending on the time, to make them more noticeable and attractive. This has enabled the provision of products that are more in line with customers’ needs, and with the extra advertising revenue, resulted in an increase in profits. The technology is also already in use at department stores and tourist spots, and there are examples of where this has boosted sales and expanded revenue.
4.2 Specific Suggestions for Improving Operational Efficiency

Displaying waiting times at screening areas is an obvious example of how the technology can be used to improve operational efficiency, but in this paper, the author would like to recommend its use in achieving appropriate staff deployment.

This involves transmitting signals via a BLE network to staff and customer terminals, so that the center controller can monitor staff and customer positions to deploy staff to appropriate locations, according to the prevailing conditions. By linking this with the center equipment, seasonal and time-based trends can also be identified, which can be used in planning appropriate staff development in advance. Not only will this help eliminate excess personnel so that operations are performed with appropriate staffing, it will also lead to improvements in service levels by enabling the airport to plan and develop suitable facilities based on accumulated customer trend data.

As mentioned earlier, studies are already underway into this within the aviation industry as well. From July to September 2014, Japan Airlines conducted a proving trial using BLE networks and compatible terminals in their airport passenger handling as a solution to problems they had in keeping track of staff locations inside the huge airport.

iBeacon transmitters were installed at the boarding and arrival gates and other areas, and passenger service agents were given terminals to receive these signals. The data on the terminal (smart phones) ID and times were relayed via the center server to the PC of the dispatcher at the control desk, who was then able to identify the precise locations of their agents in real time on a map displayed on the PC screen. The dispatcher typed in and sent instructions on the PC to specific agents, which were then displayed automatically on the terminals (smart watch) of the agents concerned. This duty is conventionally performed using paper assignment charts, but digitizing the process resulted in greater operational efficiency and the trial was very well received. This initiative won the “Best Initiative at the Gate Award” in Future Travel Experience Global 2014. Another example relates to the proving trial that began in October 2014 at 13 Japanese airports in which an existing app was used in conjunction with iBeacon to allow customers to check the status of their flights, boarding gates and boarding times when they approach the airport’s security checkpoint.
4.3 Solutions to Issues at Narita Airport

This technology could provide clues for addressing some of the problems experienced at Narita Airport. Its terminal navigation application, “NRT_Airport Navi”, estimates the user's current location based on the strength of the response signals emitted from the access points installed throughout the terminals. There is room for improvement in several features of this app. Below are a few examples of the problems and how iBeacon could be used to address them.

Problem ① Accuracy of location information
Wireless LAN access points, which are installed to provide internet access, are set to emit signals over a wide area and are, therefore, susceptible to a certain margin of error.
⇒ iBeacon transmits signals over a small area and are thus able to provide more accurate location information.

Problem ② Need for installation work
Presently, there are approximately 580 access points in the passenger terminals at Narita Airport. This is a substantially good number for an airport internet environment. However, since the signal range must be narrowed down in order to identify accurate locations, from a navigational perspective, there is still much room for improvement. Installation of access points involves providing new power outlets as well as conduits and wiring from the existing power panels, every time incurring costs. There are also some areas where the site environment would not allow access points to be installed.
⇒ A BLE network, the emission source of the iBeacon signals, can be set up without installing power sources. It means there is no need for power conduits and wiring, making implementation easier in terms of costs and the installation environment.

So far, an observation has been made and a suggestion has been given with regard to each of big data and iBeacon. The combinations of these tools with digital signage and other digital technologies are numerous and their potential is unfathomable. This is particularly true with airports already in possession of various digital technologies. With the advancement in the integration between the virtual
and the real markets, attention is now focusing on O2O (*2) initiatives. In this regard, digital technologies will bring us services beyond the scope of our imagination. It is hoped that suggestions contained in this paper will contribute to such development.

*2 Online 2 Offline: Combination of purchasing activities both online and offline. Phenomena in which online activity influences purchasing activity on site.

5. Conclusion
The relationship between the airport operator and the airport is similar to that of a parent and a child. To raise a child in a better environment with good intentions, the parents should create opportunities to interact with relatives and neighbors to discuss and exchange opinions about their ideas and beliefs. If we apply this to an airport, the airport operator must understand and reflect the views and comments of the customers and airlines to the airport operation.

Digitization has definitely increased our opportunities for achieving growth and revenue expansion. However, this does not necessarily lead directly to the growth of the airport and its profits. To capitalize on these opportunities and convert them into growth and revenue expansion, the airport operator must take note of the customer needs current at the time, and respond to them accordingly. In other words, it must understand the prevailing needs of its customers and of its frontline workforce correctly, be sensitive to innovations in technology that evolves rapidly from day to day, and continue to update the information it has on hand. It is as a result of these efforts that the airport can achieve growth and profitability using digital technologies. An ideal airport is created, not by the airport operator alone, but in conjunction with other airport workers and the customers. As a logistics base and a gateway to the country, an airport is used by a diverse mix of people. For overseas visitors, it is their first place of call and the place of their first impression of the country, having a significant influence for the visitors to like or dislike the subject country. As pointed out throughout this paper, digitization has had a significant impact on the aviation industry. It is very important to take advantage of this impact and ensure that the effects generated are positive.

With the government's tourism-oriented initiatives and the Olympic and Paralympic Games to be held in Tokyo in 2020, Japan expects to welcome a broader mix of visitors and we as an airport are required to be better-prepared to meet such expectations. We will, therefore, keep this in mind, be receptive to our users’ opinions and remain alert to the latest advances in digital technologies.