

Airports of the Future:

The Development of Airport Systems

International Symposium and Exposition in Celebration of 100 years of powered flight
Dayton, Ohio, July 14 - 17, 2003

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Abstract

Major airports in the United States typically have been individual entities, developed locally as self-sufficient enterprises. Only rarely have airport managers run systems of significant airports. Moreover, airports normally offer a broad range of products to all qualified clients. This local, all-purpose mode of operation is quite unusual for a competitive business. It is also inefficient and therefore likely to disappear in the coming generations.

Efficient enterprises usually adopt business models that

- focus on a segment of the possible markets -- to specialize in the needs of specific clients and serve them cost-effectively; and
- spread nationally and internationally -- to achieve economies of scale and scope.

This is the model for most successful manufacturers and service providers, such as Walmart or Microsoft. It is likely to be the model that will eventually prevail for airports, especially now that they are increasingly viewed as businesses rather than public services.

Adoption of this proven business model will transform the airport industry from a collection of monadic activities to systems of airports. The imperatives of focus and scale are likely to effect significantly both the physical configuration and the operational aspects of airports.

Airports probably will focus increasingly on serving particular clients or client groups and will develop into networks serving these markets. Three such systems are already emerging internationally:

- 24/7 intercontinental airports featuring multiple parallel runways and enjoying minimal noise restrictions. Examples are: Atlanta/Hartsfield, Denver/International; Hong Kong/ Chep Lap Kok; Houston/Bush; Orlando/International; Seoul/Incheon; and Toronto/Pearson.
- Cheap Fare, short haul airports serving the likes of Southwest, Westjet and Ryanair. Examples of these inexpensive airports providing service with low overhead are: Boston/Providence, Brussels/Charleroi, and Dallas/Love.
- Cargo airports dedicated to serving integrated freight operators such as Fedex and UPS. Examples are: Los Angeles/Ontario, Louisville, Memphis and East Midlands (UK).

In parallel, we can expect multinational airport operators to serve these systems, just as Hilton and Hyatt operate properties worldwide for many owners (including themselves). National and global operators have the ability to reduce unit costs and increase quality of service by profiting from enormous economies of scope. Such systems are indeed emerging in at least three ways:

- Complete airport operators such as BAA;
- Airport development teams providing BOT services, such as Hochtief and Bechtel; and
- Specialist operators focusing on specific types of activities, such as Standard Parking.

Keywords: Airport; Airport operations; Airport Systems; Airport Management; Privatization

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Introduction: An inefficient business model

Airports are an anomaly in the air transportation industry. The planning, design, and management of airports are largely local affairs, whereas the rest of the industry is global. Indeed, the manufacture of major transport aircraft is almost totally in the hands of two transnational companies: Boeing and Airbus. These organizations have international design teams, build components in factories in many different countries, and assemble an internationally integrated product. The major airlines are likewise global entities. Their own services span continents. American Airlines, British Airways, United and other airlines fly to North and South America, Europe and Asia. Moreover, they extend the reach of their own services through global alliances such as Star and oneworld. A great mismatch exists between the worldwide organization of the aircraft and airlines industries, and the local structure of the airport industry.

Major airports typically are individual commercial entities, developed and run locally as self-sufficient enterprises. Boston/Logan, Dallas/Fort Worth, Houston/Bush, Madrid, San Francisco/International, Singapore, Tokyo/Narita, Toronto and Zurich illustrate this phenomenon. Only rarely do airport managers run many important airports simultaneously, as they do in London, New York and Paris. In a few cases, national governments have operated their principal airports under a national organization. However, few of these national airport groups ever included more than one airport that was significant in the world rankings. In any case, the most important national governmental groups of airports have evolved into clusters of privatized airport authorities. Specifically, the governmental organizations that ran the Australian, Canadian, and Mexican airports have each lost their powers. The major airports that were part of these groupings, such as Sydney and Melbourne, Montreal/Dorval and Toronto/Pearson, Mexico City and Cancun, are each now independent.

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A deep organizational mismatch thus exists between the global airline industry and the local airport businesses. This leads to confusion. Airlines must deal with dozens if not hundreds of local practices, accounting systems, negotiating styles and objectives. There is no possibility of system-wide arrangements, procedures or guarantees. As far as airports are concerned, airlines have to do everything at retail. The variety of airport practices is organizationally inefficient for the industry.

The individualistic nature of the airport business is also economically inefficient. Suppliers have to sell to airports in small, often custom-designed lots -- whether they are delivering fire trucks, baggage systems or airbridges. Conversely, airports have to buy equipment and services at retail prices, since they do not combine in larger groups to exert pressure on manufacturers. Furthermore, since airports are relatively small, they cannot afford to invest in the development of major management processes, training programs and other cost-saving, efficiency-enhancing procedures. Small orders, small production runs, custom designs, inability to develop cost-saving procedures -- all contribute to higher unit costs.

To compound these organizational and economic inefficiencies, airport companies tend to be unfocused. Airports typically offer a broad range of products to all qualified clients. They provide passenger services to network, cheap-fare and charter airlines; cargo services in bulk and at retail; parking, concessions, fuel farms, fire-fighting and every other kind of service that might exist on or around the airfield. In North America, major airports generally also cater to executive and general aviation along with commercial traffic. In Europe and Asia, airports commonly provide baggage and ramp services. In various locations, such as Amsterdam, London and Paris, airport managers also take on the task of being major property developers. A typical major airport runs a wide collection of distinct businesses. This is not the model recommended by best practice.

Because this all-purpose mode of operation is inefficient, it is quite unusual for a competitive business. It is difficult to develop world-class services in any one line of business, almost impossible to do so across many disparate activities. Airports thus generally do not have a competitive critical mass or range of experience in most of their activities. For example, even the most impressive property development activities at airports, such as those at Amsterdam/Schiphol, are small businesses in this field. They pale into insignificance compared with international experts such as the Trammell Crow Company. In 2002, this company had 170 offices in North America, over 7000 employees, and annual revenues of around \$750 million

(yahoo.com, 2003). In most of their businesses, airports as now run thus cannot reasonably hope to perform at the standard set by international best practices.

The current individualistic, small-scale, unfocussed pattern of airport management is not the way to run the business efficiently. In the end, we may confidently expect that this organization will not persist. One or more new structures will replace the current arrangements. The purpose of this paper is to look ahead a generation or so to anticipate what could or might occur to rationalize the airport business, to make it as efficient and effective as it could be.

This message is for the owners and operators of airports. They have the opportunity to shape the destinies of their airports. They can define the business they are in and the clients they prefer to serve. Although aviation rules in the United States and elsewhere require airports to allow all kinds of aircraft and airlines to land on equal terms, airport owners are free to encourage some traffic and discourage others. They do this through their decisions about marketing of their airport, about the construction of runways and facilities, about the way they facilitate various services. These choices are open to both big and small airports. Thus, Denver/International and Boston/Providence; Cincinnati and Orlando/Sanford have each developed focussed roles for themselves. Airports can also determine how they will run their businesses. They can choose to do things individually, or they can move to system-wide management of their activities. The future is up to the airport owners. They can make the policy for the future.

Efficient Business Models

What are some characteristics of truly efficient businesses? What features might we expect to emerge as the airport industry develops system-wide, efficient procedures? Two seem particularly relevant in this context: focus and size.

Focus for a business means that it concentrates on a coherent line of activity. This enables the organization to master the complexities of that activity, to devote its full attention to issues and opportunities that arise, and to make sure that it stays at the forefront of developments in the field. Focus is an essential feature of many of the most effective manufacturers and service providers, such as Walmart or Microsoft. Any focused business is of course concerned with many different ventures on their premises. For example, it probably will have eating and parking facilities for its employees. This reality does not however mean that the focused company runs these distinct activities. MIT for example, quite rightly out sources the operation of its parking garages and its cafeterias. Focused on its educational mission, MIT does not need the

distraction of running these facilities. In any case, MIT can hardly hope to run parking lots and cafeterias excellently, given its lack of experience compared to expert organizations.

Standard Parking, a company that runs parking lots, is an example of a focused company relevant to the airport business. This particular company is expert on parking management. It does nothing else. According to its web site in 2003, it operates

"One million Spaces, 2,000 facilities in 270 cities... throughout the United States and Canada"... and it has "\$1.5 billion in revenue"

(<http://www.standardparking.com/>)

Such a company really knows its business. It has sustained training programs and job rotations to develop its staff in a variety of conditions and locations. It has been able to experiment with new services and to pick the best ones. It can invest in new management tools and amortize them over many facilities. Focused companies such as this, with wide experience and resources, should be able to run parking facilities much better than any airport that is trying to operate a single garage as well as do 10 other equally important jobs.

Size is also a driver of economic efficiency. When a company operates a large number of facilities over many locations, it can benefit from economies of scale and of scope. Most obviously, it can amortize the cost of investments in management processes over many transactions. Thus, Standard Parking has been able to justify a sophisticated educational program in its field, unparalleled by anything individual airports have been able to do. Again according to its web pages:

"APCOA/Standard Parking has developed an in-house, web-based training system—Standard University™—to provide every manager with the knowledge and skills needed to successfully perform specific job responsibilities."

(<http://www.standardparking.com/>)

Complementarily, size means that a company can obtain better prices on its equipment and supplies. Quite obviously, an airport ordering one new fire truck every decade cannot expect to get the same price as a group that orders 10 of them a year on average.

Geographic size is also important to a business. It allows the company to diversify and thus lower its risks due to seasonal or cyclical regional economic events. Lower risks in turn leads to lower cost of capital. A company spread over many similar operations can also shift its resources to cover the peaks of traffic at different locations at different times, thus increasing the productivity of its assets compared to individual airports that are not geographically diversified.

Although it is difficult to make good predictions, we can anticipate some developments in the airports industry. We can start with the observation that the more efficient business models tend to be focused and large. Next, we assume that, in a competitive economic arena such as the United States, more efficient forms of business tend to win out over the longer run. Thus, we may conclude that a focused, geographically extensive airport businesses will develop in the years ahead.

Emerging Operational Trends

Looking closely at worldwide developments, we can see some emerging trends toward focused specialization in airport operations. Specifically, it is possible to identify three major types of airports, each serving distinct clienteles in the air transport industry. These are:

- 24/7 intercontinental airports serving the global international passenger traffic;
- Cheap Fare, short haul airports that strive to be inexpensive to match the demands of their clients; and
- Cargo airports dedicated to serving integrated freight operators.

These patterns may form the natural bases for eventual groupings of focused airport businesses.

A network of 24/7 intercontinental airports has been emerging. These airports enjoy minimal noise restrictions and long runways. They thus liberate the airports from many of the operational restrictions that prevail at most traditional gateway airports such as London/Heathrow, New York/Kennedy and Tokyo/Narita. These limitations result from the combination of local night curfews at either end of the flight, time zone differences, and flight times. The new 24/7 intercontinental airports typically feature multiple parallel runways and thus offer excellent opportunities as hubs for distributing international traffic locally. Since they are 24/7, they can use of their facilities more intensively and productively than airports working with night and other restrictions. Since they are newer, their configurations of runways and passenger buildings tend to be more efficient. Overall, these 24/7 intercontinental airports have significant competitive advantages over the traditional gateways. Examples of these are Atlanta/Hartsfield, Denver/International; Hong Kong/ Chep Lap Kok; Houston/Bush; Orlando/International; Paris/De Gaulle; Seoul/Incheon; and Toronto/Pearson.

In parallel, a distinct network of cheap fare, short haul airports has been taking shape. These facilities cater preferentially to the highly efficient carriers such as Southwest in the United States, Westjet in Canada, and Ryanair in Europe. They thus put an emphasis on low cost, efficient facilities. Surprisingly, such efficient ground operations are key to the efficient operation of the

low-cost airlines. Airport charges may only amount to 5 to 10% of the seat-mile costs of a traditional network carrier such as American or United. However, for a low-cost airline whose overall seat-mile costs are half as large, the airport charges are one of their major cost categories (Fanning, 2003). The cheap fare airports typically have shorter runways, corresponding to the needs of aircraft such as the Boeing 737 that have been central to the business plans of their client airlines. Examples of these inexpensive airports providing service with low overhead are Boston/Providence, Brussels/Charleroi, Dallas/Love, Manchester/Liverpool (UK), Orlando/Sanford, and Toronto/Hamilton. Frequently, as for each of the airports just cited, they exist close to major network airports. The business objectives and opportunities of these airports are, in the main although not always entirely, substantially different from those of the 24/7 airports catering to intercontinental services (See de Neufville, 2003).

Cargo airports dedicated to serving integrated freight operators such as Fedex and UPS constitute a third network of airports. Examples of these facilities are Los Angeles/Ontario, Louisville, Memphis, East Midlands (UK), and Manila/Subic Bay. These airports primarily -- sometimes exclusively -- meet the requirements of integrated freight carriers. Their operating costs are relatively low for the freight carriers, which do not have to absorb the cost of passenger facilities in their landing fees. They also avoid the airside and landside congestion associated with passenger flights.

The cheap fare and cargo airports are particularly interesting because they are associated with the growing, profitable segments of the air transport industry. Their clients are the most economically powerful airline companies today, as demonstrated by the market capitalizations of the major airlines whose shares are listed on the major stock exchanges (see Table). Thus, these airports can be expected to have considerable impetus in the years ahead, compared to their competitors.

Airport owners have some degree of choice about what kind of network they want to be in. They may choose, for example, to cater to cheap-fare airports, as Boston/Providence has chosen to do, or to avoid such operations and favor traditional airlines, as Hamburg elected to do when it refused to provide cheap facilities to Ryanair. Certainly, airport managers can focus on what kind of network they are in or may belong to. They can then consciously develop collaborative alliances with other airports serving similar if not the same customers. For example, airports serving airlines such as Southwest or Westjet might associate in some kind of cooperative that would simplify their relations with these clients, would place bulk orders for equipment, and develop standardized facilities. Airports can proactively develop the systems of airports serving the emerging air transport networks.

Table: Market Capitalization of Major Air Transport Companies, demonstrating economic strength of Integrated and cheap fare airlines

Airline	Symbol 2003	Market Capitalization
		US \$, billions
UPS	UPS	66
Fedex	FDX	16.5
Southwest	LUV	11
Ryan Air	RYAAY	6
JAL	JALSY.pk	na
British	BAB	2
Delta	DAL	0.9
Airborne Freight	ABF	0.7
Northwest	NWAC	0.6
Alaska	ALK	0.5
Continental	CAL	0.3
KLM	KLM	0.3
American	AMR	0.3
United	UAL	0.05
America West	AWA	0.05
USAirways	UAWGQ.ob	0.01

Source: Yahoo.com, March 20, 2003

Emerging Business Models

Multinational airport operators are emerging to serve airport systems. These cluster in several different groups:

- Complete airport operators such as BAA and Alterra;
- Specialist operators that focus on specific types of activities, such as Standard Parking;
- Airport development teams providing BOT services, such as Hochtief and Bechtel.

Each has its own special capabilities and possible future role, as discussed below.

These operators do not generally own the facilities they operate. Indeed, given the political importance of airports to a country or a community, and the various laws that surround ownership and management of these facilities, it is generally not possible for private organizations to own major commercial airports outright. Exceptionally, private companies in Britain do own commercial airports freehold, as BAA does for London/Heathrow, London/Gatwick and five other British airports. More generally, private companies that manage airports have leased airports from national or regional governmental entities (see de Neufville, 1999, for a comparative analysis). This is the prevailing pattern for most countries that have privatized their airports, specifically in Australia, Canada and Mexico. More generally, many private companies run airport facilities under some kind of franchise or long-term contract. This pattern is the standard for food services in airports and duty-free stores, for example. Thus, Aer Rianta (the owner/operator of Dublin airport) and the DFS Group each run dozens of duty-free stores worldwide. In general, a company can manage many airport facilities over many countries without having to own the properties.

Companies managing airport properties can be compared to hotel chains. These typically have long-term agreements with the owners of the buildings, who may be insurance companies, real estate firms or private investors. Thus, Hilton and Holiday Inn operate properties worldwide for a large range of owners (including themselves). Such national and global companies have the ability to reduce unit costs and increase quality of service by profiting from enormous economies of scale and scope.

The important fact for the governmental agencies that own airports is that they do not have to merge their properties with those of other political entities in order to benefit from large-scale, system-wide management. They can attain efficiencies of scale and scope over the system by aligning their operations with those of large-scale operators. Just as pension funds that own hotels as investments hire a company such as Hyatt to run their property, public entities should be able to hire management companies to run all or parts of their properties. Indeed, they

already do. Indianapolis, for example, has such a contract with the BAA company. Thus, the fact that airports have and will be owned independently by separate political jurisdictions does not by itself preclude the establishment of large-scale, widespread airport businesses.

Complete airport operators that assume responsibility for the managing the entire airport are the immediate analogies of hotel operators. The BAA company provides a model. It is centered in Britain, where it operates seven airports, particularly the three major London airports. From this base it operates Indianapolis under a 10--year contract, several airports in Australia (including Melbourne), Naples (Italy) and an ever-growing collection of other properties. Similar airport-based management companies include:

- Amsterdam, that operates airports in Australia and properties elsewhere;
- Copenhagen, that operates airports in Mexico;
- Milan, a major partner in developing and managing Argentine airports; and
- Vancouver, that runs airports throughout Canada and Latin America.

Vancouver's operations are perhaps most similar to those of a hotel chain. It offers management services to a wide range of smaller airports that are not able to provide by themselves the management capabilities that Vancouver can. These include Toronto/Hamilton and others in Canada; Caribbean airports in the Dominican Republic, Jamaica and Turks and Caicos; as well as in Chile and New Zealand. (Vancouver, 2003)

Airport development teams provide an alternative model for an international airport company. For example, Alterra has been jointly owned by a major project management company (Bechtel) and an airport specialist (Civil Aviation Authority of Singapore). (Singapore, 2003) An important element of this business model is the capability to manage and deliver major airport developments, which individual airports normally lack since they rarely build major new facilities. Thus, Alterra is now responsible for the BOT (Build-Operate-Transfer) development of Lima airport in Peru. Other groups operating in this vein include:

- Cintra (Spain) a construction company that is a major participant in BOT projects for highways and other infrastructure -- including the operation of Niagara Falls airport; and
- Hochtief (Germany) that has been a major partner in several German airports as well as in the construction and operation of the major new airport at Athens (Greece).

Specialist operators focusing on specific types of activities perhaps constitute the most common kind of company to provide national or global economies of scale to airports. These cover specific functional areas such as parking, concession management or food services. Typically, their activities are not confined to airports. They generally provide operating expertise to many different industries. Standard Parking, for example, manages garages for all kinds of institutions

and for its own account. Similarly, the Hurley Corporation (Hurley, 2003) is one of North America's leading contractors for cleaning facilities, such as major office buildings and -- specifically relevant to this discussion -- Toronto/Pearson and Boston/Logan. The diversity these companies have across many different operations in a single community gives them a great advantage. It enables them to spread their overhead and staff costs, and achieve economies of scale in a way that would not be possible if they only provided services to the major airport serving a city.

In short, a spectrum of companies and business models are actively developing major companies designed to serve the airport industry. It is much too early to determine which companies and models will be most successful. Indeed, experience over the past decade in the privatization of airports has led many experts to change their minds as to what works best under which circumstances. Companies have formed and dissolved. Some experiences have been very successful, others not. As commonly experienced in other cases where new modes of business emerge, the initial years are confusing. The main line is clear, however. A pattern of national and global airport operators is emerging. These will tie individual airports together as never before, and will create integrated processes capable of dealing globally with the airlines, aircraft manufacturers and other participants in the air transport industry.

Getting from here to there

Systems of airport businesses may appear to be an impossible dream. Airport managers may easily cite many obstacles to the development of national chains of airport operators. Conscious of their traditions, their local politics, and national regulations, they can see many reasons a change to this situation cannot happen.

However, compelling reasons exist for the development of widespread airport systems. The economics alone should be decisive over time. Large-scale, coordinated management that enables economies of scale brings important savings to industry. Experience with other service industries demonstrates the phenomenon. Over the last generation, large integrated providers in many industries have replaced "mom-and-pop" operations. Walmart and similar chains have displaced local grocers; restaurant chains have become ubiquitous; drug store chains are major corporations. It is unlikely that airport operations are so particular that they will escape this phenomenon. Indeed, because their clients operate on global scale, and because national and international regulations standardize much of their operations, the integration of their operations into companies operating airport systems should be relatively easy.

From a management perspective, the transition from individual airport operations to systems of airports should not be especially difficult. Many functions at the airport are commodities that can easily be performed by specialist companies. These include many of the basic activities that now concern airport managers. Among them are:

- Cleaning and maintenance;
- Environmental management;
- Management of concessions;
- Parking services;
- Real estate development;
- Transport services for employees and passengers;
- and so on.

It will be more difficult to develop efficient standard practices for functions associated with management, such as contracting, planning, project development and the like. However, this transition is likely to come, especially in North America where outside consulting firms have regularly been central to these activities -- think architecture, accounting and civil engineering. In many cases, the process will require airports to substitute longer-term relationships for the kind of ad hoc deals that currently prevail. A number of airports do already operate on such principles. For example, Miami/International for years has had major airport consultants run most of its planning activities. However, these relationships, being close to important policy decisions, do require extra care.

The main obstacles to the development of efficient national and global airport operations are probably pride and patronage. Pride leads local airport organizations to believe that, since they have been in the business for many years, they are really experts and can do things efficiently. However, it is highly unlikely that the traditional, individualist airport operations are anywhere near the level of performance they could achieve with more resources, training and better procedures. Patronage, where it involves the use of mediocre or underqualified staff, is simply a professional blot that must be cleared up. As the airport business becomes increasingly sophisticated, dedicated public servants must and will eliminate patronage abuse where it occurs. Pride and patronage are not sufficient reasons to prevent the transition to the development of airport systems.

References

Civil Aviation Authority of Singapore (2001) "Changi takes stake in Alterra," press release, <http://www.caas.gov.sg/> , 25 April.

de Neufville, R. (1999) "Airport Privatization: Issues for the United States," Safety, Economic, Environmental, and Technical Issues in Air Transportation, Transportation Research Record 1662, Paper 99.0218, pp.24-31.

de Neufville, R. and Odoni, A. (2003) Airport Systems Planning, Design, and Management, McGraw-Hill, New York, NY.

de Neufville, R. (2003) "Multi-Airport Systems in the Era of No-Frills Airlines," presented at Transportation Research Board Annual Meeting, January. (Available at http://ardent.mit.edu/airports/de_Neufville_airport_papers.html)

Fanning, N. (2003) "Easyjet operations," presentation to the Airport Systems Planning, Design, and Management Course, Amsterdam.

Hurley Corporation (2003) Company web page, <http://www.hoa-llc.com/>

Standard Parking (2003) Company web page, <http://www.standardparking.com/>

Vancouver Airport Services (2003) homepage, <http://www.yvr.as.com/>

Yahoo.com (2003) Profile on Trammell Crow Company, <http://biz.yahoo.com/p/t/tcc.html>