



# Aerotropolis: Airport-Driven Urban Development

John D. Kasarda

John D. Kasarda, a ULI trustee fellow, is the Kenan Distinguished Professor of Business and director of the Frank Hawkins Kenan Institute of Private Enterprise at the Kenan-Flagler Business School of the University of North Carolina at Chapel Hill.

**T**ransportation infrastructure has shaped urban growth and form since the days of the Roman Empire. In the United States, urban development evolved in five overlapping transportation-induced waves. The nation's first major cities developed around seaports (Boston, New York). The next wave of urban growth occurred along the networks of rivers and canals that formed the backbone of America's industrial revolution (Pittsburgh, Buffalo). Railroads generated a third wave of urban development as they opened up inland areas to manufacturing and trade: major goods processing and distribution centers emerged at rail hubs and terminal points (Chicago, Kansas City). In fact, the South's largest city, Atlanta, originally developed as a railway hub and was first known as Terminus.

The fourth wave of urban development was fostered by the shift to cars and trucks to move people and goods. Freeways, beltways, expressways, and interstate highways generated a massive dispersion of housing and firms. Large suburban malls and commercial centers, industrial parks, and office complexes sprouted as much as 50 miles from major city centers. Some of these fourth-wave edge cities now have more retail and office space than the downtowns of their metropolitan areas.

The fifth wave, in which airports are the primary drivers of urban growth and form, has already begun. This wave was ushered in by the availability of large jet aircraft and by advances in telecommunications that greatly accelerated globalization; time-based competition; and corresponding needs for speed, flexibility, and reliability in the movement of people and products.



This paper examines key features of the fifth wave and explains why international gateway airports will be as important to urban development in the 21st century as automobiles and trucks were in the 20th century, railroads in the 19th century, and waterborne transport in the 18th century. While multiple transportation modes will continue to shape metropolitan growth, substantial evidence is accumulating that major gateway airports are generating spatial concentrations of commercial activities that are leading to a new aviation-linked urban form: the aerotropolis. After summarizing the underlying forces driving this new form of urban development, I will provide some examples of emerging and likely future aerotropoli.

### The Speed Imperative

A decade ago, futurist Alvin Toffler argued that by the beginning of the 21st century one indisputable law would determine competitive success: survival of the fastest.<sup>1</sup> In Toffler's view, producing high-quality goods at competitive prices would still be necessary—but no longer sufficient—for commercial success. Speed and agility would take center stage, as industry increasingly came to emphasize accelerated development cycles; international sourcing and sales; flexible, customized production; and rapid delivery.

How right he was. During the 1990s, the most successful companies used advanced information technology and high-speed transportation to source parts globally, minimize their inventories, and provide fast and flexible responses to unique cus-

tomers' needs, nationally and worldwide. They sought international partners, just-in-time suppliers, and sophisticated distributors and logistics providers. By combining flexible production systems with information systems that connected companies simultaneously to their suppliers and customers, firms reduced cycle times and customized their products to create additional value. They also offered the same speed and flexibility in the delivery process, from the time the finished goods left the factory until they arrived at the customer's doorstep.

The rise of the Internet and e-commerce further heightened time-based competition. As late as 1995, sales through the Internet were essentially zero. By 1999, U.S. Internet-based business-to-consumer (B2C) sales had grown to nearly \$7 billion. According to Forrester Research, 166 million packages were shipped in 1999 by Internet retailers (e-tailers), with approximately 70 percent going by express delivery.<sup>2</sup> By 2003, e-tailers are expected to ship 1.1 billion packages annually, with overall global e-commerce approaching \$7 trillion in transactions in 2004.<sup>3</sup>

Most of this explosive growth is expected to be business-to-business (B2B), supply-chain transactions where materials and components will be ordered through the Internet and shipped to next-stage producers. The introduction of e-marketplaces (auctions, aggregators, bid systems, and exchanges) will greatly expand B2B e-commerce: Forrester Research predicts that e-marketplaces will account for up to three-quarters of B2B supply-chain transactions by 2004.<sup>4</sup>

The new Guangzhou Huadu Airport, currently under construction in southern China, is being built in response to the staggering growth rates predicted for the country's air cargo and passenger traffic.





The Dallas/Fort Worth International Airport (top) has had a major impact on employment growth in the metropolitan area. Las Colinas (bottom), located just east of the airport, is home to more than 400 multinational companies, including IBM, Xerox, GTE, and Sprint.

Courtesy of Trammell Crow





However, as many e-tailers discovered during the 1999 Christmas season, as valuable as the Internet is in generating sales, the Web cannot move a box. Order fulfillment frequently broke down, and the WWW—world wide wait—cost e-tailers plenty.

To meet the imperative of speed in order fulfillment, e-commerce distribution centers are being built at and near airports that have extensive flight networks, a location trend that's sure to accelerate in the decades ahead. Complementing these airport-linked e-commerce fulfillment centers are flow-through facilities for perishables (either in the physical or economic sense), just-in-time supply-chain and emergency parts provision centers, and reverse logistics facilities for the repair and upgrade of high-tech products such as computers and cell phones. The clustering of such time-sensitive goods facilities around airports is stimulating the further expansion of air cargo, air express, less-than-load (LTL) trucking, freight forwarders, and third-party logistics providers along major arteries leading into and out of gateway airports. All of these functions and facilities are leveraging off each other.

Speed and agility have become so critical to the new economy that air commerce is quickly becoming its logistical backbone. Forty percent of the value of world trade already goes by air, and the percentage is steadily rising.<sup>5</sup> Further evidence that we have entered "the fast century" is offered by data showing that nearly two-thirds of all U.S. air cargo is transported via 24- to 48-hour door-to-door express shipments, with the FedEx hub at Memphis becoming the world's leading air cargo airport.<sup>6</sup>

Not only time-sensitive goods-processing and distribution facilities are being drawn to airports. Airports are also becoming magnets for corporate headquarters, regional offices, and professional services (such as consulting) that require employees to undertake considerable long-distance travel. Airport access is likewise a powerful attraction to service-sector industries such as advertising, legal services, data processing, accounting and auditing, and public relations, which often send out professional staff to their customers' sites or bring in their clients by air.

With intellectual capital supplanting physical capital as the primary factor in wealth creation, time has taken on heightened importance for today's knowledge workers. So has the mobility of these workers over long distances. Research has shown that technology workers travel by air between 60 percent and 400 percent more frequently than

those in the general workforce.<sup>7</sup> Business travelers, overall, benefit considerably from access to major airports, which offer greater choice of flights and destinations, more frequent service, more flexibility in rescheduling, and generally lower travel-related costs (for example, hub airports make it easier to avoid the time and expense of overnight stays).<sup>8</sup>

Some observers have suggested that advances in Internet access, videoconferencing, and other distributed communications technologies will diminish the need for air travel. But the evidence indicates that telecommunications advances often promote additional air travel by substantially expanding long-distance business and personal networking. Indeed, innovations in telecommunications technology have generated spatial mobility at least since the days of Alexander Graham Bell—whose first words over his newly invented telephone were "Watson, come here, I need you."

## Urban Economic and Land Use Impacts

In an economy increasingly geared to speed, mobility, and global access, frequent and extensive air service has become essential to attracting major conventions, trade shows, and merchandise marts. Two facilities—Infomart and Market Center, both of which are located on the I-35 corridor, between Dallas's Love Field Airport and the Dallas-Ft. Worth International Airport—offer examples of this attraction. Infomart is a huge, ultra-contemporary merchandise display building for telecommunications and information technology companies. Market Center—a cluster of six large buildings that contain nearly 7 million square feet of display space for fashion clothing and home merchandise—is the world's largest wholesale merchandise mart. Hundreds of thousands of buyers and vendors fly into Dallas annually to conduct business at Infomart and Market Center. In 1999, Market Center alone attracted buyers and vendors from all 50 states and 84 countries, who purchased 300,000 airline seats and filled 720,000 hotel rooms while conducting an estimated \$7.5 billion in wholesale transactions.

Clusters of high-tech facilities and information technology companies are likewise locating along major airport corridors, such as those along the Dulles International Airport access corridor in Northern Virginia and the expressways leading into and out of Chicago's O'Hare International Airport. Dulles's and O'Hare's experiences are being replicated across the country, with airport



scale becoming a primary predictor of an area's high-tech job growth.

Kenneth Button and Roger Stough conducted a comprehensive study of the impact of hub airports on employment growth in high-tech fields.<sup>9</sup> Their multiple-regression analysis (which controlled for other factors that may affect high-tech job growth) covered all 321 U.S. metropolitan statistical areas (MSAs) and generated convincing results. Button and Stough showed that the presence of a hub airport in an MSA increases the number of high-technology jobs in the area by over 12,000, and their multiple-regression model explained over 64 percent of the variation among metropolitan areas in high-technology employment growth. Additional analysis revealed that the causal link between job growth and the level of airport services flowed from air transportation to the creation of high-tech employment, and not vice versa. This finding has

been corroborated by research that Michael D. Irwin and I undertook, which demonstrated that airports have pervasive effects on overall metropolitan employment growth and that the causal relationship flows from the extensiveness of air connections to employment growth.<sup>10</sup>

Numerous other studies from around the country and the world are documenting the remarkable impact of airports on urban economies and land use. A sample of these effects:

■ In 1999, Los Angeles International Airport (LAX) was responsible for over 400,000 jobs in the five-county Los Angeles region, 80 percent of which were in L.A. County, where one in 20 jobs was found to be tied to LAX. The airport currently generates \$61 billion in regional economic activity, which translates to \$7 million per hour.

■ Dallas-Ft. Worth International Airport has become the primary driver of Metroplex's fast-growing economy. The number of companies located within the dynamic Las Colinas area, just to the east of the airport, has expanded to more than 2,000 and includes Abbott Laboratories, AT&T, Exxon, GTE, Hewlett-Packard, and Microsoft.

■ In the 26-mile commercial corridor linking Washington, D.C.'s two major airports—Reagan National and Dulles International—employment grew from 50,000 in 1970 to over 600,000 by 1996. This represents a 1,100 percent increase: in contrast, overall U.S. employment growth during this period was 59 percent. Among the companies located along the airport corridor are America Online, Computer Associates, Nextel Communications, Cisco Systems, and EDS.<sup>11</sup>

■ During the ten years following the introduction of international air service to Atlanta in 1975, 813 foreign firms located there, generating \$33 billion in investment and 54,000 jobs. Airports offering direct international service have become the most important factor in determining the siting of a foreign business headquarters.<sup>12</sup>

■ The al Chalabi Group documented that more than 200,000 manufacturing, distribution, and office jobs located in the vicinity of Chicago's O'Hare Airport between 1975 and 1990, largely because of the access they were able to obtain to national and international markets.<sup>13</sup> Al Chalabi projects that by 2020, O'Hare Airport will account for 480,000 jobs (either direct, indirect, or induced). In addition, 90,000 new jobs catalyzed by airport

Alliance Airport (top), located near downtown Fort Worth, is among the nation's first industrial airport and multimodal transportation facilities. The FedEx sorting hub at Alliance Airport is shown below.





access will create demand for 6.5 million square feet of office space, 4 million square feet of manufacturing and distribution facilities, and 25,000 new residential units.

■ In the Philippines, Subic Bay Freeport is rapidly expanding around a former U.S. naval air base that was converted to commercial use in 1993. Since FedEx located its Asia/Pacific hub at Subic Bay in 1994, over 150 firms—employing 40,000 workers—have located there, generating almost \$2.5 billion in investment. Between 1994 and 1999, the annual value of exports from Subic Bay jumped from \$24 million to \$559 million. In late 1998, Acer opened its largest personal computer assembly facility in the world at Subic Bay; the facility relies heavily on air freight for its supply-chain management.

■ By late 1997, nearly 50,000 people were employed on the airport grounds at Amsterdam's Schiphol Airport, a 7.2 percent increase over the previous year. In 1998, nearly half of the 547 companies linked to Schiphol grew—compared with 31 percent in 1995. Schiphol alone accounts for 10 percent of the European air cargo market and 1.9 percent of The Netherlands' GNP; the airport forecasts

that by 2015, it will generate 2.8 percent of the GNP—approximately \$14 billion.

The impact of airport-induced job growth on land use in the vicinity of airports is substantial. An analysis of employment growth in the suburban rings of U.S. metropolitan areas showed that the job growth rate for areas within four miles of airports was two to five times faster than the overall job-growth rate for the suburban ring within which the airport was located. Most of the employment was concentrated around the airport or along a major access corridor within 15 minutes of the airport.<sup>14</sup>

## The Rise of the Aerotropolis

Emerging corridors, clusters, and spines of airport-induced businesses are giving rise to new urban forms as much as 15 miles from major airports. These represent the beginnings of the aerotropolis. In response to the new economy's demands for speed and reliability, the aerotropolis is based on low density, wide lanes, and fast movements. In other words, form is following function.

Although aerotropolis have so far evolved largely spontaneously, with previous development creating

**Commercial and residential development is clustering near the newly completed Hong Kong International Airport.**







**A major new aerotropolis is developing in South Korea around Incheon International Airport, which is scheduled to open in 2001.**

arterial bottlenecks, in the future they will be improved through strategic planning. For example, dedicated expressway links (aerolanes) and high-speed rail (aerotrans) will efficiently connect airports to nearby and more distant business and residential centers. Special, truck-only lanes will be added to airport expressways as well.

The new measurement for determining land value (and corresponding urban structure) will be time-cost access to the airport. Firms of various types will bid against each other for accessibility predicated on the utility each gives to reducing the time and cost of moving people and goods to and from the airport.

To many, this new structure will appear simply as additional sprawl along main airport corridors. Yet the aerotropolis will actually be a highly reticulated system based on time-cost access gradients radiating outward from the airport; in short, the three “A’s” (accessibility, accessibility, accessibility) will replace the three “L’s” (location, location, location) as the most important commercial real estate organizing principle.

Air-commerce clusters and spines are already taking on distinct spatial form around international gateway airports such as New York’s Kennedy, LAX, London’s Heathrow, Paris’s Charles de Gaulle, and Amsterdam’s Schiphol. In the United States, even smaller, specialized air-cargo airports—such as Alliance Airport, near Ft. Worth, Texas, and Rickenbacker Airport, in Columbus, Ohio—are generating mini-aerotropoli in the form of low-density cluster and spine development. Commercial





real estate development surrounding southern California's Ontario Airport (which is the cornerstones of a major logistics complex 40 miles east of Los Angeles) and along I-10 and I-15, which radiate from the airport, offers an excellent contemporary illustration of an aerotropolis in evolution.

Aerotropoli are also emerging in distinct patterns around new international airports in Asia. One example is Lantau Island, where the newly opened Hong Kong International Airport is spawning highly visible business and residential clusters directly linked to the airport. In late 1999, the Walt Disney Company announced that it would locate its third international theme park (Hong Kong Disneyland) on Lantau Island to take advantage of the international airport and its high-speed rail and expressway links to Hong Kong. This siting decision is not unlike those Disney made earlier for Tokyo Disneyland, near Narita International

Airport, and EuroDisney, near Paris's Charles de Gaulle Airport.

A major planned aerotropolis is under development at Inchon, Korea, where the government is creating a 24-hour aviation city on Yongjong Island, about 40 miles west of downtown Seoul. The new international airport (scheduled to open in 2001) will anchor an expansive urban agglomeration composed of commercial, industrial, residential, and tourism sectors. Its centerpiece will be Media Valley, Korea's version of Silicon Valley. Designed as a center for global high-tech industries, Media Valley is being constructed adjacent to the airport on a 3.6-million-square-meter site that will include a large techno-park and a university research center.

As of mid-1999, 625 companies—including 49 companies from Canada, Israel, Japan, The Netherlands, Taiwan, and the United States, among others—had



**The Cavite Multi-Function Complex, a 4,500-acre transportation complex and planned development in the Philippines, is in the planning stages.**



submitted letters of intent to move into Media Valley. Arthur D. Little predicts that by 2003, a total of 1,300 companies will be located in Media Valley's campuslike setting, and by 2005 slightly over 2,000.<sup>15</sup>

A new town is being developed to serve as a residential base for those employed at Media Valley and in other sectors of this emerging aerotropolis. Dedicated expressways will give both Media Valley employees and the new town residents high-speed access to Incheon Airport. By 2004, the airport, currently nearly 90 percent complete, will be complemented by a seaport and a teleport now under construction. The plan is to form a consolidated "tripport" for 21st-century transportation, distribution, and information processing.

An even more ambitiously planned aerotropolis radiates northward from the Kuala Lumpur International Airport in Malaysia. This massive new airport will provide the aviation foundation for Malaysia's Multimedia Super Corridor (MSC), a high-tech government, commercial, education, and residential zone about the size of the city of Chicago. Promoted internationally as the future information technology center of Asia, MSC will contain two new cities (Putrajaya, the relocated government capital, and Cyberjaya, or Cyber-city, each of which will house about a quarter of a million residents), along with a multimedia university to train IT workers. MSC's advanced infrastructure will be complemented by laws and policies designed to create the ideal commercial environment for developing and merging 21st-century audio, video, and data-transmission technologies.

Also on the drawing board is the Cavite Multi-Function Complex, which has been proposed for a substantial reclamation of Manila Bay, in the Philippines. When fully developed, Cavite will combine a new airport and deep-water seaport with commercial and residential areas, creating a transportation complex and planned development of over 4,500 acres.

Cavite, if and when it ever gets built, along with Hong Kong's Lantau Island, Malaysia's Multimedia Super Corridor, and Korea's Incheon-Aviation City project demonstrate that airports will be the cornerstones of dynamic new forms of 21st-century urban development. The commercial real estate community has already begun to take serious notice. For example, both the Trammell Crow Company and Hines have established airport property divisions as new units in their corporate structures. Real estate investment trusts such as Prologis and

AMB are giving primary emphasis to airport-linked logistics and distribution properties. In fact, AMB is disposing of much of its traditional warehousing and retail properties to focus its investments on high-velocity flow-through distribution facilities at or near America's six largest airports. Specialized commercial real estate companies such as International Airport Centers, headquartered in Birmingham, Michigan, are concentrating on building business and distribution parks around the nation's top airports.

It is clear that as the fast century begins, a fifth wave of airport-induced urban development is becoming firmly established. Real estate professionals who recognize this megatrend can select strategic sites near major gateway airports and position investment to be leveraged by air commerce. Planners and developers who design and build infrastructure and facilities that are consistent with the new form and function of the aerotropolis can contribute substantially to the economic competitiveness of urban areas and to the emerging needs of business.

## Notes

- 1 Alvin Toffler, *Powershift: Knowledge, Wealth, and Violence at the Edge of the 21st Century* (New York: Bantam Books, 1990).
- 2 Jose Gose, "Thanks to E-Commerce, Warehouses Aren't Just for Storage Anymore," *Barron's*, March 13, 2000.
- 3 Forrester Research, "E-Marketplaces Will Lead US Business eCommerce to \$2.7 Trillion in 2004" (Cambridge, Mass.: Forrester Research, 2000).
- 4 Ibid.
- 5 John D. Kasarda, "Time-Based Competition and Industrial Location in the Fast Century," *Real Estate Issues* (winter 1998/1999):24-29.
- 6 "Traffic Continues to Increase at World's Airport," *World Airport Week*, May 2, 2000, p. 5.
- 7 Steven P. Erie, John D. Kasarda, Andrew McKenzie, and Michael A. Molloy, "A New Orange County Airport at El Toro: Catalyst for High-Wage, High-Tech Economic Development" (Irvine, Calif.: Orange County Business Council, September 1999).
- 8 Cyrus Freidheim Jr. and B. Thomas Hansson, "Airports as Engines of Economic Development," *Strategy and Business*, Third Quarter 1999, 1-6.
- 9 Kenneth Button and Roger Stough, "The Benefits of Being a Hub Airport City: Convenient Travel and High-Tech Job Growth" (Fairfax, Va.: Institute of Public Policy, George Mason University, November 1998).
- 10 Michael D. Irwin and John D. Kasarda, "Air Passenger Linkages and Employment Growth in U.S. Metropolitan Areas," *American Sociological Review* 56, no. 4 (August 1991):524-37.



<sup>11</sup> Fairfax County Economic Development Authority, 1998 Annual Report, <http://www.eda.co.fairfax.va.us/fceda/news-f.htm>; Loudoun County Department of Economic Development, 1999. <http://www.loudounva.com/index2.htm>.

<sup>12</sup> For example, foreign businesses locating adjacent to Paris's Charles de Gaulle Airport include General Electric and Hewlett-Packard (USA), Sharp Electronics (Japan), and Unilever (The Netherlands).

<sup>13</sup> Margery al Chalabi, "The Economic Impact of a Major Airport," Working Paper Series, Paper 633 (Washington, D.C.: ULI—the Urban Land Institute, July 1993).

<sup>14</sup> Glen E. Weisbrod, John S. Reed, and Roanne M. Neuwirth, "Airport Area Economic Development Model" (paper presented at the PTRC International Transport Conference, Manchester England, 1993).

<sup>15</sup> "Miracle on Han Is Moving Down River: Incheon Nurtures Its Strategic Central Location," *Business Korea*, July 1999, pp. 18–22.