

***Aerotropolis: Business Mobility and
Urban Competitiveness in the 21st Century***

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The 21st century is bringing competitive advantage to cities that understand and capitalize on the changing context of business mobility and commercial development. This context is being altered by a catalytic interaction of digitization, globalization, and aviation transforming where and the way business is conducted. It is also transforming the pace and distances that products and people routinely traverse.

These dynamics have heightened competition among places as well as firms. Adapting to similar realities, both are employing similar strategic responses. Here, the increasingly turbulent, fast-paced, globally networked economy has made speed, agility, and connectivity the competitive mantra of not only many of the world's most successful firms but also cities such as Amsterdam, Chicago, Dubai, Hong Kong, Memphis, Paris, Shanghai, and Singapore.

Such cities, among others, have recognized that the constellation of the above factors is creating a new economic geography with aviation networks and major airports driving and shaping business location and urban development in the 21st

century as much as highways did the 20th century, railroads in the 19th and river, canals and ports in the 18th. Today, areas around these airports have become magnets for time-critical manufacturing and distribution, entertainment, tourism, and corporate offices, among others, that require speedy, long-distance connectivity.

Aviation routes operate as their “Physical Internet” moving people, parts, and products quickly among far flung locations with airports serving as the routers (see Aviation’s Physical Internet in Figure 1). As this Physical Internet evolves in breath and depth, route development, airport development, business development and regional economic development are going hand-in-hand around the world.



Source: Airline Route Mapper

Figure 1
Aviation's Global Physical Internet
(54,317 Routes)

The aerotropolis, an airport-centric urban economic region, coalesces these development processes, spatially and functionally. Its spatial elements consist of aviation-oriented businesses and people that cluster near the airport and outward along connecting transport corridors, generating observable form. Its functional elements include the spatial elements as well as businesses and business people who may be widely dispersed throughout the metropolitan area or clustered at points some distance from the airport but nonetheless are highly dependent upon it for time-critical access to their global suppliers, customers, or enterprise partners. Simply put, the aerotropolis is where the global meets the local.

The Aerotropolis, in fact, represents the physical manifestation of globalization made concrete in the form of aviation-oriented, airport-centric urban development where many local businesses are more dependent on distant suppliers and customers than on those in their own region. Its competitiveness rests with its aviation connectivity and corresponding ability to move people and products quickly around the world. In the 21st century Aerotropolis, aviation, globalization, and time-based competition have become inextricably interwoven in functional and spatial form.

Fast-Cycle Logistics

Driving much contemporary aerotropolis development is the growing importance of fast-cycle logistics, especially which utilizes air cargo. In many respects, the 21st century is becoming as much the “Fast Century” as it is the “Aviation Century”.

Customers in both advanced and emerging markets are demanding speedy and predictable delivery of products, often with distinctive features. Competitive advantage is thus being gained by firms that respond flexibly, quickly and reliably to their domestic and global customers, delivering lower cost, higher-quality (often customized) products quickly over great distances.

Nowhere is this more manifest than with high-tech manufacturers who must be able to access global networks of suppliers of materials, components and sub-assemblies in order to obtain the best-quality components at the lowest possible price. Likewise, contract drug and medical testing often requires 24-hour turnaround from specimen source to distant test site with results back to the source, the latter typically done electronically. Since the web will not move a box, aviation's Physical Internet is heavily relied upon in the high-tech arena for speedy delivery and time-critical inventory control.

At the same time, increased flows of information worldwide are leading to accelerating changes in customer demands. Companies that can detect these changes, design and produce the desired products and services, and deliver them faster than their competitors are capturing market share. Since speed also reduces warehousing costs, stock-outs and remaindered goods, the speed advantage becomes a cost advantage as well.

Fast-cycle logistics as a new competitive tool is being further validated by marketing research which shows that, worldwide, consumer tastes are now changing much more swiftly than was the case in prior decades. Indications are that the pace of such shifts will accelerate further in the decades ahead, resulting in situations where products that are “hot” one month may become obsolete just a few months later. Such is already happening in the fashion clothing industry and with “smart” devices like successive generations of iPads and iPhones where delivery time to the retail shelf (or now directly to the customer) impact sales and profits, frequently separating market winners from losers.

The implications of these trends for fast-cycle logistics strategies are already evident. Adapting to growing demands for flexibility, predictability, and speed, companies such as Apple, Boeing, Lenovo, Nokia, and Siemens have reengineered their sourcing and distribution systems to become much more agile, reliable, and customer responsive. They now compete not only on price and quality but also on the basis of speedy, predictable delivery, as well as after-sales support (including repair and return) of their products. They manage complex networks that encompass the entire value chain of suppliers, distributors, and customers across national borders as is illustrated in Figure 2 for Apple’s iPhone 5.

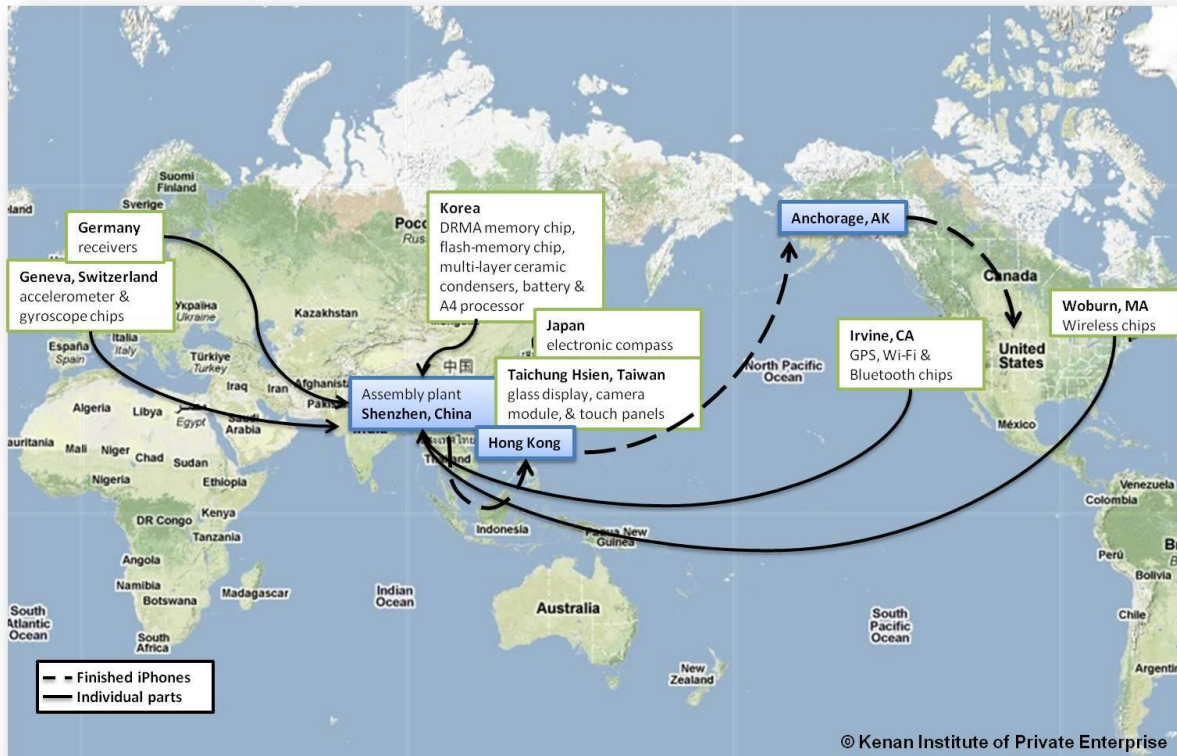


Figure 2
Global Supply Chain of Apple iPhone 5

Mandating such changes are rapid and relentless worldwide technological, political, and economic transformations. Modern transportation, telecommunications, and goods-producing technologies have spread throughout the globe. Trade policies continue to be liberalized and new markets opened. Communist/socialist and former socialist countries such as China, Russia, Poland, and Vietnam are now participating in capitalist marketplace with vigor. Huge wage differences between advanced industrial and developing countries have resulted in much wider geographic dispersion of component manufacturing sites, places of assembly, and of final sale. With rising workforce skills in developing nations and rapid cross-border technology transfer,

countries such as Brazil, India, South Africa and Thailand have achieved much greater levels of economic output and now produce highly sophisticated products.

International customers have also become far more connected, sophisticated and demanding. Because of increased digital and physical connectivity, they are able to see and have delivered an unparalleled variety of products from all over the world. They are able to assess and identify value, and are therefore highly selective in purchasing. They expect quality, competitive pricing, and predictable delivery. They also want customization of the products they buy, and they want these customized products right away, not in two to four months. For many purchases, not even two to four weeks is fast enough. In our “must have it now” world, they often want them in two to four days.

Rapid, predictable delivery of high-value products over long distances has become so critical to the new economy that air commerce is becoming its logistical backbone. According to research conducted at the University North Carolina’s Kenan Institute, over 30 percent of the value of world trade goes by air. Air logistics, which includes air cargo, air express, and their supporting logistics services, approached a US\$400 billion industry in 2012. It is expected to double again by 2025, with international air express shipments expected to nearly triple during this period.

Already, air cargo and air express are the preferred modes of international shipping for higher value to weight business to business (B2B) transactions in

microelectronics, medical instruments, smart phones, digitized auto parts, optics and small precision manufacturing equipment, along with high-value perishables such as seafood, fresh cut flowers, and biomed. Even lower value to weight product distribution, including apparel, footwear, and seasonal toys, have become time-sensitive and are increasingly shipped by air. With *economies of speed* becoming as important as economies of scale and economies of scope, many such industries are gravitating to airport areas that offer them extensive speedy connectivity to global markets.

Air Passenger Connectivity

It's not just time-critical goods processors and distributors that are clustering around gateway airports. As the world's service economy also shifts into fast-forward, these airports are becoming magnets for regional corporate headquarters, trade representative offices, and professional associations that require executives and staff to undertake frequent long-distance travel. Airport access is likewise a powerful attraction to information-intensive industries such as auditing, advertising, legal, financial and insurance services. With business remaining a "contact sport" these so-called producer services firms regularly send out executives and professional staff to distant customers' sites or bring in their clients by air. Airports which offer a greater choice of flights and destinations, more frequent service, and more flexibility in rescheduling (that is, they possess the fastest and broadest Physical Internet) have become particularly powerful external assets for producer service firms.

With the shortest time between two distant locations being a non-stop flight, the accessibility air passenger hubs provide has also become essential to attracting business meetings and conventions, trade shows, exhibitions and merchandise marts. Such long-distance physical accessibility has made them attractive locations, as well, for medical tourism, executive education, and large entertainment venues such as theme parks and Formula 1 race tracks along with hotels housing distant travelers.

Knowledge-transfer firms like consulting are similarly gravitating to airport areas. With intellectual capital supplanting physical capital as the primary factor in 21st century wealth creation, time has taken on heightened importance for today's knowledge workers as has their long-distance travel to transfer complex information.

Research conducted by the University of California has shown that knowledge workers travel by air 400 percent more frequently than workers in general, giving rise to the term "nerd birds" for aircraft connecting U.S. tech regions such as Austin, Boston, and San Jose, California.

The Rise of the Aerotropolis

As more and more aviation-oriented businesses are being drawn to airport areas and along transportation corridors radiating from them, an aerotropolis emerges stretching up to 25 kilometers outward from some major airports. Analogous in shape to the traditional metropolis made up of a central city core and its rings of commuter-heavy suburbs, the Aerotropolis consists of an airport-centered commercial core

(Airport City) and outlying corridors and clusters of aviation-linked businesses and associated residential development. Some of these largest Aerotropolis clusters including Amsterdam Zuidas, Las Colinas, Texas, and South Korea's Songdo International Business District near Incheon International Airport have become globally significant airport edge-cities whose business tentacles routinely touch all major continents.

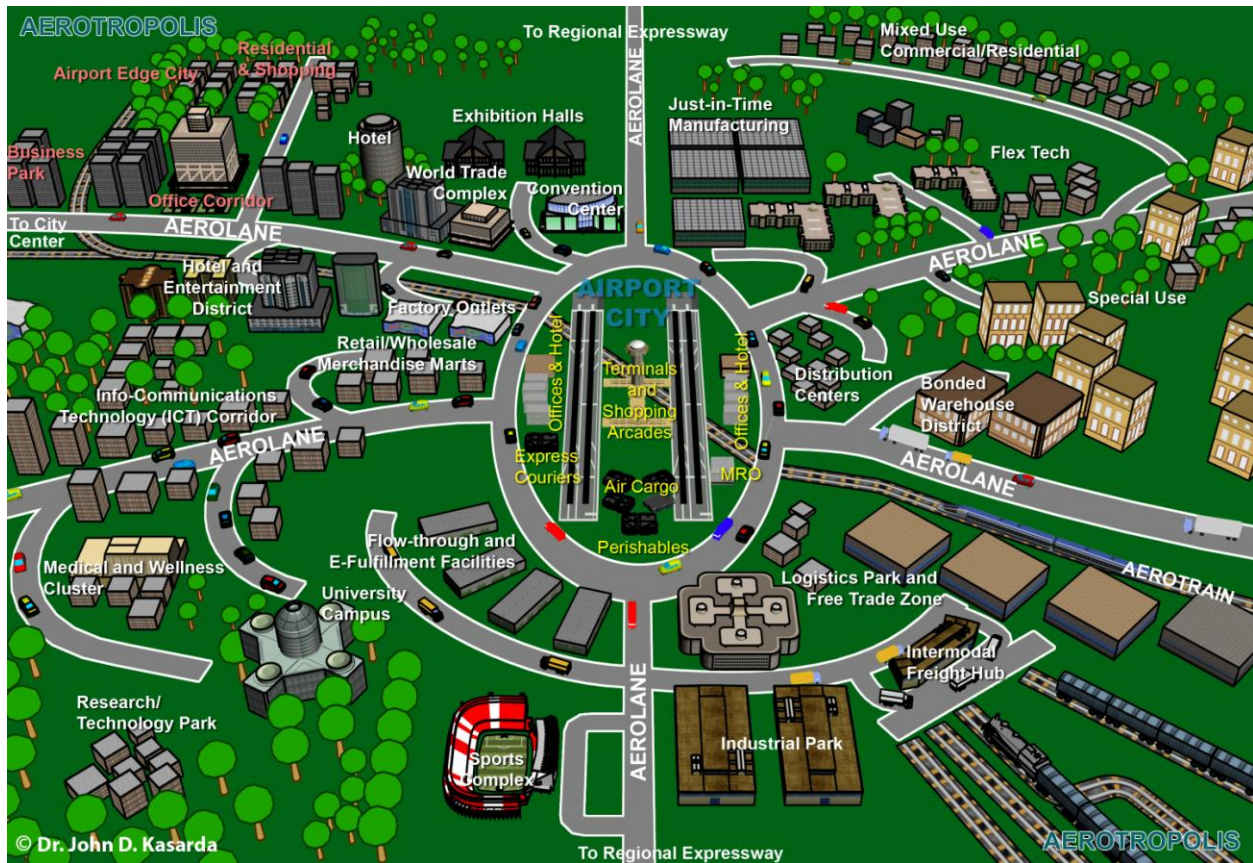
Dozens of Aerotropolises are evolving either by design or spontaneously (see www.aerotropolis.com). Among the most prominent are those on and around Amsterdam Schiphol, Chicago, Dallas-Ft. Worth, Dubai, Hong Kong, Incheon (South Korea), Memphis, Paris Charles de Gualle and , Washington Dulles airports. Each has attracted a remarkable amount of business investment to their airport areas generating huge economic returns to their regions and nations.

In many cases, the economic impact is in the tens of billions of US dollars annually. For example, more than 1000 firms have located in the Amsterdam Aerotropolis (including the world headquarters of ABN Amro and ING banks located just six minutes from Schiphol's terminal) in large part because of the superb connectivity this airport provides their executives. Likewise, four Fortune 500 world headquarters are located in Las Colinas Texas, less than a ten minute drive from Dallas-Ft. Worth International Airport, while Chicago's O'Hare airport area has more office and convention space than most major cities. The Washington Dulles airport region is the second largest retail market in the US (just behind New York City's Manhattan Island) and has become a high-tech business and consulting hub, as well. Both Hong

Kong and Incheon Airports boast leading logistics complexes with these two airports also sustaining, respectively, Hong Kong Disneyland and New Songdo IDB, the latter an “Instant City” the size of downtown Boston designed and built by global corporations for global corporations. Dubai and Singapore have emerged as a full-fledged Aerotropolises with their large leisure, tourism, commercial and finance sectors dependent on aviation. They, along with Hong Kong, Incheon, Memphis and Paris Charles de Gaulle have likewise effectively developed global air logistics hubs that have attracted substantial external investment, boosted trade, and made their economies far more competitive.

The economic impact of the airports has been immense. For instance, Memphis International Airport contributed nearly US \$30 billion to its metropolitan area economy in 2009, led by its FedEx world super-hub. And both Dubai and Singapore may be described as global hub airports with city-states attached.

A spatially compressed model of the Aerotropolis depicting its main features is presented in Figure 3. No Aerotropolis will look exactly like this illustration but most will eventually take on similar features, led by newer ‘greenfield’ airports less constrained by many prior decades of non-aviation oriented surrounding development. The Aerotropolis is thus much more a dynamic, forward-looking concept than a static, cross-sectional model whose form reflects historic airport-area development to date. Its future development will be driven by further global integration and the need for speed both fostered by the continuing expansion of aviation serving as the worlds 21st century high-speed Physical Internet.



*Figure 3
Aerotropolis Schematic with Airport City Core*

Although most aerotropolis development to date has been organic, spontaneous and haphazard — often spawning congestion and environmental problems — in the future it can be markedly improved through strategic infrastructure and urban planning.

- Dedicated airport expressway links (aerolanes) and airport express trains (aerotrain) should efficiently connect airports to major regional business and residential concentrations.

- Special truck-only lanes should be added to airport expressways, as should improved interchanges to reduce congestion.
- Time-cost accessibility between key nodes should be the primary aerotropolis planning metric rather than distance.
- Businesses should be steered to locate in proximity to the airport based on their frequency of use, further reducing traffic while improving time-cost access.
- Airport area goods-processing activities (manufacturing, warehousing, trucking) should be spatially segregated from white-collar service facilities and airport passenger flows.
- Noise and emission-sensitive commercial and residential developments should be sited outside high-intensity flight paths.
- Cluster rather than strip development should be encouraged along airport transportation corridors with sufficient green space between clusters.
- Form-based codes should establish general design standards for airport area buildings, walkways, travel lanes, landscaping, and public space.
- Placemaking and wayfinding enhanced by thematic architectural features, public art, and iconic structures should make aerotropolis developments interpretable, navigable, and welcoming.
- Mixed-use residential/commercial communities housing airport area workers and frequent air travelers should be developed with easy commutes and designed to human scale providing local services and sense of neighborhood.

In short, aerotropolis development and sustainable "smart growth" can and should go hand-in-hand.

The above outcomes will not occur under most current airport area planning approaches which tend to be localized, politically and functionally fragmented, and often conflicted. A new approach is required bringing together airport planning, urban and regional planning, and business-site planning in a synergistic manner so that future Aerotropolis development will be more economically efficient, aesthetically pleasing,

and socially and environmentally sustainable. The real question is not whether aerotropolises will evolve around major airports (they surely will). It's whether they will form and grow in an intelligent manner, minimizing problems and bringing about the greatest returns to the airport, its users, businesses, surrounding communities, and the larger region and nation it serves.

Aerotropolis Skeptics

A number of observers have suggested that advances in Internet access, high-resolution videoconferencing, and other distributed telecommunications technologies will diminish the need for air travel thereby undermining the Aerotropolis development model. While some substitution for air travel will no doubt occur, experience shows that most telecommunications advances promote additional air travel by substantially expanding long-distance business and personal networking, a portion of which leads to face-to-face meetings. Indeed, virtually every significant advance in telecommunications technology has actually resulted in greater, faster and farther mobility beginning with Alexander Graham Bell's first words over his newly minted telephone: "Watson, come here, I need you." If only a miniscule fraction of today's mushrooming Internet social networking leads widely separated, new-found common interest people to text "Let's get together" or "I'd like to meet you" air travel will receive a substantial boost. The net-age and the jet-age will each continue to flourish in a mutually reinforcing manner.

Others have suggested that prolonged global economic downturns exacerbated the constant threat of terrorism; along with periodic contagious disease outbreaks will permanently diminish air commerce and air passenger travel. This does not seem likely since the imperatives giving rise to the growth of air commerce and business and leisure travel (especially global integration, rising incomes in large emerging markets, and the need for speed) are increasing in importance.

Despite periodic global economic cyclical dips and corresponding short-term declines in air travel, longer-term trends in air passenger and cargo volumes remain strongly upward (see Figure 4). Nor has the growth in aggregate global air traffic been slowed by the introduction of faster and more efficient passenger and freight rail service. If anything, the main constraint to aviation growth and urban competitiveness has been the inability of many hub airports to expand their capacity to meet increasing passenger and cargo demands. In some cases this has been a result of airport ground and air capacity limits; in others noise complaints.

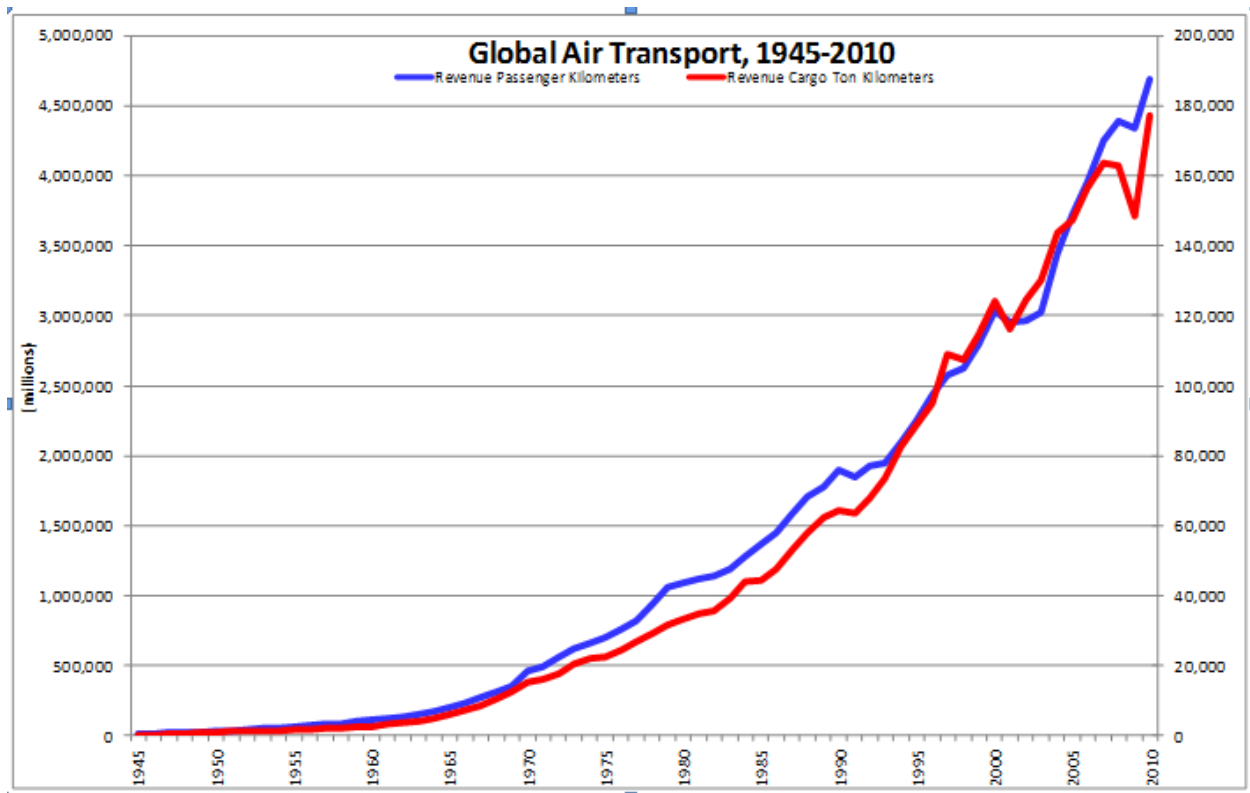


Figure 4
Global Air Transport, 1945-2010

There are also those who contend that rising jet fuel prices or greenhouse gases will curtail aviation’s future growth and, hence, airport-linked development. This has not happened thus far and, there is no evidence that it will diminish forecasted aviation demand. While jet fuel prices have soared in the past decade so has air travel. Significant advances are being made with biofuels as well as with lighter airframe composites and more efficient jet engines to reduce fuel burn and emissions. At the same time, aircraft manufacturers, airlines, and airports have commenced all-out efforts to limit aviation's carbon footprint. Aviation now contributes about 2 percent to

greenhouse gases globally but without significant technological advances it will generate 4 percent or more by 2050 as air traffic grows.

A related issue is peak oil (when oil production no longer rises and is surpassed by growing demand). Although numerous scientific models have been put forth, nobody actually knows when peak oil will be reached because the assumptions keep changing as new sources are discovered and innovative energy extraction methods emerge. While there appears little doubt that peak oil will be reached at some point this century, there is also good reason to believe that advances in aerospace energy use will meet the coming challenge. In this regard, many skeptics seem unaware of how fast aerospace technology evolves. For instance, it was just 66 years from the time that the Wright brothers flew a little over a hundred meters in the first self-propelled airplane (1903) until both the Concorde supersonic aircraft and Boeing 747 jumbo jet were both traversing the Atlantic Ocean, and we put a man on the moon (1969).

As human beings, we seem programmed to foresee (and predict) crises but not innovation. Yet, innovation is our constant companion, especially when faced with long-term critical challenges such as greenhouse gases and peak oil. Despite the real challenges that aerotropolis skeptics correctly point out, more and more people and products are destined to take to the sky in the coming decades.

Apropos the above, the 5.5 billion passengers passing through airports worldwide in 2012 are forecasted to increase to over 12 billion by 2030, with air cargo

projected to grow even faster. China is leading the way in this global growth with plans to invest nearly US\$250 billion in its aviation sector over the next five years alone. Other emerging markets are following suit. This is not only where the numbers are but also where economies and incomes are growing the fastest that will stimulate even greater air travel. As one pertinent example, the World Tourist Organization forecasts that by 2020, over 100 million Chinese mainlanders will be traveling abroad. Who is going to tell them they have to stay home?

Finally, there are those who argue that the aerotropolis fosters wasteful sprawl, lacks urban amenities, is culturally sterile and fundamentally elitist, catering exclusively to business and those who can afford the luxury of air travel, devoid of benefits to the working class. This need not be the case with appropriate aerotropolis planning, community design, and institutional development.

There are certainly limits on what can be done around older commercial airports that have been engulfed by decades of unplanned, haphazard development, creating the mess we see. Yet, for newer airports, especially those located on metropolitan peripheries with huge parcels of accessible open land nearby (e.g., Denver, Belo Horizonte, Brazil and Munich) and new greenfield airport sites such as those in Africa, the Middle East, and Asia (e.g., Durban, Doha, and Hyderabad) there is almost a blank canvas for innovative, socially and environmentally positive aerotropolis planning and development.

Here, mixed-use residential communities can be created housing airport area workers that are welcoming, provide a sense of neighborhood, and offer many urban amenities and institutional services that provide appealing life-style options. These communities should be built outside flight paths but in proximity to aerotropolis job centers and surface transportation (including public transit) that reduces commute times and costs. Redensification around the airports and planned cluster development outward can actually be an antidote to sprawl.

Such planned development should combine the best of urban and suburban. Contrary to what some aerotropolis critics seem to believe, not everyone wants to live in a large, dense metropolitan center regardless of the many amenities they provide. Indeed, the long-standing top residential preference choice, at least in U.S. surveys, remains a lower-density suburban residential location. Ideal aerotropolis development would bring urban amenities (museums, fine dining, upscale retail) to or near these mixed-use residential clusters, as is already happening to some extent organically.

Let me conclude by pointing out that aviation and the aerotropolis are far more egalitarian when it comes to job creation and income generation than many realize. We tend to think of aviation as serving primarily the elite – well paid business people, wealthy international tourists, and higher-income leisure travelers. The fact is that aviation and the aerotropolis help those at the bottom rungs of the socioeconomic ladder at least as much. For every well-heeled business person who jets from Frankfurt to Bangkok or London to New York, there are taxi drivers, hotel maids, restaurant

workers, and building custodians who service them. Truck drivers move air cargo from the airports to destinations, frequently labor-intensive manufacturing or distribution facilities depending on time-critical supplies being flown in or shipping high-value finished products to distant markets. Air cargo, as noted, presently accounts for over 30 percent of the value of world trade.

Our research at the University of North Carolina has shown that nearly one out of every ten jobs in transport and warehousing in the United States is located within 2.5 miles of its 25 busiest airports.¹ Large concentrations of hotels, employing maids, kitchen help, and laundry service workers are also in close proximity to these airports. For example, 49 hotels are located within 2.5 miles of Atlanta's airport fence. The vast majority employed by those hotels are lesser educated.

Our research likewise found that, on the whole, jobs in the 2.5 mile, 5 mile, and 10 mile radius of the 25 airports generated higher metropolitan area payroll percentages than their employment percentages. This indicates that the diversity of jobs near major airports are relatively well paid.

Much more research needs to be conducted on airport area employment growth and its meaning for jobs and incomes of those of the lower rungs of the socioeconomic ladder. Suffice it to note that our very preliminary work may suggest that a fundamental transformation in the nature of income inequality could take place as the

¹ Stephen J. Appold and John D. Kasarda, The Airport City Phenomenon: Evidence from Large U.S. Airports, *Urban Studies*, published online 15 November 2012

aerotropolis job machine accelerates in the 21st century. That is, the employment pie is substantially grown changing the primary discourse on aerotropolis inequality from between the haves and the have-nots to between the haves and the have more.

Income inequality will always be with us reflecting individual human capabilities and the structure of opportunities. It should not be so much the gap that is the focus of attention as where the bottom stands in terms of their absolute level of income supported by jobs providing living wages. Moving up the bottom significantly through the creation of permanent living wage jobs is far more critical to their well-being than closing their gap with the top earners who may move up as well, perhaps even further.

As the aerotropolis leads the way to greater metropolitan competitiveness, attracting increased investment that creates jobs and raises incomes for those of all levels of the socioeconomic ladder, it may well provide the 21st century pathway to not only faster and further physical mobility but also faster and further social mobility. Thus, instead of resisting 21st century aerotropolis evolution, metropolitan regions (including traditional central cities) might give more thought to leveraging it for their long-term competitiveness and economic well-being of their residents. After all, in our globally-connected world, cities are no longer as much the fundamental urban competitive unit as are the metropolitan regions of which they are part.

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