Leveraging Piedmont Triad International Airport and other Regional Assets for Piedmont Triad Regional Competitive Advantage

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Chapter 1

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I. Introduction: Development Challenges and Strategic Response

The Piedmont Triad, consisting of twelve economically interdependent counties surrounding the cities of Greensboro, High Point, and Winston-Salem, is at an economic crossroads. Low-wage global competition combined with productivity increases in manufacturing have stripped the Region's traditional industrial clusters in furniture, textiles, and tobacco of tens of thousands of jobs since 2000. Many of the more than 60,000 jobs that remain in these three Piedmont Triad clusters (making up almost half of the Region's current manufacturing employment) will no doubt disappear in the coming decade.

Problems extend beyond the Region's traditional manufacturing sector, with the overall competitiveness of the Piedmont Triad considered weak by national comparison. Although 36th in relative population size, the Piedmont Triad metropolitan area ranked 165th in 2005 among the nation's 200 largest metro areas in terms of job and income growth according to the Milken Institute's study of Best Performing Cities.

There is some sunlight appearing on the horizon, however. New regional high tech clusters are beginning to emerge in microelectronics and medical technologies while information-intensive services are getting a foothold, some linked to or spun-off by the Region's three excellent Ph.D. granting institutions (North Carolina A&T, UNC-Greensboro, and Wake Forest University). Moreover, the decision by FedEx to establish its Mid-Atlantic hub at Piedmont Triad International Airport (PTI) provides the Region special competitive advantage in air logistics, offering time-sensitive industries speedy, reliable long-distance connectivity, heretofore lacking in the Region. The evolution of the hub is already beginning to attract such manufacturing and distribution firms, a trend that will likely accelerate once the FedEx hub opens and grows.

Apropos the above, there are signs of PTI and its environs becoming the new "downtown" of the Piedmont Triad Region, the same way that the Research Triangle Park (RTP) has become the functional downtown of the greater Raleigh-Durham-Chapel Hill Region. RTP contains the signature global corporations of the Triangle Region, becoming its predominant image-maker and driver of

regional economic development. It is important to note that in no way have the municipalities of Raleigh, Durham, or Chapel Hill suffered as a result of RTP's development. In most respects, all three cities and the entire 13-county region have been substantially enhanced by the Park's growth and commercial success.

Led by FedEx and HondaJet's locating at PTI, a similar process can occur in the Piedmont Triad. Indeed, how PTI and its immediate surrounding areas develop will determine to a large extent how the Piedmont Triad and its constituent municipalities go in terms of industrial mix, business competitiveness, job creation, and citizen quality of life.

Critical issues are at stake. Will the Piedmont Triad Region be able to transition successfully to "new economy" high-tech manufacturing and information-intensive services sectors? Will both its traditional manufacturing, newer high-tech, and white-collar service industries be able to compete effectively, domestically and worldwide, in the globally integrated, speed-driven marketplace? Will the Region fully capitalize on the FedEx Mid-Atlantic hub scheduled to open in June 2009 and its current and future interstate highway accessibility to attract more business investment and create high-quality jobs? Finally, will industrial and commercial development around PTI and along its major transportation corridors be economically efficient, attractive, and environmentally sustainable, becoming a global magnet for industry, workers, and residents alike while not impeding the functioning and future expansion of the airport?

All these issues, of course, are interwoven. Taken together, they will help determine the economic fate of the cities and counties that make up the greater Piedmont Triad Region.[1] It is therefore imperative that they be addressed with both strategic vision and coordinated action. This requires, first, a solid understanding of the drivers of 21st century job creation, and economic development, especially the increasingly important roles that speed, agility and connectivity play in industrial location. Second, Piedmont Triad International

[1]Centered around the cities of Greensboro, High Point, and Winston-Salem, the twelve county Region, consisting of Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Montgomery, Randolph, Rockingham, Stokes, Surry, and Yadkin counties, is a coherent and economically interdependent Region. The ten county Greensboro/Winston-Salem/High Point Combined Statistical Area ("CSA"), based on population and commuting patterns, includes all Piedmont Triad counties except Caswell and Montgomery, the Region's two least populated counties. The twelve county Region contains 1.6 million people, approximately 27% of North Carolina's population. The three major cities for which the CSA is named comprise a linked urban system that anchors the integrated urban-rural regional economy.

Airport, working in partnership with the North Carolina State Department of Commerce, Piedmont Triad regional transportation and economic development organizations, local governments, and federal agencies, must implement a coordinated set of strategies, policies, programs and actions to harness the new FedEx Mid-Atlantic hub for the competitive advantage of the Piedmont Triad Region and the entire state.

Regarding new commercial realities, it is already clear that an increasingly fast-paced, globally networked economy is changing the rules of business competition and industrial location. These rules are being altered by a catalytic convergence of digitalization, globalization, aviation, and time-based competition. Speed, agility, and connectivity have become the competitive mantra of many of the world's most successful firms.

The combined importance of these factors is creating a new economic geography, with commercial airports driving and shaping business location and industrial development in the 21st century as much as highways did in the 20th century, railroads in the 19th and seaports in the 18th. Today, these airports have become key nodes for time-critical manufacturing, distribution, and business services and engines of local economic development, attracting air commerce-linked enterprises of numerous types to their environs. These include among others, time-sensitive manufacturing and distribution, e-commerce fulfillment and third-party logistics firms; hotel and exhibition complexes; and office complexes that house air-travel intensive professionals such as researchers, consultants, auditors, and high-tech industry executives.

As more and more aviation-intensive businesses cluster near these airports and along transportation corridors radiating from them, a new urban form is emerging—the Aerotropolis—stretching up to 20 miles outward from the airports. With the airport serving as a multi-modal transportation and logistics nexus, strings and clusters of business and technology parks, industrial parks, distribution centers, and information and communications technology (ICT) complexes are forming around the airports and along connecting surface transportation corridors. Even some cities and development zones located up to 60 minutes drive from some airports are experiencing accelerated economic growth. The potential for direct economic benefits from PTI extends to the entire 12-county Region and can be further enhanced by improvements to connecting highways as described later in this report.

Such development is occurring because of the speed and connectivity advantages commercial airports (especially those that have developed as multi-modal air logistics hubs) provide to business and industry in the new networked economy. Air logistics development and economic development are now going hand-in-hand around the world.

For over two decades, Piedmont Triad International Airport has been counted upon to attract business and drive economic development in the Triad Region. Until a few years ago, outside the fence airport-linked development was minimal. Yet, with FedEx locating its new regional hub at PTI, this has already begun to change. Time-sensitive industries are taking note of the Region and some, such as MWG Biotech, Rheem, Cedarlane Laboratories, and Polo.com have already located in the Region in anticipation of the hub's opening. The recent announcement by Honda Aircraft Company that it would locate its headquarters and HondaJet production facility at PTI was also influenced by the anticipation of the FedEx regional hub.

Passenger traffic increases at PTI have been sluggish with some significant down years since 2000. This will likely change as well with the new hub (along with improved and new interstate highways) spurring greater regional business investment which, in turn, will likely result in more passenger travel.

Piedmont Triad leadership has placed high priority on leveraging the FedEx hub and the Region's highway assets for business recruitment and economic growth. An immediate need is for coordinated Region-wide planning and local government partnerships to accomplish this, thereby helping PTI to achieve its full potential as an engine for job creation and economic development, not only immediately around the airport but also throughout the entire 12-county Piedmont Triad Region.

With this objective in mind, the Piedmont Triad Partnership has commissioned this report to provide (1) the vision, (2) lessons learned from other air logistics developments, (3) strategic guidelines, and (4) action-specific recommendations for PTI (and especially its new FedEx hub) to become a catalyst for regional economic development and a state-wide resource for business competitiveness. Pivotal to the vision, strategy, and actions is positioning PTI as a leading multi-modal air logistics hub that will drive airport-linked industrial development on and near its property, as well as substantially beyond airport perimeters, creating a greater Piedmont Triad Aerotropolis.

To set the context for this vision and strategy for a PTI air logistics hub and extended Aerotropolis, the remainder of this chapter will (1) discuss its underlying business rationale and competitive logic, (2) provide concrete examples of air logistic hub/Aerotropolis successes elsewhere (as well as describe some that have not achieved success to date), and (3) discuss the credibility and viability of PTI becoming a significant air logistics hub that powers local, regional, and state-wide economic development.

Following this introductory chapter covering the above issues, three additional chapters offer, in order, the (1) infrastructure, (2) business plan, and

(3) implementation plan guidelines to assist those who will be planning, designing, and developing appropriate infrastructure and facilities for PTI to have the greatest Region-wide economic impact. Critical success factors will be presented as well as target industry clusters specified. To attract newer, high growth, high value-adding industries, it will be stressed that the relative importance of traditional tax incentives by government need to be reinforced by logistical capabilities at PTI and connecting surface transportation infrastructure, offering Piedmont Triad firms quick and efficient access to their suppliers and customers.

The report concludes with 30 recommendations and action steps to be considered by leadership responsible for PTI, the Piedmont Triad Region and its constituent local governments to successfully leverage PTI and its FedEx Mid-Atlantic hub for greater Region-wide and more local benefits. Those recommendations and action steps will focus on required hard and soft infrastructure including the business environment and logistics cluster strategies to be pursued to provide local and regional firms superior connectivity, speed, and agility: the three emphasized factors for their gaining competitive advantage in the 21st century. The recommendations also address needed cross-jurisdictional cooperation, infrastructure phasing, and marketing strategies for industrial recruitment and branding the Region.

II. Logic of New Competitive Advantages of Air Logistics

With mass customization and time-based competition taking on increased economic importance, substantial changes are occurring in the way business is being conducted around the world. At the forefront is the emergence of a commercial environment where price and quality are necessary—but not sufficient—for competitive success. Increasingly, customers in both national and international markets are demanding fast, flexible, and reliable delivery of products, often with distinctive features. Competitive advantage is being gained by firms that respond flexibly and rapidly to their domestic and global customers, delivering lower cost, higher-quality and often customized products quickly and efficiently.

Staying on top of the industrial competition also requires fast-cycle logistics. Manufacturers must be able to access regional, national, and global networks of suppliers of materials, components and sub-assemblies in order to obtain the best-quality components at the lowest possible price. At the same time, increased flows of information worldwide are leading to rapid changes in

customer demands. Companies that can detect these changes, design and produce the desired products, and deliver them more quickly than other producers will capture market share. Since speed also reduces warehousing and inventory costs, stock-outs and remaindered goods, the speed advantage becomes a cost advantage as well.

The fast-cycle logistics as a competitive tool is being further validated by marketing research which shows that, worldwide, consumer tastes and product demands are changing much more swiftly today than was the case in prior decades. Indications are that such shifts will accelerate even faster in the decades ahead, resulting in situations where products that are "hot" one month may become obsolete just six months later. Such is already happening in the fashion clothing, pharmaceutical, and the computer software industry where delivery time to the retail shelf (or now directly to the customer) frequently separates market winners from losers.

The implications of these trends for new logistics strategies are already evident. Adapting to growing market demands for flexibility and speed, companies such as Dell Inc., General Electric, Honda, Nokia, and Siemens are reengineering their sourcing and distribution systems to become much more agile and customer responsive. They now compete not only on price and quality but also on the basis of speedy, reliable delivery, and 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 often across national borders, with speed and reliable delivery overarching goals.

Companies will not be able to meet the challenges of such a time-critical environment without dramatic changes in how they organize their flows of components and finished products. This is why they are rethinking the role that logistics plays in their organizations and are reassessing their current strategies in light of the new demands for efficient supply chain management and quick response. It is becoming clear that new strategies to meet these challenges will require the development of innovative multi-modal air logistics infrastructures which synthesize information and multi-modal transportation to speed the delivery of parts, components and finished goods from suppliers to manufacturers and from manufacturers to customers around the nation and increasingly worldwide.

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 are being liberalized and new markets opened. Communist/socialist and former socialist countries such as China, Russia, Poland, and Vietnam have entered the 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 and rapid cross-border technology transfer, countries such as Brazil, China, and Malaysia have achieved much greater levels of economic output and now produce highly sophisticated products.

International customers (including those in China, India and Southeast Asia, which given their large and rapidly growing markets may pose the best long-term prospects for North Carolina companies) have also become far more sophisticated and demanding. They have available 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 reliable delivery. They also want customization of the products they buy, and they want these customized products right away, not in two to six months. For many purchases, not even two to six weeks is fast enough.

E-Commerce and Fast-Cycle Logistics

The rise of e-commerce further heightened time-based competition and the importance of airports. As late as 1995, sales through the Internet were essentially zero. By 1999, U.S. Internet-based business-to-consumer (B2C) sales alone had grown to nearly $7 billion, skyrocketing to over $70 billion in 2004, a 50 percent increase over 2002 compared to a 9 percent increase in total U.S. retail sales (U.S. Department of Commerce, 2004). According to Forrester Research, 166 million packages were shipped in 1999 by Internet retailers (e-tailers), with approximately 70 percent going by expedited delivery. By 2003, e-tailers were shipping 1.1 billion packages annually. This has grown to nearly 2 billion packages in 2006. Despite the death of thousands of "dot coms" between 2001 and 2004, it is near consensus among economic and business forecasters that e-commerce will flourish in the future.

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 quickly shipped to next-stage producers. Manufacturers already are able to electronically access an international network of suppliers in order to acquire the best-quality materials and parts at the lowest possible price. The introduction of e-marketplaces (auctions, aggregators, bid systems, and exchanges) is greatly expanding B2B e-commerce: Forrester Research estimates that e-marketplaces currently account for up to two-thirds of B2B supply-chain transactions, depending on the industry, capturing 42 percent of online industrial trade and an average 28 percent of all business to business

trade. Many suggest that with the wide-spread introduction of Enterprise Resource Planning (ERP), these e-commerce figures will go much higher in the near future.

The expansion of the B2B e-commerce and direct-to-customer Internet orders has placed a particular premium on speed and reliability in the delivery process. To meet these new imperatives in order fulfillment, e-commerce distribution centers are being built near air express hubs that have speedy, reliable shipping networks. Air express hubs actually extend the business day for e-commerce fulfillment by allowing shippers to take orders for expedited national or global delivery as late as 11:00PM in some locations. Dozens of such e-tailers have located their fulfillment centers near Memphis International Airport to leverage FedEx's world-wide air express hub. The same trend holds for Louisville International Airport and Indianapolis, where numerous companies have also sited e-commerce fulfillment centers near these air express hubs.

Complementing 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 notebook computers and mobile phones. The clustering of such time-critical goods facilities near air-express airports is stimulating further expansion of air cargo, less-than-load (LTL) trucking, freight forwarders, and third party logistics providers (3PLs) along major highways with quick accessibility to these airports.

Speedy, reliable delivery of products over long distances has become so critical to the new economy that air commerce is quickly becoming its logistical backbone. According to the International Air Cargo Association, forty percent of the value of world trade now goes by air, and the percentage is steadily rising. Air logistics, which includes air cargo, air express, and their supporting logistics services represented a $250 billion industry in 2006. It is expected to nearly triple by 2025, while international air-express shipments are expected to increase at least four-fold during this period (Boeing Company, 2006).

Already, air cargo and air express are the preferred modes of international shipping of higher value to weight B2B transactions in microelectronics, automobile electronic components, aircraft parts, mobile telephones, fashion clothing, pharmaceuticals, optics and small precision manufacturing equipment, as well as many perishables such as seafood and fresh cut flowers. (See the global supply-chain model of Dell Computer's Texas facility in Exhibit 1.1.) Even lower value to weight B2B product distribution such as fashion apparel and seasonal toys are becoming time-sensitive and increasingly shipped by air.

The growing importance of air commerce to the U.S. economy is illustrated in Exhibit 1.2. It shows that by 2005, the value of U.S. exports by air substantially exceeded the value of exports by vessel. When detailed industrial sectors were broken out, new economy sectors such as microelectronics, pharmaceuticals, and medical devices had more than 90 percent transported globally by air. Such industries, as will be described later, are increasingly gravitating to airport areas.

III. Passenger-Driven Commercial Development Synergies

Not only time-sensitive goods-processing and distribution facilities are being drawn to locations near 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 consulting, advertising, legal and financial services, data processing, accounting and auditing, which often send out professionals to distant customers' sites or bring in their clients by air. This has been particularly the case at the largest commercial airports which offers greater choice of flights and destinations, more frequent service, and more flexibility in rescheduling.

The accessibility commercial airports provide have become essential to attracting business meetings and conventions, trade shows, exhibitions and merchandise marts. Two U.S. mega-facilities—Infomart and Market Center, both of which are located on the I-35 corridor to Dallas-Ft. Worth International Airport—offer good examples of the latter attraction. Infomart is a huge, ultra-contemporary merchandise display building for information and communication technology (ICT) companies. Market Center—a cluster of six large buildings that contain nearly seven 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 2005, Market Center alone attracted buyers and vendors from all 50 U.S. states and 84 countries, who purchased 300,000 airline seats and filled 720,000 nearby hotel rooms while conducting an estimated $7.5 billion in wholesale transactions.

High-tech industries and airports also increasingly reinforce each other. 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 the mobility of these workers over long distances. Research in the U.S. has shown that high-tech professional workers, for example, travel by air at least 60 percent more frequently than most other professionals (Erie, Kasarda, McKenzie, and Molloy, 1999).

Some observers have suggested that advances in Internet access, videoconferencing, and other distributed communications technologies will diminish the need for air travel. The evidence indicates that telecommunications advances often promote additional air travel by substantially expanding long-distance business and personal networking that lead to future face-to-face meetings.

Others have suggested that prolonged global economic downturns exacerbated by catastrophic events such as 9/11 and the constant threat of terrorism, as well as contagious disease outbreaks such as SARS will permanently diminish air commerce, in general, and business travel by air, in particular. This does not seem likely since the business imperatives giving rise to the growth of air commerce and business travel (speed, mobility and global access) are increasing in importance. From 2004 to 2006, air cargo and air passenger travel rebounded strongly from their 2001 to 2003 cyclical dips and are forecasted to rapidly grow in the decade ahead.

The current 4.1 billion passengers traveling annually world-wide are forecasted to grow to over 9 billion within 15 years, with air cargo projected to grow at an even faster rate. By 2015, the FAA forecasts that over 1 billion passengers will board commercial aircraft in the U.S. Simultaneously, there is expected to be a dramatic growth in very light jets (such as those Honda will be producing at PTI) fostering air taxi services and private and shared-jet transport.

IV. Economic Impact and Job Creation at Selected Airports

Nowhere is the impact of airports becoming greater than the centerpiece of the new economy—high-tech. With this sector's supply-chains and employees increasingly geared to speed, connectivity and mobility, quality air express and air passenger service have become essential to the location of many high-tech firms. Clusters of high-tech companies are thus locating at and near air express hubs such as Memphis, Louisville, Indianapolis, Alliance Texas, Ontario, California, Subic Bay Philippines, and Campinas Brazil. To note just a sample:

- Memphis International Airport (world headquarters of FedEx) is responsible for over 160,000 jobs in the metropolitan area. One of four jobs in the Region is tied to the airport, which has an annual economic

impact of $22 billion. Air cargo and air express operations account for 95 percent of the airport's economic impact and regional job generation. I will return to Memphis later in this chapter.

- Indianapolis International Airport is FedEx's second largest hub. The hub has had a growing impact on the Indianapolis Region. So successful has this hub been that in early 2006 FedEx announced a $214 million expansion of its operations there which will add over 600,000 square feet to its existing 1.9 million square foot facility. When finished in 2008, FedEx will be employing nearly 5,000 workers in Indianapolis, up from just 368 employees when the hub opened in 1998.
- 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 regional hub at Subic Bay in 1995, over 200 firms—employing 54,000 workers—have located there, generating almost $2.5 billion in investment. Between 1995 and 2005 the annual value of exports from Subic Bay jumped from $24 million to $1.3 billion. Acer has 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. Nearer to Manila, the former U.S. Clark Air Base is attracting tens of thousands of information and communications technology and other high-tech manufacturing jobs, as UPS is growing its Southeast Asia regional air express hub there.
- In Penang, Malaysia air cargo has created a "Silicon Island" contributing immensely to job creation near the airport. Inc. manufactures 100% of its laptops in Malaysia. The company relies heavily on air express in its Malaysian facility sourcing and exports, having over 2,000 employees alone there, with $5 billion in its sales originating from Penang. Its firm clustering impact has also been huge as 70 Dell suppliers have either manufacturing centers or distribution centers at Penang, providing parts and components.
- Viracopos Airport in Campinas, Brazil, is a major regional air express hub with a substantial FedEx presence; 10 percent of all Brazilian air imports arrive though air cargo facilities there. Viracopos has greatly contributed to Campinas becoming the second fastest growing high tech area in all of Latin and South America, with investments in microelectronics and information and communications technology (ICT) totaling $7 billion in the past 10 years. Fifty Fortune 500 companies have located high tech manufacturing facilities in Campinas, including IBM, Motorola, Lucent/Alcatel, Samsung, and Texas Instruments.

- Ontario, California airport, which is the west coast regional air express hub for UPS, has driven major growth in the Inland Empire (San Bernadino-Riverside) Region. In addition to time-sensitive manufacturing, over 10 million square feet of logistics and distribution space have been added to the Region every year since 1998.

The impact of airport-induced job growth on land use in the vicinity of airports is likewise substantial. Recent research at UNC's Kenan Institute of employment growth in the suburban rings of U.S. metropolitan areas showed that areas within six miles of airports are adding jobs much faster than the overall job-growth rate of the suburban ring within which the airport was located. While most of the employment is concentrated near the airport or along major connecting highways within 15 to 20 minutes of the airport, research at Massachusetts Institute of Technology's International Center for Air Transportation documents that impacts occur up to 60 miles from airports with air connections significantly facilitating a region's access to suppliers, markets, ideas and capital (EconSouth, 2003).

V. Airport-Generated Commercial Development (Inside and Outside the Airport Property)

Emerging corridors, clusters, and spines of airport-linked businesses are giving rise to a new urban form—the *aerotropolis*—stretching up to 20 miles from larger airports. The airports function as the multi-modal logistics hub and commercial nexus of this diffuse airport-integrated urban complex, analogous to the function central business districts (CBDs) play in the traditional metropolis (see Exhibit 1.3 for a generic illustration). Indeed, under the rubric of Airport Cities, some of these airports have assumed the very same roles of metropolitan CBDs by becoming regional intermodal surface transportation nodes and significant employment, shopping, meeting and entertainment destinations in their own right.

An excellent example is Amsterdam's Schiphol. Its grounds employ 58,000 people daily—more than the 50,000 resident criteria to attain metropolitan central city status in the U.S. Two major expressways link the airport to downtown Amsterdam and the broader urban area. A modern train station, directly under the air terminal, efficiently connects travelers to the city center and the rest of the Netherlands.

Schiphol's passenger terminal, incorporating modern retail mall design elements, contains expansive, well-appointed shopping and entertainment

arcades accessible both to travelers and the general public. By combining terminal design with mall design, Schiphol has substantially increased revenues through concession rents and passenger purchases. In fact, the airport often attracts Amsterdam residents who come to shop and relax in its public section, especially on Sundays when most city retail stores are closed.

Directly across from Schiphol's passenger terminal is the World Trade Center with meeting and commercial facilities and regional headquarters of such firms as Thomson-CFS and Unilever. A Sheraton and a Hilton hotel adjoin this complex.

Providing further logistical advantage, the A4 and A9 high-speed motorways are both within a mile and a half of the airport center. Radiating from Schiphol along these motorways are strings and clusters of business parks, logistics parks, high-tech industrial parks, distribution centers, information and telecommunication complexes, and wholesale merchandise marts—all of which are airport-intensive users. Exhibit 1.4 illustrates the synergies between Schiphol's Airport City and its broader regional *Aerotropolis*.

VI. Aerotropolis Development and Planning Principles

Reflecting the new economy's demands for connectivity, speed and reliability, the *Aerotropolis* is optimized by corridor and cluster development, wide lanes, and fast movements. In the next chapter, I shall discuss how an airport ring road, widened and improved highway connectors to PTI along with current and future interstates in the Piedmont Triad Region can increase PTI's accessibility and enhance its regional economic impact.

Although most *aerotropolises* have so far evolved largely spontaneously—with insufficient transportation infrastructure or previous nearby development often creating arterial bottlenecks—in the future many will be improved through strategic infrastructure planning. For example, at full future development, (as illustrated in Exhibit 1.3), dedicated expressway links (*aerolanes*) and commuter rail (*aerotrains*) will efficiently connect airports to nearby and more distant business and residential clusters. Special truck-only lanes should be added to airport expressways and nearby interstate highways, as should be improved highway interchanges to reduce congestion. Seamlessly connected multi-modal infrastructure will accelerate transfers of goods and people, improving transport system effectiveness and further influencing land values, business development, and resulting urban form. While such infrastructure development at and around PTI is likely decades away, the regional planning process needs to commence

immediately and appropriate land reserved before on-going property development precludes such critical future infrastructure.

The metric for determining future land value and particular business locations will be time-cost access to the airport. Over time, firms of various types will bid against each other for airport accessibility predicated on the utility each gives to the related combination of time and cost of moving people and products to and from the airport and the extensiveness of the airport's flight networks to regional and global markets. Land values, lease rates, and commercial use will no longer be measured by traditional bid-rent functions that decline linearly with spatial distance from the primary node (here, the airport) but by the time and cost of moving goods and people to and from the airport from alternative regional sites via connecting highway and high-speed rail arteries.

To many, this new land use and structure will appear simply as additional sprawl along main airport transportation corridors. Yet, the aerotropolis is actually 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 industrial and business location organizing principles. Of course, accessibility and location are closely related.

Air commerce clusters and spines are already taking on distinct spatial form around major international gateway airports such as Chicago O'Hare, Dallas-Ft. Worth, Miami, New York Kennedy, Washington-Dulles, Hong Kong International, Korea's Incheon, London Heathrow, Paris Charles de Gaulle and Amsterdam Schiphol. In the United States, even small and mid-size airports with regional air express hubs—such as Alliance Airport, near Ft. Worth, Texas (FedEx), Ontario, California Airport, near LA (UPS), Rickenbacker Airport, in Columbus, Ohio (BAX) and Wilmington, Ohio (DHL)—are generating aerotropolises in the form of airport-linked business cluster and spine development. For example, Alliance Airport alone has attracted over $4 billion in commercial investments since 1994 to its 16,000-acre development area. Similar development is beginning at Hahn Industrial Airport about 100 miles west of Frankfurt, Germany. I will return to these mid-size air express airports shortly.

Those in the air express and air cargo industry know that the battle for air freight is won on the ground—not the air—with good highway connections key. This is why most of the leading air express and air cargo airports also have excellent expressway links and on-site or nearby truck cross-docking facilities. These highway/air cargo synergies are often reinforced by excellent nearby intermodal rail facilities such as at Ontario, California, Alliance Airport in Texas and at Hahn in Germany. The following section elaborates the multi-modal air

logistics/Aerotropolis synergies utilizing specific cases of airport-driven industrial development in the U.S., Asia and Europe.

VII. Emerging Air Logistics Airport/Aerotropolis Cases

Ontario, California

Commercial growth surrounding Southern California's Ontario Airport—an emerging air logistics hub that cornerstones a major urban complex 40 miles east of Los Angeles—offers an excellent contemporary illustration of multi-modal synergies. The airport (recently renamed LA/Ontario International Airport) is at the nexus of major east-west and north-south interstate highways I-10 and I-15, with the Burlington Northern–Santa Fe intermodal rail yards nearby. The ports of Los Angeles and Long Beach are connected by interstate highways and rail lines. Between 2000 and 2006, over 60 million square feet of warehouse, distribution, and light industrial space were added adjacent to the airport and along Interstates 10 and 15 radiating out from it, led by e-commerce fulfillment and distribution facilities ranging up to 1 million square feet in floor space. With commercial clusters rapidly developing around the airport and outward along I-10 and I-15, Ontario is emerging into a full-fledged aerotropolis (see Exhibit 1.5).

Enhancing Ontario's air logistics and aerotropolis development is the growth of air express transportation services at and around Ontario Airport. During 2005, UPS, whose west coast regional hub is at Ontario Airport, handled nearly 700 million pounds of freight while FedEx carried over 100 million pounds. This express service was boosted by another 100 million combined pounds carried by BAX Global, Menlo Worldwide and Airborne (now DHL/ABX) Express. Ontario's development as a regional air express airport has greatly contributed to making its broader "Inland Empire" area one of the fastest growing employment regions in the United States, where tens of thousands of jobs are being created annually.

Alliance, Texas

Another regional air express airport/aerotropolis example is Fort Worth (Texas) Alliance Industrial Airport, where 15,000 acres span two counties and

include portions of four cities. Promoted as the nation's first industrial airport by Ross Perot's company, development began in 1988 with the objective of serving business and commercial users rather than passengers. From the beginning, multi-modality was emphasized, especially quick and efficient access to regional and national markets via interstate highways and intermodal rail connections. A major development driver was put in place in 1997 when FedEx opened its southwest regional hub at Alliance. Since then, over 100 major companies (33 from the Global 500 largest) have located at and around Alliance; such as AT&T, Nokia, BFGoodrich Aerospace, Bell Helicopters, Gulfstream, Zenith Electronics, Nestle Distribution, and Dell Inc. Alliance offers a Foreign Trade Zone, an enterprise zone with further city and state incentives, a world trade center, state-of-the-art fiber optics and telecommunications, and a special inventory tax exemption, as well as efficient U.S. customs services.

As a result of its wide variety of present and expected future tenants and users, such as time-sensitive manufacturers and distributors, third-party logistics providers, retailers, international firms and aviation-related companies, Alliance is partitioned into geographic sectors geared to different tenant needs and requirements. These developments include:

- *Alliance Center*, a 2,600-acre high-density business complex that encircles the airport and is geared primarily towards aviation-related enterprises that require direct taxiway access.
- *Alliance Commerce Center*, a 300-acre business park for manufacturing and high-tech firms, which has served as a starting point for several small and mid-sized companies that have expanded into larger facilities throughout Alliance.
- *Alliance Air Trade Center*, a 52-acre air cargo development with direct access to the Alliance Airport runway system, direct access to Interstate 35W, and nearly adjacent to the BNSF intermodal facility. It has over 250,000 square feet of warehouse space available for intermodal cargo and international air freight companies.
- *Alliance Gateway*, a 2,400-acre distribution, manufacturing and office sector which provides parcels of land for constructing large-scale facilities such as warehouses and is designed to accommodate large distribution and industrial firms. It also has convenient access to Dallas/Fort Worth International Airport via State Highway 170.
- *Alliance Advanced Technology Center*, a 1,400-acre complex that is becoming one of the nation's premier technology hubs for major companies from around the world.

- *Heritage Reserve at Alliance*, which is integrated into a woodlands greenbelt and offers locations for research and development facilities in a natural setting.
- *Westport at Alliance*, a 1,500-acre industrial and distribution sector located directly adjacent to Burlington Northern Santa Fe Railway's main north/south line and Intermodal Center. It caters to shippers needing rail access and other multi-modal transportation options.
- *Alliance Crossing*, a 170-acre retail complex that is designed to accommodate retailers, restaurants and other service-oriented firms needed to service the areas increasing population base as well as employees and visitors of Alliance.

Alliance's commercial success has been attributed to its excellent multi-modality, a variety of economic incentives it provides to tenants, its attracting a substantial number of third-party logistics (3PL) providers who offer manufacturers, distributors and retail shippers with value-added services including packaging, labeling, inventory management, transportation and transportation tracking as well as returns management. Alliance also provides educational and technical training facilities for companies located at its complex, including conference and teleconference facilities.

Of particular interest, all firm recruitment and real estate development is managed by a private company, Hillwood Development. Of the $4.8 billion invested in Alliance thus far, 97 percent has been from private sources. According to the Alliance website, this translates into over 20,000 permanent jobs at the complex and $150 million annually in local property taxes generated.

Rickenbacker, Ohio

An excellent general air cargo airport case, centered at a mid-sized airport, is Rickenbacker Airport in Columbus, Ohio. A former U.S. air force base, Rickenbacker went into service as a commercial air cargo airport in 1980. Despite being the 1980's hub for the air cargo firm, Flying Tigers (now part of FedEx), Rickenbacker did not obtain success until the 1990s when a new public-private management model was put in place and a new marketing strategy developed based on the "Inland Port" concept.

Rickenbacker's success thereafter rested largely with efficient and cost-effective handling and distribution of supplies and finished goods, in contrast to more costly, less efficient handling at alternative (often larger) airport complexes that lacked multi-modality and as efficient logistics operations. The airport is strategically located to serve national markets, and it has excellent access to

major interstate highways and intermodal rail facilities. Like Alliance, Rickenbacker operates in a Foreign Trade Zone. It also has special state and federal tax exemptions such as those on inventory, abatement on real estate taxes for improvements to land and buildings as well as a subsidy of $3 million per year from local governments. In addition, the State of Ohio has committed $65 million in revenue bonds for future facility improvements.

Economic development around Rickenbacker since the early 1990s has been remarkable. The airport serves as the logistics hub of a 15,000-acre development zone (nearly identical to Alliance), called the Rickenbacker Area. This area contains over 20 million square feet of state-of-the-art logistics and distribution space, employing 15,000 workers. Despite the national and global downturn in air cargo between 2001 and 2003, Rickenbacker continued to experience robust air cargo growth.

Rickenbacker provides tenants and users with a 500,000-square-foot cargo terminal (which is being continuously expanded), modern materials handling equipment and logistics services, and direct airfield access to freight forwarders, third-party logistics providers and time-sensitive manufacturers and distributors who are advantaged by airside access. As one example, Excel Logistics, one of the world's largest supply chain management companies, operates a 230,000 square foot one-stop shop facility that includes customs brokerage, airfreight forwarding, intermodal operations, value-adding logistics services, and warehousing. Rickenbacker's logistics and fulfillment firms are undergirded by state-of-the-art fiber optic loops, high-speed data circuits, and teleconference facilities.

To further spur commercial development, Rickenbacker formed a partnership with Duke Realty in late 2005 to develop 1,200 acres of prime industrial land in the airport area. The partnership will also help with the development of Rickenbacker Global Logistics Park which will be near the new Rickenbacker Intermodal Facility scheduled to open later in 2007.

As mentioned above, Rickenbacker's development success can be attributed in large part to its management strategy implemented in 1991 with the establishment of the Greater Columbus Inland Port Commission to promote trade through developing and leveraging logistics services and intermodal infrastructure. The Inland Port Commission is an exemplary public-private partnership made up of city, county, state and federal representatives from the public sector and the Greater Columbus Chamber of Commerce and individual manufacturers, shippers, logistics providers, and others from the private sector. Cost-benefit analyses have shown that for every U.S. dollar of public investment in Rickenbacker, three dollars in private investment have resulted with twenty-five dollars in regional economic impact, estimated to be nearly $3 billion in 2006.

North Carolina Global TransPark

The North Carolina Global TransPark (GTP) was conceptualized as a multi-modal industrial airport designed to support manufacturing, distribution, agribusiness, and transportation-related companies. A comprehensive planning effort was completed in 1994 with the objective of fully integrating air, rail, road, and nearby sea transportation capabilities to serve the logistics requirements of industrial and distribution tenants and users.

The GTP encompasses 5,000 acres in eastern North Carolina, 70 miles east of the Research Triangle Park and 40 miles from the Atlantic coast. At full infrastructure build-out (forecasted to be around 2025), the project was planned to have two long-range parallel runways, a state-of-the-art central cargo processing area, an intermodal rail terminal, a dedicated system for transporting cargo throughout the GTP, internal road networks, and upgraded connections to regional road and rail systems. Two deepwater ports are located approximately one hour away by rail and highway. Thousands of acres within the GTP are currently available for private, industrial, manufacturing and distribution facilities.

As of March 2007, less than 500 people are employed at the GTP which is disappointing to many. Locational problems created severe constraints. As noted, the North Carolina Authority selected a relatively isolated low-income region of the state as the site of the GTP in part to spur job growth, income and overall economic development of a declining region. This location has posed a number of liabilities. First, the highway system and related transportation and telecommunications infrastructure were not well developed to the site. The GTP is over 40 miles from the nearest interstate highway and developing limited access connectors to the interstate will take at least a decade. The lack of interstate highway accessibility dissuaded a number of early targeted manufacturing firms from locating at the GTP. In addition, the runway at the Kinston Jetport (the GTP) was only 8,000 feet long, and therefore unable to handle the take-offs and landings of large cargo aircraft.

Securing the environmental approvals and federal and state financing to extend the runway to 11,500 feet took four and a half years. These approvals and financing came in late 1997 and 1998 and the runway extension was completed in late 2002 which was the middle of a major air cargo downturn period. Without federal environmental approvals (which, as noted previously, involved a full EIS) and a sufficient runway length for fully loaded all cargo aircraft to land and take-off, it was impossible to recruit major cargo airlines and therefore the firms that would use them.

The lack of a nearby developed industrial base in the poorest part of the state further discouraged a number of air cargo firms. The North Carolina GTP found itself in a chicken and egg situation that is now only beginning to be resolved through transfer of activities and responsibility to a major private sector commercial real estate development firm (Duke Realty) and private sector development consultants and logisticians (Longistics). PTI with its modern airport infrastructure in place (including a soon to be completed second runway), nearby interstate highways within easy reach and well-developed industrial base faces none of the critical problems which have delayed progress of the North Carolina GTP. PTI also possesses an an in-place passenger and air cargo network that the GTP lacks and the committed FedEx Mid-Atlantic regional air express hub scheduled to be operational in mid-2009.

Southern California Logistics Airport

Another effort to create an air cargo/industrial airport that has faced similar difficulties is Southern California Logistics Airport (SCLA) located at the former George Air Force Base in Victorville approximately 100 miles northeast of Los Angeles. The developer of SCLA, Sterling Enterprise, has entitled 64 million square feet for commercial and industrial development. Thus far, the firm has leased out 1 million square feet to air cargo and logistics providers, as well as for distribution facilities of major companies such as Boeing and General Electric.

The former air base, like the GTP, has faced a number of challenges. It is considered too isolated for air express activity and its local industrial base is not strong enough to provide sufficient origin and destination air cargo. There is also intense competition from other nearby "Inland Empire" airports, including Ontario, San Bernardino, and March Air Base. Los Angeles International and Ontario have a solid grip on freight forwarders, who are reluctant to move to SCLA, despite its cost advantages and major incentives provided. Since freight forwarders account for the vast majority of traditional (non-express) air cargo, this has proven to be a liability that SCLA has yet to overcome.

Again, PTI is in a much better position with an established aviation network and large regional area industrial base. The Piedmont Triad is the third largest metropolitan Region in the state, with the southeast's only air express hub while SCLA faces intense competition from air cargo giant LAX and nearby regional air express complexes at Ontario (UPS) and Riverside/March (DHL) airports

Subic Bay, Philippines

In the prior section, I noted how establishing the FedEx regional hub at Subic Bay accelerated the development of the area around it. Within months of the opening of the regional hub in 1995 with only 15 daily flights, substantial investment in time-sensitive industries began flowing into industrial parks at and around the air express hub. As the FedEx hub expanded, many more firms were attracted to the airport region. These included, among numerous others, South Korea's Anam Group, one of the world's largest producers of computer chips. Anam invested US $400 million in its Subic Bay plant that now turns out 50 million chips per month, equivalent to nearly half the production of South Korea. Also from South Korea, Poongsan constructed a $100 million facility to make components for chip boards. Taiwan's Wistron (Acer's manufacturing subsidiary/spin-off) was attracted to Subic Bay's fast-cycle logistics and rapid response distribution time, investing $120 million in its computer assembly facility there. Other major microelectronics firms, such as Taiwan's TEMIC Semiconductor, Japan's Omran, and U.S.A.'s Sanjo Allow, were attracted to Subic Bay for the same reason.

Between 1995 and 2000, 150 firms located around the airport, constituting US $2.5 billion in commercial investments. During the same period, as stated previously, exports increased from US $24 million annually to over US $1 billion annually. By 2005 , exports exceeded $1.3 billion with airport-linked employment estimated to be 56,400. The UPS regional air hub at the former Clark Air Base (now known as the Clark Aerotropolis) is having a similar impact, drawing time-sensitive manufacturing and fulfillment centers from throughout Asia.

European Air Logistics Airport Experiences

I have already described the evolution of an Aerotropolis around Amsterdam's Schiphol Industrial Airport, with logistics being a primary driver. Considerable airport-driven commercial development is also occurring around Paris' Charles de Gaulle Airport and London's Heathrow, the latter exhibiting the most expensive industrial space in the world around it.

There are also a number of smaller cargo-oriented airports using air logistics to attract industry. These include Vatry Cargo Airport in the Champagne Region of France, about 100 miles north of Paris. It has been trying to position itself as a logistics hub and third airport of the greater Paris Region. Vatry commenced operations in March 2000 following a seven million euro investment by local authorities and advertised itself as "the first multimodal

100% cargo center in Europe." In 2002, Vatry handled 6,100 tons of freight and had a total of 10,300 aircraft movements. It is near the center of major trucking in Europe linked to the French motorway network (A26 and A4). Prologis, a major U.S. real estate investment trust focusing on logistics and distribution centers is building a substantial complex at Vatry. Overall, development at Vatry has been slower than many anticipated with the primary reason given as its distance from Paris and paucity of freight forwarders and 3PLs in the vicinity.

A primary cargo airport in Germany at Hahn, about 100 miles from Frankfurt, is likewise positioning itself as an industrial airport. This former U.S. airbase has consistently raised its freight tonnage from just 5,500 tons in 1997 when it opened to over 130,000 tons in 2004. Frankfurt AG (now known as FraPort) has taken a major equity stake (73%) in Hahn and the airport has been renamed Frankfurt-Hahn.

A number of 3 PLs are active at Frankfurt-Hahn. The airport features a five-lane road feeder system with integrated truck cross-docking facilities along with complete logistics services including all documentation and processing of special cargo. The airport also features 24/7 operation and is the German base of a number of air cargo charter companies, including the Western European hub of Volga-Dnepr Heavy Lift. It likewise serves as the European hub for Antonov (Russia) and as the German base for low-cost passenger carrier Ryanair.

Frankfurt-Hahn received a major boost in September 2004 when British Airways commenced weekly B747F flights to Johannesburg, Africa and Hong Kong. In November 2005, it added two more weekly flights to Hong Kong. Russia's Aeroflot has also made Hahn its European cargo hub with four DC10Fs stationed there currently offering 12 weekly fights to Moscow, Beijing, Shanghai, and Tokyo. Scheduled cargo flights are also now offered by Egypt Air, Air Armenia, Iran Air, Turkey's MNG Airlines, and Royal Jordanian.

Hahn's success in attracting air cargo companies, which is driving nearby airport-linked industrial development, is due to its fast and efficient cargo handling and lower costs compared to Frankfurt International Airport and other large European airports. Hahn also has the advantage of being located within four to six hours trucking time of major European markets.

Of particular relevance to PTI, once Hahn's air cargo traffic began to boost airport-related industrial development, additional air passenger demand was created. Annual passenger traffic expanded from just 29,000 in 1998 to 1.5 million in 2002, to 2.8 million passengers in 2004, and on up to 3.7 million passengers in 2006. Although much of this passenger growth resulted from Irish low-cost carrier RyanAir establishing Hahn as its German hub, a number of other

new European carriers have started passenger service at Hahn, as well, over the past three years.

With both cargo and passenger demand at Hahn soaring, in 2004 the state of Hesse took a 17.5 percent stake in the airport (leaving Fraport with a 65 percent majority share) with the other 17.5 percent share held by the state of Rhineland-Palatinate. These three shareholds have committed themselves to investing 42 million Euros (about 80 million dollars) from 2005 to 2009 to improve airport infrastructure and further expand cargo and passenger capacity.

The Mother Ship: Memphis International Airport

In less than 30 years, FedEx has transformed Memphis from a sleepy mid-size southern city into a global distribution center. It's Memphis hub is the largest, fastest, and most connected air logistics complex in the world. In 2005, the airport handled 3.6 million metric tons of cargo, 94% due to FedEx which processed over 2 million packages per night on average. With 300 daily national international non-stop flights, the hub covers the globe. This air connectivity is further enhanced by superior interstate highway and rail access as well as by excellent passenger service. Northwest Airlines offers 279 daily scheduled departures to 89 U.S. cities and to Amsterdam.

As a result of the FedEx presence, the economic impact of Memphis International Airport is immense. According to a 2005 study by the University of Memphis, the airport had a $22 billion impact on the metropolitan economy, $19.5 billion resulting from air cargo activities. A total of 166,000 jobs in the metro area are tied to the airport (40,000 employed by FedEx alone) which constitutes over 1 in 4 jobs in the Region. Almost half of the businesses in the Memphis area feel that their economic future is linked to the airport.

Because of the high employment multiplier effects of air express and air cargo activities (e.g., trucking, logistics, and distribution centers, time-sensitive assembly, repair and testing, etc.). Memphis International Airport has an economic impact greatly disproportionate to its passenger numbers and population base (see Exhibit 1.6). For example, while Phoenix Sky Harbor Airport has nearly four times the annual passengers and its metropolitan population base is three times larger than Memphis, Memphis International has an economic impact that is 50 percent larger than Phoenix Sky Harbor airport.

A substantial aerotropolis is evolving at and around Memphis International Airport. In addition to logistics and distribution facilities, hotels, office parks, retail and entertainment complexes are locating along airport

corridors. The FedEx hub has attracted major arterial clusters and strings of logistics and distribution facilities (see Exhibits 1.7 and 1.8). These include:

- World's largest laptop computer repair depot—Solectron Repairs 5,000 laptops every night
- World's largest cornea bank—The National Eye Bank Center
- World's largest DVD distribution center—Thomson Technicolor ships 1.2 million DVDs per day (½ of DVDs purchased in the U.S.)
- Largest overnight drug testing center in the U.S.—Advanced Toxicology runs 5,000 lab tests per night for next day delivery.

Major national distribution facilities for Flextronics, Hewlett-Packard, Sharp, Cingular, Jabil Global, Pfizer, Baxter, GlaxoSmithKline, Medtronic, and many others have located in Memphis largely because of the FedEx hub. Some of these such as Sears logistics services, Hewlett-Packard, Nike, Williams-Sonoma and Thomson Technicolor operate distribution facilities that exceed two million square feet.

VIII. Piedmont Triad Air Logistics Hub/Aerotropolis Potential—Credibility, Viability, and Challenges to Success

Whereas PTI will be a regional air express hub and highly unlikely to ever reach the scale of the current Memphis hub, it will grow and attract the type of time-sensitive goods processing facilities such as described above. This is already occurring around U.S. regional air express hubs such as Indianapolis, Ontario California, and Alliance Texas. It is also likely that a Triad aerotropolis will form around PTI and outward along nearby interstate highways for reasons to be noted below.

The Piedmont Triad is rich in logistical assets. The Region is strategically located in the center of the Atlantic coast air transport corridor. Contributing to its multi-modal transportation advantage, the Triad offers excellent interstate highway access and competitive rail service, as well as being within five-hour trucking proximity to deep-water ports at Wilmington, NC, Morehead City, NC, Charleston, SC, and Norfolk, VA. Surface transportation infrastructure at and around PTI is being markedly upgraded. These assets are a major reason FedEx chose the Piedmont Triad for its Mid-Atlantic hub and why others such as UPS operate a ground hub in the Region and the United States Postal Service has a

bulk mail center. Large trucking firms such as Old Dominion have also established trucking terminals in the Region. Let me elaborate briefly upon the Piedmont Triad's logistics assets and note what is required for even greater successful leveraging.

PTI is within two hours flying time of most major U.S. markets, including, among others, New York, Chicago, Philadelphia, Detroit, Washington, DC, Boston, Memphis, Atlanta and Miami. It is currently served by six passenger-cargo combination airlines and five all air-cargo airlines, as well as five cargo facilities, effectively linking people and products in the Triad Region to markets across the country and around the world.

FedEx's Mid-Atlantic hub will considerably improve connectivity for speedy, reliable shipping, especially up and down the East Coast where regional shippers can drop off their cargo at PTI potentially as late as 11:00PM for next day delivery. With its two existing runways (the main runway being 10,000 feet), and a new runway parallel to the main runway currently under construction, PTI should not experience the congestion problems and delays frequently encountered by its larger, competitor airports along the East Coast.

As noted, the Piedmont Triad has superior interstate highway access, which was a pivotal reason in FedEx's choice of PTI for its Mid-Atlantic regional hub. Interstate highways I-40 and I-85, as well as the future I-73 and I-74, converge near PTI, and with convenient connectivity to I-77, the airport (and greater Piedmont Triad Region) is highly accessible to and from most markets in the eastern U.S. Piedmont Triad International is already a multi-modal air cargo complex with many major trucking lines operating terminals near the airport. In addition, the area is served by the Norfolk Southern and CSX rail lines, with existing lines that can be extended to airport property development sites. PTI also boasts world-class maintenance facilities for aircraft of all types.

Multi-modal air logistics complexes evolve best where there are wide highway lanes and fast, uncongested trucking and automobile mobility. With upgrades in progress, the immediate PTI area should be well situated in this regard. Although sections of existing highways near PTI (such as NC 68) are facing congestion challenges, as will be described in the next chapter, there are several projects planned and in the works (including the future I-73 and I-74 corridors) that should enhance connectivity and speed regional traffic movements.

In the following chapters, the importance of telecommunications infrastructure in further leveraging the Piedmont Triad's multi-modal transportation asset will also be emphasized. Here, the Region already possesses a state-of-the-art telecommunications infrastructure that is reliable, robust, and

redundant. Complementing the Piedmont Triad's excellent interstate highway connectivity and advanced telecommunications assets are "soft" infrastructure support, including critical knowledge (college and university) and commercial support (regional economic development partnerships). The latter soft support serves as an important networking mechanism for new firms locating in the area to gain quick access to required investment information and to local business leadership and government officials.

High tech industry cluster development not only tends to go hand-in-hand with air logistics complex development (as described earlier in this chapter), but also where the area's colleges and universities produce ample numbers of appropriate graduates. The Piedmont Triad's nine community colleges (enrolling 33,567 students), and eleven bachelor and masters degree colleges and universities (enrolling 31,935 students) offer an excellent labor pool as well as knowledge-base skills. A number these institutions, such as Forsyth Tech, Guilford Tech, UNC-Greensboro and North Carolina A&T, are currently offering or are developing logistics curricula concentrations to leverage and be leveraged by the FedEx Mid-Atlantic hub and the Piedmont Triad's other emerging logistics assets. For example, Guilford Technical Community College (GTCC) has formed a partnership with Embry-Riddle Aeronautical University to transfer this university's considerable expertise in aviation and air cargo to the GTCC/PTI campus.

Further stimulating high-tech clustering are the growing number of scientists, engineers, architects, designers, medical professionals, and other "creative class" professionals being produced or employed by the Piedmont Triad's research institutions: Wake Forest, UNC-Greensboro, and North Carolina A&T. A major regional planning study called HOT (Heart of the Triad) is recommending a significant intellectual/lifestyle cluster be developed on land about five miles west of PTI to retain and attract more of these knowledge workers.

Given the Piedmont Triad's logistics and other assets to be soon reinforced by the FedEx Mid-Atlantic hub, the Region has a propitious opportunity to create a world-class, differentiating competency in multi-modal air logistics that can strengthen its traditional manufacturing economy and attract new economy industries such as microelectronics, pharmaceuticals, medical devices, and aerospace equipment. Indeed, the Piedmont Triad's confluence of location, interstate highways, PTI and its new FedEx hub provide the Region competitive advantage that can help brand the Piedmont Triad nationally and globally in the same way that RTP and research have branded the Raleigh-Durham-Chapel Hill area and financial services have branded Charlotte. Beyond branding, the Piedmont Triad's combination of logistics assets give the Region true economic

advantage (its unique selling proposition) that can have the potential to drive the creation of ten of thousands of new jobs across the entire 12-county Region.

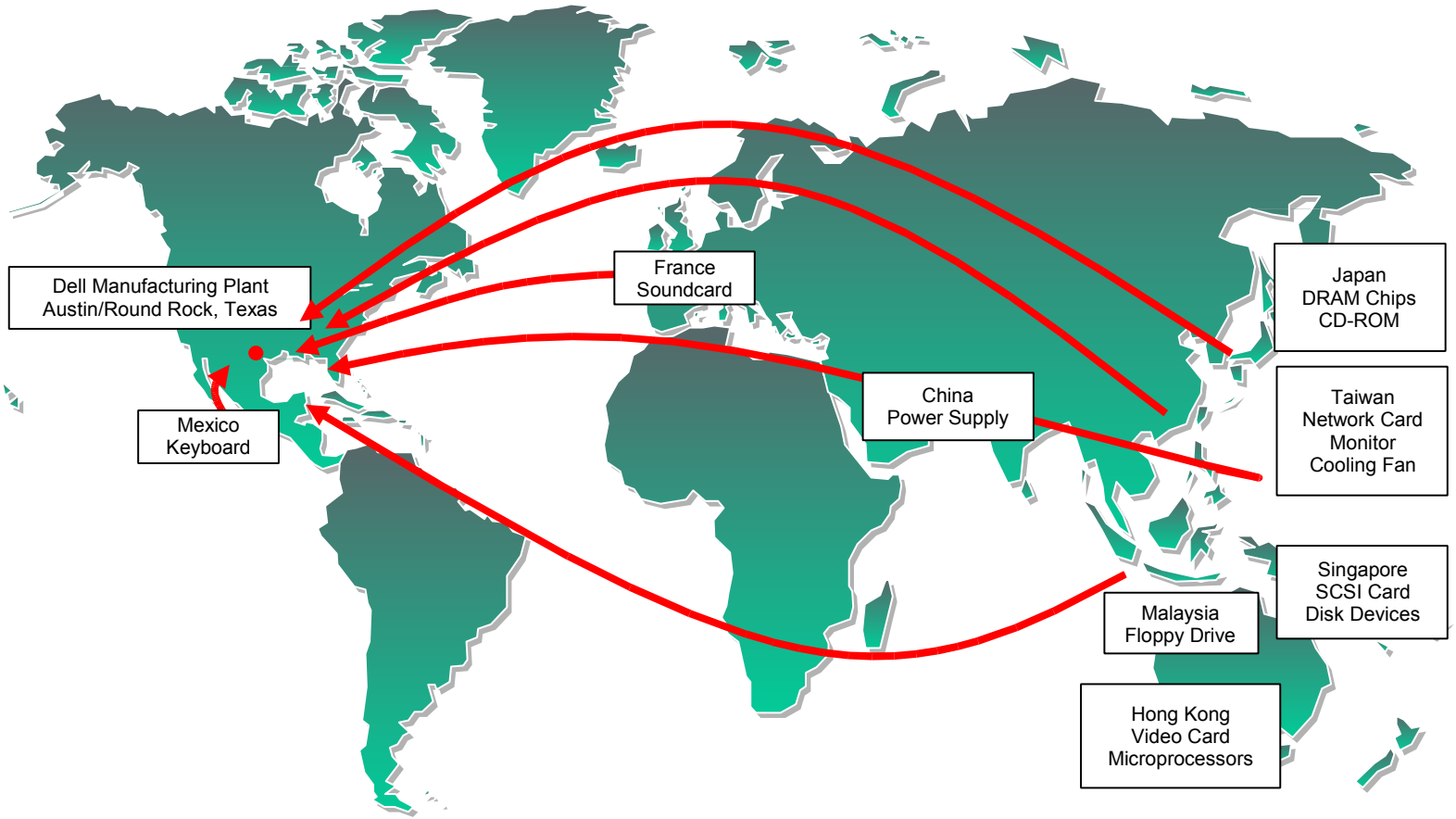
This will not likely happen, however, under the present city-county centric planning and action paradigm that predominates in the Piedmont Triad Region. To compete nationally and globally, all jurisdictions in the Piedmont Triad must work together as a unified entity reflecting the reality that the Region is, in fact, a single market economy. This involves planning, developing and marketing the Region as a whole to create integrated multi-modal infrastructure and economies of scale, and to coordinate actions to maximize the regional brand and long-term benefits to individual jurisdictions. For example, without established protocols between jurisdictions, companies choosing to locate in the Piedmont Triad will likely continue to play the cities/counties off one another to the detriment of the local jurisdictions, their tax bases, and ultimately their citizens.

Returning to PTI, given its baseline assets noted above, and the forthcoming FedEx regional Mid-Atlantic hub, Piedmont Triad International Airport has an excellent opportunity to develop a world-class air logistics hub. Planned, developed, and marketed effectively, PTI will not only grow and prosper in its own right, but with coordinated Region-wide planning and action, PTI will serve as a powerful engine for Piedmont Triad job creation and economic development for many decades to come. As this occurs, it is likely that numerous aerotropolis features one sees emerging around and outward from U.S. and Asian air logistics hubs will take place in the Piedmont Triad Region.

In point of fact, there is little doubt that an aerotropolis in some form will emerge and grow around PTI. *The critical question is: will it emerge and grow in an intelligent manner so that development is economically efficient, aesthetically pleasing, and environmentally sustainable, bringing jobs and an improved quality of life to residents of the entire Piedmont Triad Region? Or will it emerge and grow in a spontaneous, haphazard, unsightly, and ultimately unsustainable manner as has occurred around so many commercial airports in the U.S. to date, which will substantially impede the potential benefits not only to areas proximate to PTI but to the entire Region?*

The following three chapters will provide the infrastructure plan guidelines, businesses plan guidelines, and implementation plan guidelines to better leverage PTI, in general, and the new FedEx Mid-Atlantic hub, in particular, for the economic and social well-being of the entire Piedmont Triad Region. These guidelines will again reinforce the need for coordinated Region-wide planning and actions, the absence of which will preclude the Piedmont Triad from achieving the full development potential the FedEx hub and other regional logistics assets can offer.

Exhibit 1.1
GLOBAL SUPPLY CHAIN—DELL COMPUTER TEXAS FACILITIES



Source: Abbey, Twist and Koonmen. 2001

Exhibit 1.2
UNITED STATES TOTAL AIR AND VESSEL EXPORTS FOR
1990, 1997 AND 2005, BY VALUE (IN MILLIONS OF US$)

	1990	1997	2005
TOTAL VALUE	$260,927	$444,127	$554,489
AIR VALUE	$110,321	$219,751	$292,970
VESSEL VALUE	$150,605	$224,376	$261,519

GROWTH	90–97	97–05	90–05
TOTAL VALUE	70.2%	24.8%	112.5%
AIR VALUE	99.2%	33.3%	165.6%
VESSEL VALUE	49.0%	16.6%	73.6%

Source: U.S. Department of Commerce
Merchandise Trade Files.

Exhibit 1.3
AEROTROPOLIS SCHEMATIC

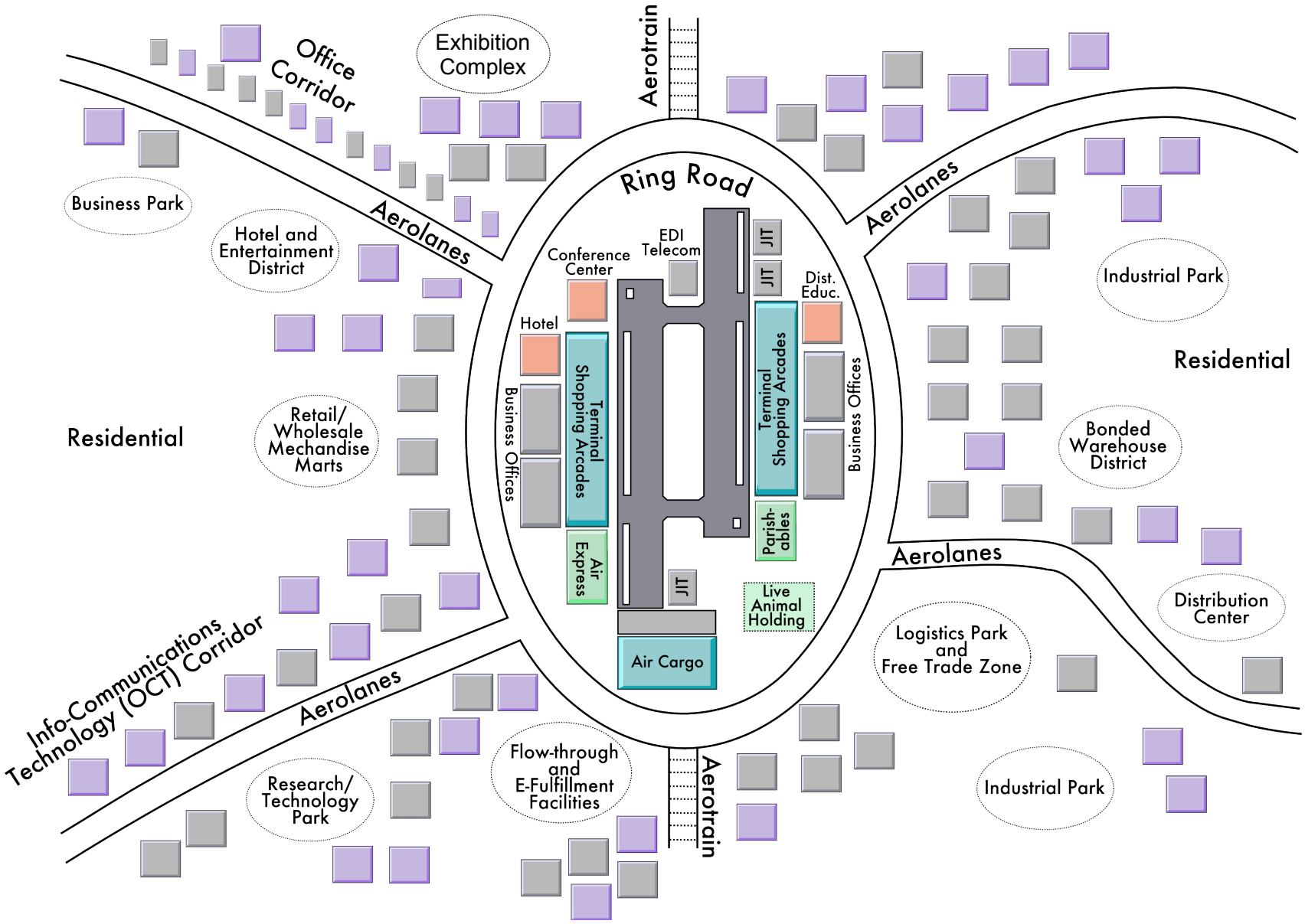
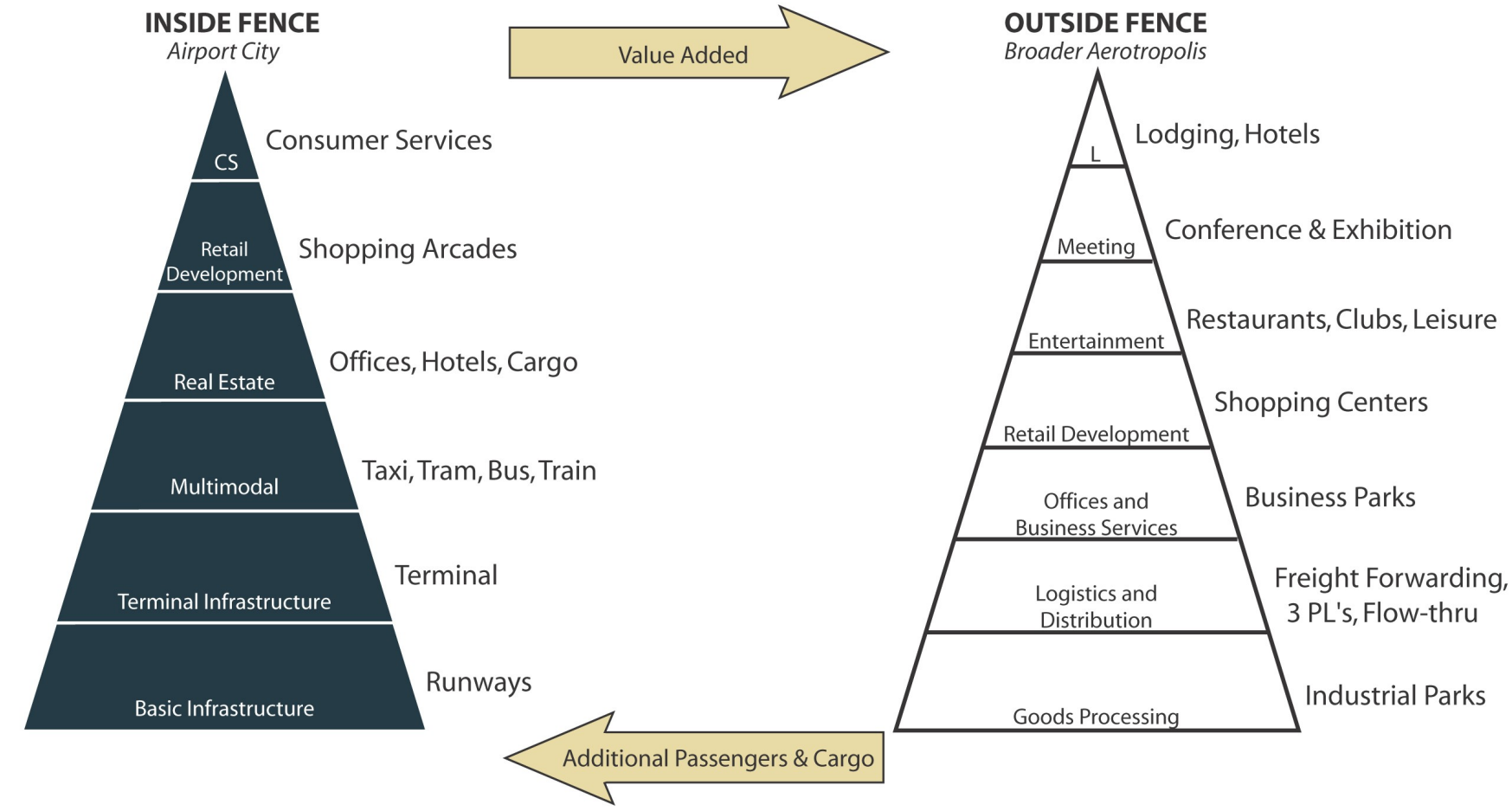


Exhibit 1.4
AMSTERDAM–SCHIPHOL AIRPORT CITY–
AEROTROPOLIS SYNERGIES



Source: Schiphol Group and Dr. John D. Kasarda

Exhibit 1.5
BUSINESS AND INFRASTRUCTURE DEVELOPMENT
AROUND LA/ONTARIO INTERNATIONAL AIRPORT, 2004

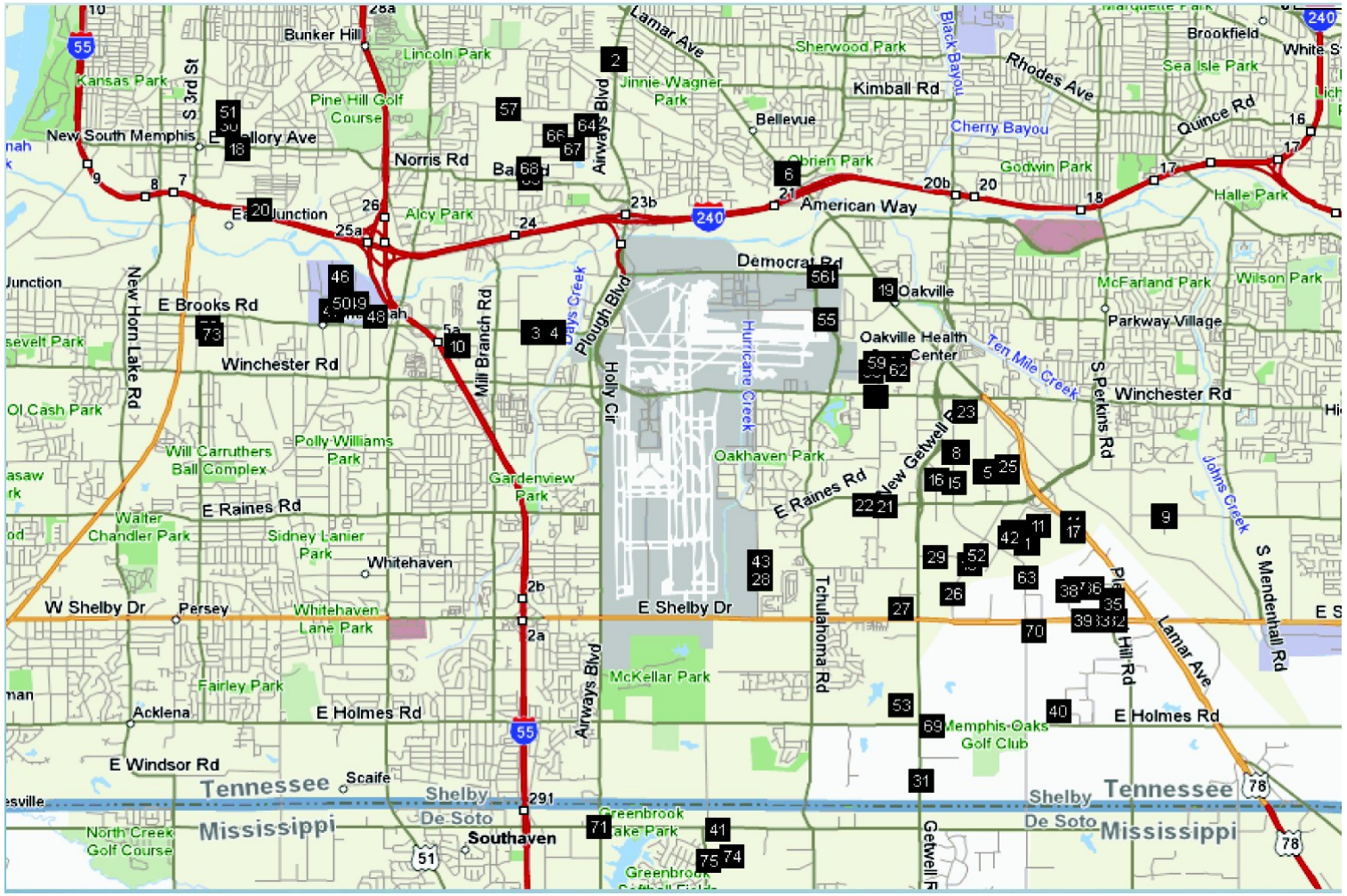
Exhibit 1.6
COMPARATIVE ECONOMIC IMPACT OF AIRPORTS

Airport/City	2004 Passengers	Metro Population	Economic Impact
Memphis	10,883,759	1,250,293	$21 Billion
Denver	42,393,766	2,330,146	$17 Billion
Phoenix	39,504,898	3,715,360	$14 Billion
Minneapolis	36,713,173	3,116,206	$11 Billion

Source: Memphis-Shelby County Airport Authority, 2005.

Exhibit 1.7
MEMPHIS DISTRIBUTION FACILITIES NEAR AIRPORT, 2005

Exhibit 1.8
MEMPHIS AEROTROPOLIS
LOGISTICS AND DISTRIBUTION CLUSTERS, 2005



Chapter 2

Infrastructure and Facilities Plan Guidelines

I. Piedmont Triad International Airport

The PTI campus encompasses more than 3,000 acres in Guilford County. Classified as an air carrier airport, PTI offers air passenger and air freight services through a variety of major commercial airlines, charters, air cargo, and integrated express carriers, as well as services for general aviation.

The airport currently has one long-range runway (5/23: 10,001 ft.) and one crosswind runway (14/32: 6,380 ft.). To accommodate the FedEx Mid-Atlantic hub, a runway is under construction and is scheduled for completion this coming fall. When operational, the new 9,000 ft. runway will be designated 5L/23R and the existing main runway, 5R/23L.

During the past 25 years, both passenger and cargo service has followed a roller-coaster pattern. As shown in Exhibit 2.1, annual enplaned passengers rose from 683,403 in 1982 to 1.9 million in 1994. The huge jump in 1994 resulted from Continental's CALite low-fare PTI hub experiment which created an increase in 872,831 enplanments associated with this airline hub that year. Annual enplanements dropped sharply over the following three years to 1.1 million in 1997 before slowly climbing back to 1.4 million enplanements in 2000. Since then, with cutbacks in the U.S. legacy carriers (e.g., Delta, U.S. Airways) and low-cost airline competition from Raleigh/Durham and Charlotte Douglas airports, annual enplanements slipped back to just under 1.1 million in 2006.

A passenger leakage study conducted for the Piedmont Triad Airport Authority showed that PTI retains 61.8 percent of its primary catchment area commercial passengers with RDU attracting 22.9 percent and CLT 14.6 percent of the top 25 destinations served by PTI. Nearly 1,200 regional passengers travel to PTI's competing airports every day. The Authority is taking extensive steps to reduce this leakage (including aggressive recruitment of low-cost carriers). For example, Allegiant Airlines will begin service to Florida in May.

Boosting the number of passengers using PTI will be pivotal to attracting additional airline service. The new FedEx hub should contribute to this in the longer term by attracting time-sensitive industries to the Triad which research has shown generate substantial additional passenger travel (see Erie, Kasarda, McKenzi, and Molloy, 1999).

Air cargo has also been sluggish in recent years. PTI's air cargo has fluctuated from a high of 148,300 tons in 1998 to 85,700 tons (enplaned and deplaned) in 2001. Air cargo will receive a major boost when the FedEx Mid-Atlantic hub opens in mid-2009. Though future figures have yet to be forecast, there is little doubt that volumes will be multiples of current air cargo processed, with FedEx annual operations (flights) at PTI expected to range from 12,350 in 2009 to 32,760 in 2014, compared with 2,300 annual FedEx operations at present.

PTI Campus Business and Employment

PTI management has not been asleep at the switch when it comes to aviation-oriented business recruitment. Fifty companies are already located on the PTI campus, employing 4,500. These include major aircraft maintenance facilities of Timco, Cessna, Comair, Atlantic Aero, and Landmark Aviation. Timco alone occupies four hangers and employs 1,500. There are also five cargo facilities covering 180,000 square feet and employing about 175 persons.

The GTCC Tom H. Davis aviation school offers professional and vocational education and training in aviation systems, aviation management, career pilot technology and aviation systems technology. Adjacent to the control tower is the 18,000 sq. ft. Flight Standards District Office (FSDO) building housing FAA inspectors.

Anchoring the PTI campus is a 300,000 sq. ft. commercial passenger terminal building with 24 gates. The two-level passenger terminal also offers a range of retail and service establishments and houses administrative offices of airport management and Airport Authority. A spacious Marriott Hotel, with meeting facilities, is located near the passenger terminal. Exhibit 2.2 shows the location of current major facilities on the PTI campus.

With support of PTI management, Atlantic Aero has been quietly assisting Honda Motor Co. Ltd since 2000 in developing its experimental very light jet (VLJ) with a focus on aircraft cost minimization, fuel efficiency, low emissions and state-of-the-art thrust technology. Honda has had a number of its top engineers working with Atlantic Aero in Greensboro. The HondaJet's inaugural test flight took place at PTI on December 3, 2003.

In February 2007, Honda Aircraft Company announced it would locate its new HondaJet assembly facility and corporate headquarters on the PTI campus. These facilities are expected to employ approximately 300 workers initially, paying well above regional average wages and salaries.

The FedEx Mid-Atlantic Hub

As discussed in Chapter 1, FedEx Express, the integrated air express subdivision of Federal Express Corporation (FedEx) selected PTI for its Mid-Atlantic sort hub in April 1998. Scheduled to open in mid-2009, FedEx's PTI hub will be the company's fifth U.S. air express hub. Others are located in Memphis, Indianapolis, Anchorage, and Ft. Worth. The initial phase is being constructed at a cost of $531 million (with FedEx contributing $300 million, the FAA $114 million, NCDOT $52 million, and the Piedmont Triad Airport Authority $65 million). The hub will be anchored by a regional package sort facility serving primarily East Coast origins and destinations from Maine to Miami.

In its initial phase, the FedEx facility will be approximately 1 million sq. ft., capable of sorting 24,000 packages per hour and served by 20–25 aircraft each weekday. Land has been reserved for facility expansion at later phases.

Following an extensive 41-month environmental impact study, the FAA, on December 31, 2001 issued a favorable Record of Decision supporting the project and the construction of the new parallel long-range runway to accommodate hub operation. In October 2002, FedEx Express and PTI executed a lease in which FedEx agreed to open the facility for operation by June 2009.

The Piedmont Triad Airport Authority, FedEx and the FAA have worked closely with consultants and local stakeholder groups to develop strategies to minimize noise impacts on nearby residents resulting from hub nighttime flights. An airport area land use plan has been developed by a committee representing numerous stakeholder groups that will help guide development in areas around the airport and will direct residential construction away from high noise impact areas (see Exhibit 2.3).

Substantial progress has been made during the past two years in the initial phase FedEx hub development program (see Exhibit 2.4). Grading on the hub site began in January 2004 and was completed in May 2006. Rerouting and construction of Bryan Blvd commenced in April 2004 and is expected to be completed in September 2008. Construction of new parallel runway 5L/23R began in November 2004 and is scheduled to be completed in September 2007. Construction of the initial connecting taxiway to the FedEx sort facility began in April 2005 and is expected to be completed in September 2007. Utility site work has been finished and foundation work started for the 1 million sq. ft. FedEx sort facility, expected to be completed in early 2009.

The forecasted economic impact of the Mid-Atlantic hub is immense. A consultant study contained in the Environmental Impact Statement for the project (released in late 2000) estimates that the FedEx hub will create nearly 20,000 new jobs in a 14-county catchment area over a 16-year period. Total new

wages and salaries are projected at $5.5 billion, with a total value-added impact of $9.3 billion on the Triad's economy, according to the study. The study estimates that $703 million in new state tax revenues and $236 million in new local tax revenues will be generated over the 16-year period. (Since these figures are not inflation adjusted, the five-year delay in the hubs opening cause them to be understated.)

FedEx expects to hire approximately 750 workers in phase I, expanding to a total of 1,500 workers in Phase II. About one-third will be full-time (approximately $40,000 per year) and two-thirds part time (approximately $12 per hour). All employees will receive an excellent benefits package, including full medical, dental, retirement, and tuition reimbursement benefits. In the initial phase, FedEx will bring in a number of senior managers ($70,000 – $100,000 per year) who will relocate to the Piedmont Triad. Over time, it is expected that locally hired employees will move into these upper management ranks as they acquire professional experience and skills.

An independent study undertaken in 1998 by Regional Technology Strategies, Inc. projects that the total ten-year impact of the FedEx facility itself, excluding other downstream investment and economic impacts, will be approximately $1.67 billion in 1998 dollars.

Based on airport-linked employment growth that has occurred around other regional air express hubs (as described in Chapter 1), it is my opinion that the 20,000 new job forecast figure is on the low side. This is because it is based largely on traditional economic impact methods that focus primarily on direct, indirect, and induced (multiplier) effects and therefore do not fully capture "catalytic" effects of the hub. Catalytic effects represent employment growth created by firms locating in an airport region because of the connectivity the airport provides to their suppliers and customers.

One important attraction of air express hubs is that they offer considerably later drop-off times of time-sensitive parcels for next-day delivery compared to areas without hubs. As time-based competition and time-critical delivery increase in the future, these much later drop-off times will likely make a marked difference for more and more time-sensitive firms shipping up and down the East Coast. The extensive FedEx trucking network that will accompany the Mid-Atlantic hub will also likely attract numerous firms to the Region that rely on time-definite deferred (two- to three-day) delivery.

II. Piedmont Triad Surface Transportation Assets and Needs

I pointed out in Chapter 1 that the battle for air cargo is won on the ground, not in the air. Surface transportation and resulting accessibility of the hub by firms, their suppliers, and their customers is therefore key. In this regard, PTI and the 12-county Piedmont Triad Region have some powerful assets as well as challenges. Exhibit 2.5 illustrates PTI's excellent regional connectivity. Location along I-40 and near I-85 provides PTI with east-west and north-south interstate access. With future interstates I-73 and I-74 being developed nearby, surface access will be further improved. As noted, it was the Triad's superb present and future interstate highway access that was a pivotal factor in FedEx selecting PTI for its Mid-Atlantic hub. Similarly, these excellent connectors provide opportunities for the entire Piedmont Triad Region to directly benefit from PTI.

In addition to excellent interstate access, PTI's local transportation accessibility is being improved. Following aerotropolis principles, a ring road is proposed around PTI. The new ring road will be formed by linking I-40, NC 68, new I-73, and I-840 around the airport (see Exhibit 2.6). New Bryan Blvd and Market Street can form an inner-ring road (see Exhibit 2.6). The proposed inner and outer ring roads will provide access from all sides of the airport to multiple development sites on airport property as well as to surrounding areas.

As will be stressed in the next section, Region-wide connectivity is also important to fully leverage PTI and its FedEx Mid-Atlantic hub. The Piedmont Authority for Regional Transportation (PART) has been working with NCDOT officials, local governments, the Piedmont Triad Airport Authority, HRD consultants and others to identify and make recommendations to address current and anticipated regional surface transportation choke points. Also included in PART's planning are rail connectivity improvements in the Region. These recommended road and rail improvements are illustrated in Exhibit 2.7.

Although some portions of NC 68 north of PTI are proposed to be upgraded to interstate highway standards as one of the I-73 options around Greensboro, growing congestion on NC 68 could lead to future problems as well as more immediately affect airport accessibility. Since NC 68 is an important part of PTI's future ring road, its choke points must be addressed. Other necessary roadway improvements include construction and completion of I-73; completion of Bryan Blvd. to US 29 and completion of the Winston-Salem Northern Connector. In addition, secondary roads such as Pleasant Ridge, Sandy Ridge and Highway 150 need improvements to provide better access to PTI from the northern part of the state. These roads would serve as secondary

accesses from major highways (68, 29, 220). Better airport access also should be provided from points south of PTI.

III. PTI Campus Commercial Development Prospects

It was noted that fifty companies with 4,500 employees are already located on the PTI campus. With the opening of HondaJet and the FedEx Mid-Atlantic hub, this will grow to approximately 6,000 employees in the next three years. The Piedmont Triad Airport Authority has identified additional tracts of land on the PTI campus for future commercial and industrial facility development. These are shown and described in Exhibit 2.8.

As noted, HondaJet made the decision in mid-February 2007 to locate both its production facilities and executive offices on tract #6. The facilities will initially employ 283 persons and the company expects to produce a minimum of 70 very light jets costing approximately $3.5 million each, per year.

To plan for future commercial growth and allow PTI's infrastructure and flight schedule to expand, it is important for the Airport Authority to consider acquiring additional land. There are some existing housing areas along the eastern boundary of the airport that should be evaluated for potential acquisition as well as a number of undeveloped sites near the airport that may be purchased to meet longer-term airport needs. Although local conditions and financing will play a role in which areas outside the current airport fence may be acquired by the Airport Authority, Exhibit 2.9 illustrates some that should be considered for future acquisition.

It is further recommended that all undeveloped property in the vicinity of the airport be carefully examined by local zoning authorities to make sure that non-conflicting development occurs. In particular, new residential developments that may conflict with future PTI expansion needs and operation should be discouraged or prohibited. Encroachment of residential and other non-compatible land uses directly threatens the huge economic potential that PTI and the Piedmont Triad Aerotropolis can provide in employment, wages, and local government tax revenue to governments both immediately proximate to the airport and to the entire 12-county Region. Elected officials, economic developers, and planners of areas on and around PTI must understand that they have a long-term fiduciary responsibility to manage land uses near the airport for the benefit to the entire Region.

IV. A PTI Air Logistics Hub: Planning for 2020 and Beyond

As the FedEx hub expands and more time-sensitive industries are attracted to the PTI campus and surrounding Region, demand for traditional air cargo should likewise expand. There will thus be a need for a supplementary air cargo area and shared state-of-the-art central cargo facility. Though market conditions will determine when a new cargo operating area and central cargo facility are demanded, land should be reserved and planning guidelines established in the coming year. In this section, I describe key features of the infrastructure and facilities that would make PTI a leading air logistics hub by housing on one campus both an expanding FedEx regional sort facility and a state-of-the-art air cargo complex serving multiple cargo airlines, freight forwarders, and third party logistics providers (3PLs).

Exhibit 2.10 describes generic infrastructure and facilities constituting a future expanded air logistics hub at Piedmont Triad International Airport. Manufacturing, distribution and perishables facilities can be located near or along customized taxiways and ramps, allowing air freighters to come virtually to these facilities. Direct multi-modal (highway and rail) linkages will be critical elements of the expanded air logistics hub and regional network.

Within the core area, a cargo transfer system (CTS) will carry materials, components, and finished products throughout the air logistics hub on an internal network of dedicated rights-of-way. This network will link off-ramp tenants to the central cargo area, a state-of-the-art intermodal complex providing access to air freighters, trucks, rail, and materials-handling systems. In addition, the CTS will connect tenants and the central cargo area to an intermodal rail facility (IRF) containing multiple rail sidings, loading platforms, and truck cross-docking. The IRF, which will need to be built, will handle primarily bulk products and containerized cargo and will serve as a valuable connection to a regional network through connecting rail lines already near PTI. At some point in the future, the IRF may also be linked to a new HondaJet facility and possibly to an inland cargo port with appropriate truck cross-docking (see Exhibit 2.10).

Key to the efficiency of the entire operating infrastructure would be PTI's air logistics hub's intermodal interfaces. These must be designed to allow seamless and flexible flows of materials among convergent transportation modes and commercial facilities, both in the core and peripheral areas of the air logistics hub.

The hub of the central cargo area and cargo transfer system is the central cargo facility (CCF) located along one of PTI's main taxiways. The CCF provides off-ramp and off-site factories, warehouses, and distribution centers with

automated sorting capability, customs clearance, and air freighter access. Since most PTI air logistics hub tenants will not have the volume of cargo to justify direct air freighter docking, the central cargo facility offers them air access via the cargo transport system and/or direct truck cross-docking at the rear of the facility. (See Exhibit 2.11, PTI Central Cargo Facility)

At full development, the entire complex would be served by a ring road encircling it, providing efficient access to all parts of the air logistics hub to local and interstate highway systems and to the intermodal rail facility. Internal roads will connect the central cargo area and the tenants to the ring road.

In focus group interviews conducted with potential industrial tenants for the Global TransPark in Kinston, workforce skills was always mentioned as a key location factor. To ensure that tenants have enough skilled workers and managers, a wide range of worker training, management education, and technology-transfer functions should be provided through an on-site education and training center (ETC). A key feature of the ETC should be distance-learning capability, providing tenants and users with real-time audio, video, and tactile worker training customized to their skill needs, from virtually any location in the world. As will be discussed in the next chapter, the creation of an ETC will provide a timely opportunity for PTI to market and distinguish itself among other competing industrial sites in North Carolina and the Eastern Seaboard.

V. Central Cargo Area Design

The basic design element of the air logistics hub is the Central Cargo Area (CCA) which constitutes a zone of facilities at the operational center of the complex. The CCA includes the Central Cargo Facility (CCF), Perishables Centers (PC) to support in-transit and regional agricultural shipments, and the Customs Clearance Center (CCC). Other primary components of the Central Cargo Area are the Airport Operating Area (AOA), manufacturing and distribution tenant facilities, nearby intermodal truck and rail terminals (with links to inland port facilities), special materials handling and freight forwarder and 3PL facilities, along with a Cargo Transport System (CTS) linking air logistics hub tenants with cargo handling facilities. Since the CCA is the primary and most important component of the air logistics hub, its development and design guidelines are elaborated below.

V-1. Guidelines for Central Cargo Area Design

The Piedmont Triad air logistics hub must be conceived as more than a multi-modal logistical infrastructure. Its full potential and ultimate success will rest on creating a total business environment that will substantially improve sourcing, production and distribution activities of its tenants and Region-wide users. This business environment will be elaborated in the next chapter. Sufficient to note here that along with its multi-modal transportation and cargo-handling systems, the air logistics hub design must support tenants and users with comprehensive electronic commerce capabilities. Electronic data interchange (EDI) and other telecommunications systems using the latest technologies, including broadband fiber optics, multimedia networks, an on-site digitized satellite uplinks and downlinks, should offer PTI air logistics hub tenants and users state-of-the-art electronic access to the global commercial world. EDI improves supply-chain management and a variety of other logistical practices as it tracks, coordinates, and controls materials and product flows across both domestic and international transportation modes. Open architecture, plug-in software systems (described later) will allow PTI air logistics hub's tenants and regional users real-time access to national and worldwide supplier, distributor, and customer databases.

Three key principles should be followed in the design for a future Central Cargo Area: (1) Flexibility, (2) Targeted Mechanization, and (3) Expandability/Phased Growth. Building agility into the processing capability and location of facilities is essential because of: (i) unpredictable longer-term cargo handling demands, and (ii) a dynamically changing and improving technological environment.

Flexibility

A critical design requirement of the CCA is that its development be demand-driven and responsive to changing needs and requirements of PTI air logistics hub tenants and users. A flexible, incremental development approach is highly recommended, given the difficulties of forecasting the exact types and levels of future cargo activity at PTI. Thus, for example, automation of materials handling systems or full-scale development of intermodal connectors and interfaces may not be prudent early in the implementation of the air logistics hub. In the design of most processing systems, cost, flexibility of operation, and operational efficiencies demand appropriate compromises at different stages of infrastructure and technology development.

To save initial expenses and promote flexibility, mobile equipment is generally preferred to fixed position equipment (e.g., a mobile nose loader/unloader as compared to a fixed-bridge nose loader/unloader). Ideally, all equipment should be readily reconfigurable and rearrangeable as operations layout requirements change over time. Fixed position equipment (e.g., automated conveyors attached to the floor or hung from the structural system) hinders the "fluid" design concept recommended for PTI's future air logistics hub operation.

Targeted Mechanization

Experiences of air cargo operations and associated materials handling needs at PTI and airports elsewhere do permit initial determination of some targeted modest mechanization in PTI's air logistics hub operations essential to efficient cargo handling. Mechanization of standard processing operations such as container consolidation, container breakdown, and conveyors to accommodate x-ray equipment should be included in initial operations. Yet, such targeted mechanization should be provided only when and where it is clearly demand driven and economically justified.

Expandability/Phased Growth

Since it is all but impossible to predict future cargo demands with any confidence, it was proposed that central cargo area development at PTI encompass flexible, evolutionary and phased growth. Facility requirements should be estimated as accurately as possible at each phase of evolution, based on air cargo data as it becomes available. Yet, the PTI air logistics hub must also be allowed to become what it needs to be as requirements reveal themselves over time. Thus, proposed design guidelines are not so much a fixed plan as they are a flexible framework to accommodate a wide variety of tenant industries, regional users, and physical layouts. The framework allows for future air logistics hub development to be modified as demand, resources, new technologies, and infrastructure advances occur.

The Piedmont Triad Airport Authority and public sector agencies responsible for broader regional development must be prepared to respond rapidly and creatively to evolving tenant and user needs and an ever-changing business environment; hence, PTI management and Piedmont Triad government agencies themselves must be agile as they create or coordinate "one-stop shop" support for tenants and regional users of the air logistics hub. In this sense, such

agencies may not only wish to market the air logistics hub, but also will operate as a strategic partner with tenants and users in dealing with other government agencies and in seeking access to a full range of technical, financial, and political resources of the state and Region.

Consistent with ISO 14000 standards (international standards that enable companies to systematize and improve their environmental management efforts), maintaining environmental quality and safety must be a fundamental objective of PTI air logistics hub planning and development. For example, the air logistics hub system must provide facilities and procedures for the handling, storage, transportation, and disposal of environmentally sensitive materials as a continuous process. Likewise, modern air logistics hub utility systems must offer high-quality and reliable (and possibly redundant) power, water, natural gas, wastewater treatment, and solid-waste disposal to meet growing tenant needs.

Each potential hub tenant should be evaluated for its compatibility with established environmental regulations and standards. The PTI management/tenant partnership will address the requirements for operating within acceptable environmental parameters jointly. Innovative site planning and design should ensure visually attractive development with ample landscaping and aesthetic touches. Older, deteriorating buildings should be restored or replaced, making the air logistics hub more appealing to potential tenants where feasible. Ideally, the PTI air logistics hub should appear more like a university campus than a traditional industrial/logistics complex.

Although cost savings remain important in today's industrial location decisions, the air logistics hub system should be designed and developed on the assumption that tenants will pay more for integrated, high-quality, reliable services and sound environmental planning. Because a delicate tradeoff exists between costs and on-site services, however, the air logistics hub's cost effectiveness will be achieved by the phasing of development to minimize initial investment and location costs for tenants.

Development of the overall site infrastructure should be incremental, demand-driven, modularized, and reconfigurable. Further flexibility will be achieved by oversizing and making adequate provisions for future infrastructure and facility expansion. The internal transportation corridors linking the transportation modes and production facilities also should be oversized to meet increasing traffic levels overtime and to accommodate future developments in vehicles and transport systems. The same corridors should have all the underground utility channels needed for powering and servicing production and distribution facilities. This includes designing corridors with rapid and flexible plug-in telecommunications capability for tenants, as needed.

I've recommended that the Central Cargo Area be designed for low-tech, cost-effective, flexible or expandable facilities with modular and reconfigurable attributes. Such design would allow facilities to grow over time to accommodate ultimate space needs. One way to reserve space initially is to provide excess separation between contiguous facilities, allowing them to grow closer together as increasing space requirements are met over time. Another way is to site selected easy-to-relocate facilities between other facilities with the intention of moving them at a later date to permit the surrounding facilities to grow together in the space vacated by the relocated facility. All of this is key to agile infrastructure development that should guide the planning at the PTI logistics hub.

Since international cargo will likely be a growing component in PTI's future, a key element, initially placed in the Central Cargo Facility (CCF) but possibly later separated, is the Customs Clearance Center (CCC). This facility would be the initial contact point at the PTI air logistics hub for any party leaving or picking up international cargo. At traditional international air cargo operations, those familiar with the receipt or drop off of international air cargo know what documents are required and where they must go to accomplish their particular air cargo handling task. At the air logistics hub, regional industrial and distribution personnel, typically less familiar than third party logistics providers (3PLs) and freight forwarders with such operations, must become more intimately involved with cargo operations that go beyond their traditional roles (i.e., manufacturing and distribution). Therefore, the Customs Clearance Center should be placed and designed to permit user friendly access to resources (e.g., regulatory, security, and customs offices). Relevant information, including appropriate signage, and adequate parking are needed to serve the future international cargo handling needs of PTI's tenants and Region-wide users.

V-2. Major Facilities within the CCA

The Central Cargo Area, as noted, is the primary area within the air logistics hub for processing of shipments. These include just-in-time fabricators, assemblers, and distributors, and third party logistics firms that may receive direct air, truck, or rail shipments. The purpose of the CCA is to provide, in one location, a complex of structures, infrastructure, and services capable of providing interfaces with domestic and international air, ocean, truck, and rail transportation networks such as that requested by Boeing in their B787 Dreamliner RFP.

VI. Intermodal Interfaces

A major process element of the air logistics hub is the connection and integration of multiple modes of transport (air, truck and rail). Ideally, each mode must be able to seamlessly and efficiently connect to any other mode without significant loss of time or high cost. The primary operational air logistics hub connector (the "glue" that connects the various transportation modes) is a cargo transfer system (CTS). The transfer system will emanate from the Central Cargo Facility (CCF). The cargo transfer system may be composed of a combination of trucking modes operating on internal roads, or in later phases of development by dedicated automated cargo movement systems (for example, light rail or tram) depending on the relative configuration of the elements of the air logistics hub and the level of activity.

VI-1. Guidelines for On-Site Transportation Connectivity

The CCF would need to interface with the following modes of transportation: (1) air, via PTI's taxiways, (2) truck, with adequate cross-docking at the CCF and other CCA facilities, as required to meet trucking demand forecasts, and (3) rail, by first providing a rail access and an intermodal terminal at the air logistics hub, and later providing an interface between the CTS and a rail hub in proximity to the CCF. The CTS would also be the primary connector between the CCF and off-ramp air logistics hub production and distribution facilities, as well as a possible inland port. These intermodal interfaces are illustrated in Exhibit 2.12.

Because the predominant mode of Piedmont Triad regional transportation for products moving to and from PTI domestically would be via highways, truck terminal facilities and facility cross-docks along PTI's ring road linking to interstate highways in the Region would be critical design elements for successful operation of the air logistics hub. Again, PTI is well situated in this regard, with several major interstate highways near the airport. Trucking terminals along connecting interstate corridors complement the on-site assets.

VI-2. Guidelines for Future Domestic and International Connectivity

The Piedmont Triad's regional logistics system must be able to accommodate a broad variety of transportation origins and destinations not only to and from the air logistics hub but throughout the Region. Flow paths of domestic and international air, truck and rail (when required) modes are represented in Exhibit 2.13 as they might occur between the air logistics hub and future domestic or international origins and destinations. Flow paths of intra-air logistics hub cargo are shown within the boundaries of the air logistics hub in the Exhibit. Truck and rail terminals, separate from the Central Cargo Facility, may locate near manufacturing or distribution tenants as the air logistics hub develops in later phases.

Regional truck and rail transportation should be available between all major Piedmont Triad industrial nodes and the air logistics hub. Truck shipments consigned to air logistics hub tenants will most likely be delivered directly to those tenants. Deliveries to consignees located further from the air logistics hub will be delivered to the Central Cargo Facility, or to appropriate truck or rail terminals for processing and subsequent delivery to the consignee. During early operations, the truck or rail terminal may be located beyond the core of the PTI air logistics hub (i.e., outside of the CCA).

Although presently of minor importance to PTI, direct rail transportation lines to and from the air logistics hub must be put in place. To be considered is a possible extension or provision of spur rail lines to larger industrial or distribution facilities on the PTI campus that may eventually need rail transportation.

VI-3. Guidelines for EDI Design

- To support 21st century business practices of electronic commerce, just-in-time delivery, and supply chain management, electronic data interchange must be provided as a tool for air logistics hub operators, tenants, logistics service providers, and U.S. Customs. The air logistics hub EDI system will be a network of computers and databases that provide an interface between all parties involved in arranging a shipment. This EDI system must be capable of interfacing with multi-modal carrier systems to provide on-line tracking and tracing capability for the shipper. A key function of this system should be to interface with U.S. Customs. The local air logistics hub EDI network should also have access to global

telecommunications networks via satellite transmission. Similarly, the EDI system should be tied to a bar-coding or more advanced RFID systems for shipment identification within the system and in-transit. The general objectives of the PTI's air logistics hub EDI system, consistent with the communication vision of 21st century business practices are to:

- Build a cost-effective, resilient, and manageable network, available throughout the Piedmont Triad Region.
- Allow businesses throughout the Piedmont Triad Region to connect to the PTI air logistics hub via a network backbone without extra charges;
- Ensure connectivity by providing enough bandwidth and connection channels;
- Ensure capacity so that the Piedmont Triad regional community and air logistics hub tenants can connect and not be denied access due to insufficient ports;
- Provide support for all protocols required by the users of the system;
- Allow tenants, users, and logistics service providers with a range of hosts (e.g., Wi-Fi workstations with high-speed network access, mobile computing and data exchange via secure wireless networking) to connect to the PTI air logistics hub's network.
- Allow PTI air logistics hub tenants and the Piedmont Triad regional user community to access applications (e.g., database inquiries/updates) on a range of different computers operated by third party entities. This requires open architecture and a common EDI platform for software compatibility.

Conceptually, the air logistics hub Communications System can be viewed in Exhibit 2.14. This exhibit also illustrates a possible future global communication system for the PTI air logistics hub. Here, it is important to remember that each entity often interacts with many different companies, with different LAN's, different computers, different communication protocols, and other factors that make harmonizing EDI systems extremely complex. Because harmonization of EDI and other messaging standards will be so important to the efficient operation of a PTI air logistics hub, its tenants, users, and logistics service providers, I will briefly elaborate EDI standardization and harmonization guidelines in the sections below. I will then suggest a phasing strategy to accomplish this objective.

VII. Air Logistics Hub Planning Integration Strategy

As described in the previous sections, the future PTI air logistics hub would represent a new kind of logistical center in which information technology, multi-modal transportation and supply chain activities are operationally integrated to create a seamless business environment. Traditional planning activities do not capture the intersections and linkages that are necessary to create this new environment.

The proposed integrated planning process at PTI must differ from traditional planning processes in three respects:

1. Shift from *Element Focus to Process Focus*. Traditional master planning exercises target individual elements of infrastructure in separate plans; for example, master plans independently produced for ports, railways, highways, and airports. Each of these master plans is based on traditional concepts of the role and function of these infrastructures. In a process-oriented plan, the exercise begins with an understanding of the integrated business processes and needs of the tenants and customers. In this new approach, for example, the design concept for an airport should be guided by the desire to create value for the commercial user of the facility rather than to maximize the utilization of designed capacity. Also, multi-modal logistical synergies need to be emphasized such as highway-air linkages that have been successfully implemented by integrated transportation service providers such as FedEx. This will involve a close coordination and integration of all elements of infrastructure planning for the PTI air logistics hub and greater Piedmont Triad Region.
2. Identify New Elements of the Air Logistics Hub. The air logistics hub will require new elements of infrastructure. In the 21st century, businesses will compete based on how efficiently and creatively they manage information to create competitive advantage. Even Fred Smith, Chairman of FedEx, has described his company as an IT firm that happens to fly airplanes. It was the information technology that allowed FedEx to trace, track, and control package shipments that gave the company a huge early competitive edge. The provision of information technology therefore is not an afterthought, addressed once the size and function of a building or infrastructure have been designed, but rather an organizing principle around which the identity and function of a building or infrastructure have been designed. In this process planning environment, information technology capabilities must complement and reinforce the development of multi-

modal transportation and industrial capabilities at the PTI air logistics hub and throughout the Piedmont Triad Region.

3. Establish New Linkages between Infrastructure Elements. As will be elaborated in the next chapter, the creation of a 21st century business environment at and around Piedmont Triad International Airport requires new linkages among key infrastructure elements. Uninterrupted flows of products and materials through the PTI air logistics hub require the integration of material handling systems with various modes of transportation. It is therefore necessary to plan the material handling and management systems that will integrate the movement of goods and materials from across these modes regionally and to and from the PTI air logistics hub.

VIII. Designing for Future Tenant Needs

Business Process Needs of Tenants

The ultimate success of PTI's air logistics hub will depend on how well it meets the business needs of future tenants and users. The real customer for the planning process is not the Airport Authority or the Piedmont Triad Partnership (or any other local government body), but firms the Partnership, Piedmont Triad counties, and municipalities wish to assist, support, and recruit. Therefore, concepts and capabilities targeted to 21st century business practices described below should guide and inform the planning process and the required functionality of PTI air logistics hub and regional infrastructure. These businesses need the following:

- Paperless Environment: Companies are quickly moving to a paperless environment in which orders for materials as well as finished goods are transmitted electronically from customers worldwide to their suppliers. Global manufacturers are requiring that their suppliers communicate electronically. Therefore, the availability of access to state-of-the-art communications and information networks will qualify future air logistics hub tenants, large and small, for new, expanded commercial opportunities.
- End-to-End Supply Chain Visibility: The ever-growing imperative for speed and lower costs has caused companies to more closely manage their supply chains. The basis of competition has changed from head-to-head

competition between companies to a competition that pits supply chain against supply chain. A weak link anywhere along the supply chain can have a devastating impact on a company's ability to perform. Increasingly companies are requiring end-to-end asset visibility along the entire chain requiring electronic tracing and tracking information technology.

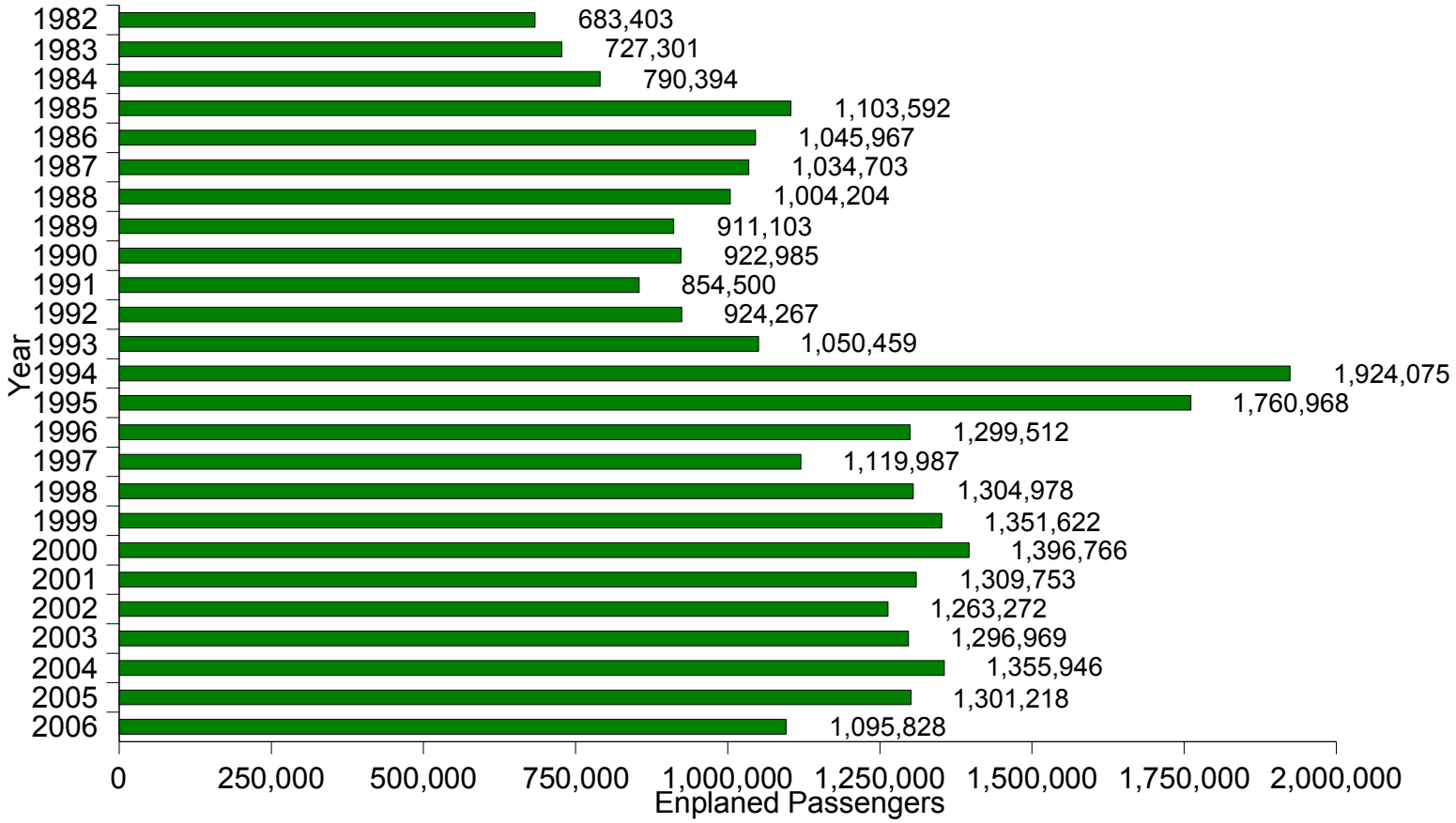
- Just-in-Time Delivery: As companies manufacture in increasingly smaller lots and provide more customization of their products, the need for just-in-time delivery has grown. Not only must small batches of materials be shipped as economically as large batches, but they must be delivered within 36 to 48 hours anywhere across the globe. Today's manufacturers seek suppliers that are located near the manufacturing site as well as distant sites where both have access to good airports and uncongested highway systems. The availability of an integrated information and transportation infrastructure provides the capability for suppliers, manufacturers, and customers to work across great distances as if they were located nearby.
- Real-Time Asset Control: To assure flexible and fast response to changing customer needs, companies must not only to able to trace and track their assets quickly, but also to change their destination, routing or carrier mode as customer requirements change. Only the complete integration of information, transportation and manufacturing can provide this capability. Few, if any companies are able to do this now, but this will become a standard of doing business in the near future.

In sum, successful development of a PTI air logistics hub will require a broad understanding of the basic business processes of tenants, users, and logistics service providers, their current information system capabilities, and their transportation infrastructure needs. These include better understanding of the emerging needs of information-rich industries such as software packaging, financial services, transport-related services such as third and fourth-party logistics and trading and transshipment, strategic and high-growth industries such as auto parts, micro-electronics, pharmaceuticals, medical devices, and telecommunications, and even hospitality industries, such as hotels, tourism, and recreation that will form the service backbone of airport-driven commercial development.

Attracting time-sensitive manufacturers, assemblers, and distribution industries to the Piedmont Triad Region will also require a thorough understanding of modern supply chain management principles and fast-cycle order-to-delivery logistics processes. To offer a truly marketable competitive advantage, the Piedmont Triad Airport Authority, with the assistance of the

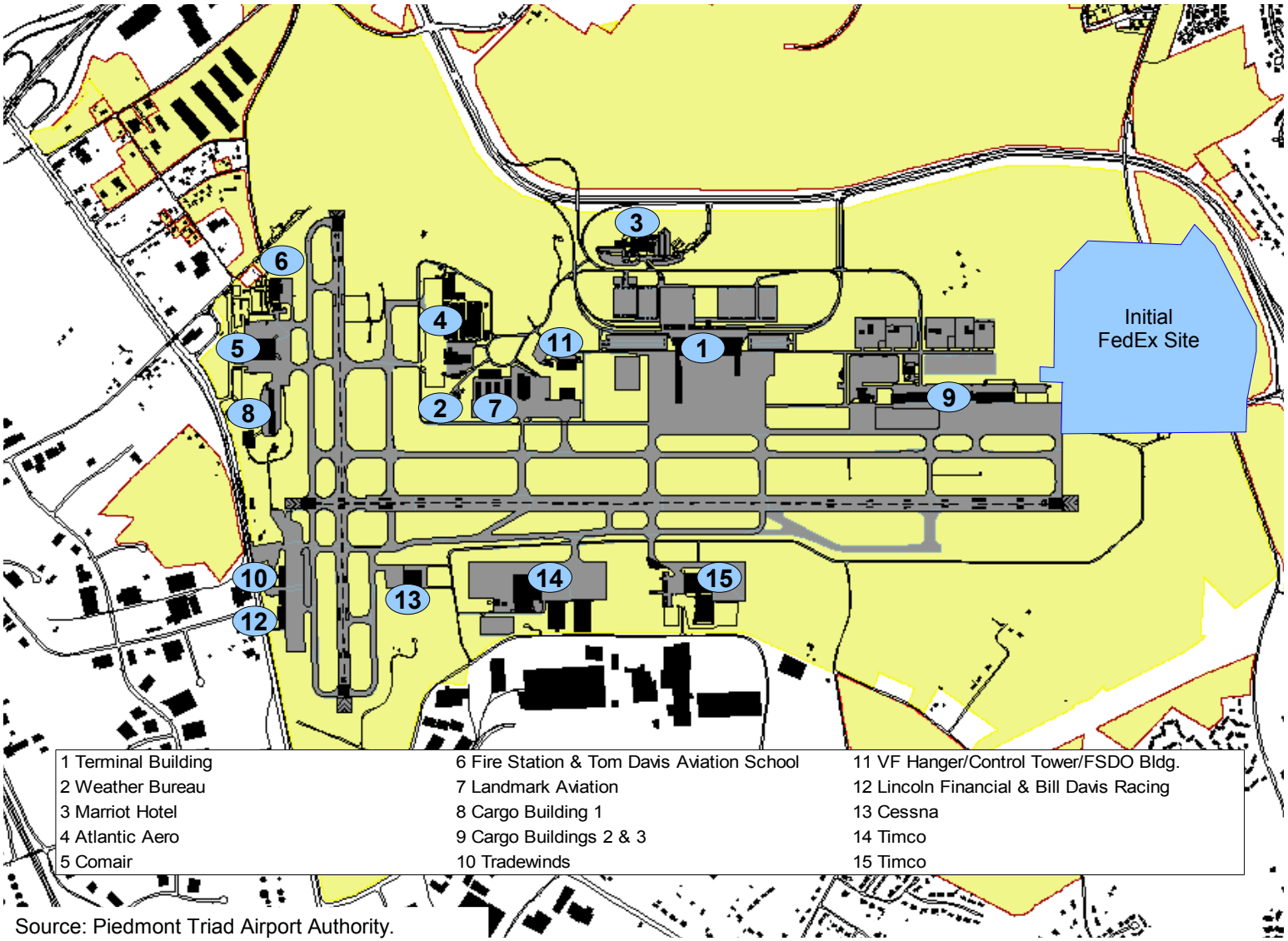
Piedmont Triad Partnership and PART, should bring together experts in logistics and supply chain management, multi-modal infrastructure development, and information technology to work to create the design specifications that properly integrate all critical system elements. Few locations in the U.S. are doing this, so PTI and the Piedmont Triad Region can have a first-mover advantage in attracting high value-adding time-sensitive industries if it takes the lead in a coordinated regional effort to seize this opportunity.

Exhibit 2.1
PTI ANNUAL ENPLANED PASSENGERS:
1982 TO 2006



Source: Piedmont Triad Airport Authority.

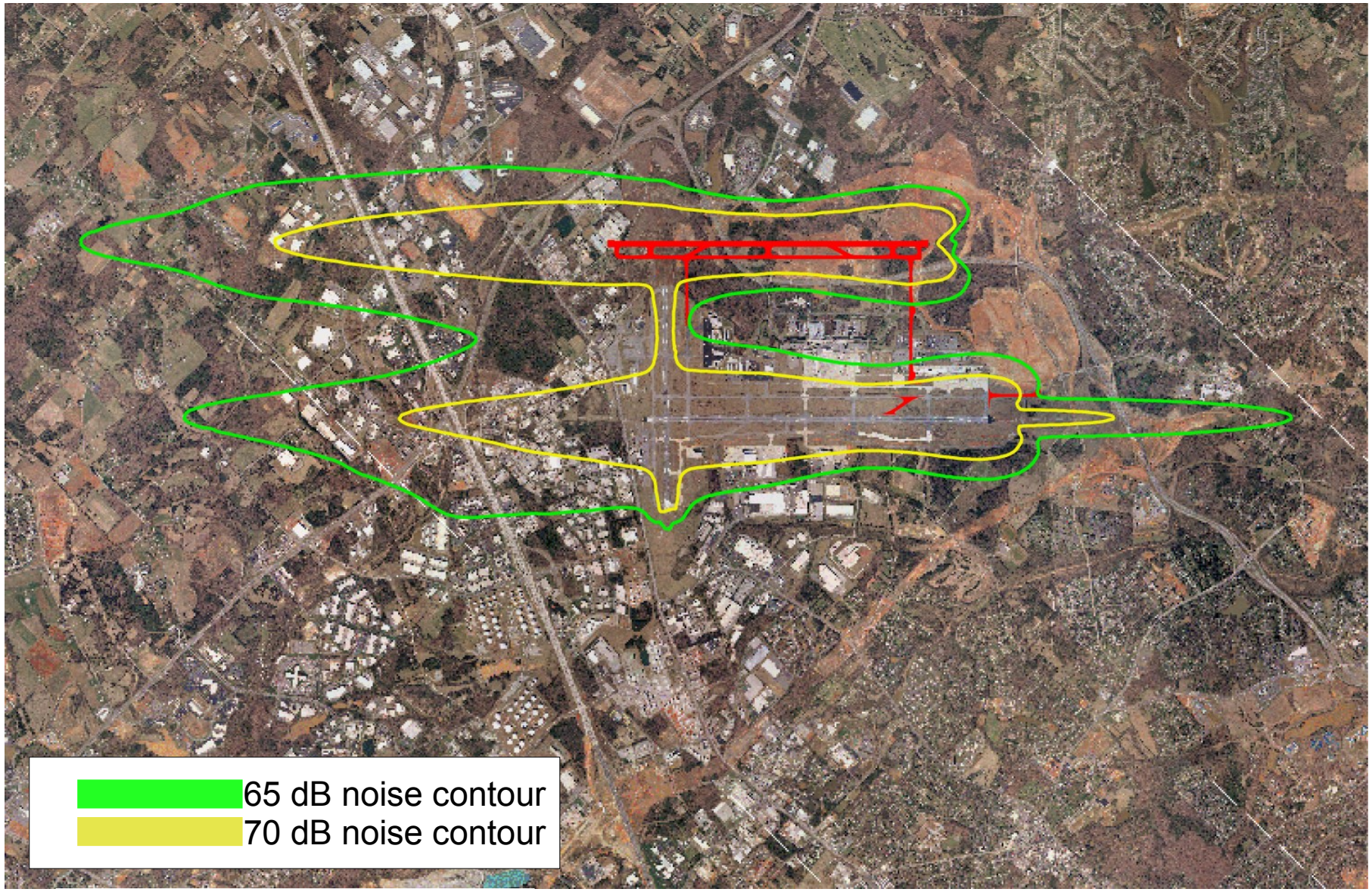
Exhibit 2.2
MAJOR FACILITIES ON PTI CAMPUS, 2007



1 Terminal Building	6 Fire Station & Tom Davis Aviation School	11 VF Hanger/Control Tower/FSDO Bldg.
2 Weather Bureau	7 Landmark Aviation	12 Lincoln Financial & Bill Davis Racing
3 Marriot Hotel	8 Cargo Building 1	13 Cessna
4 Atlantic Aero	9 Cargo Buildings 2 & 3	14 Timco
5 Comair	10 Tradewinds	15 Timco

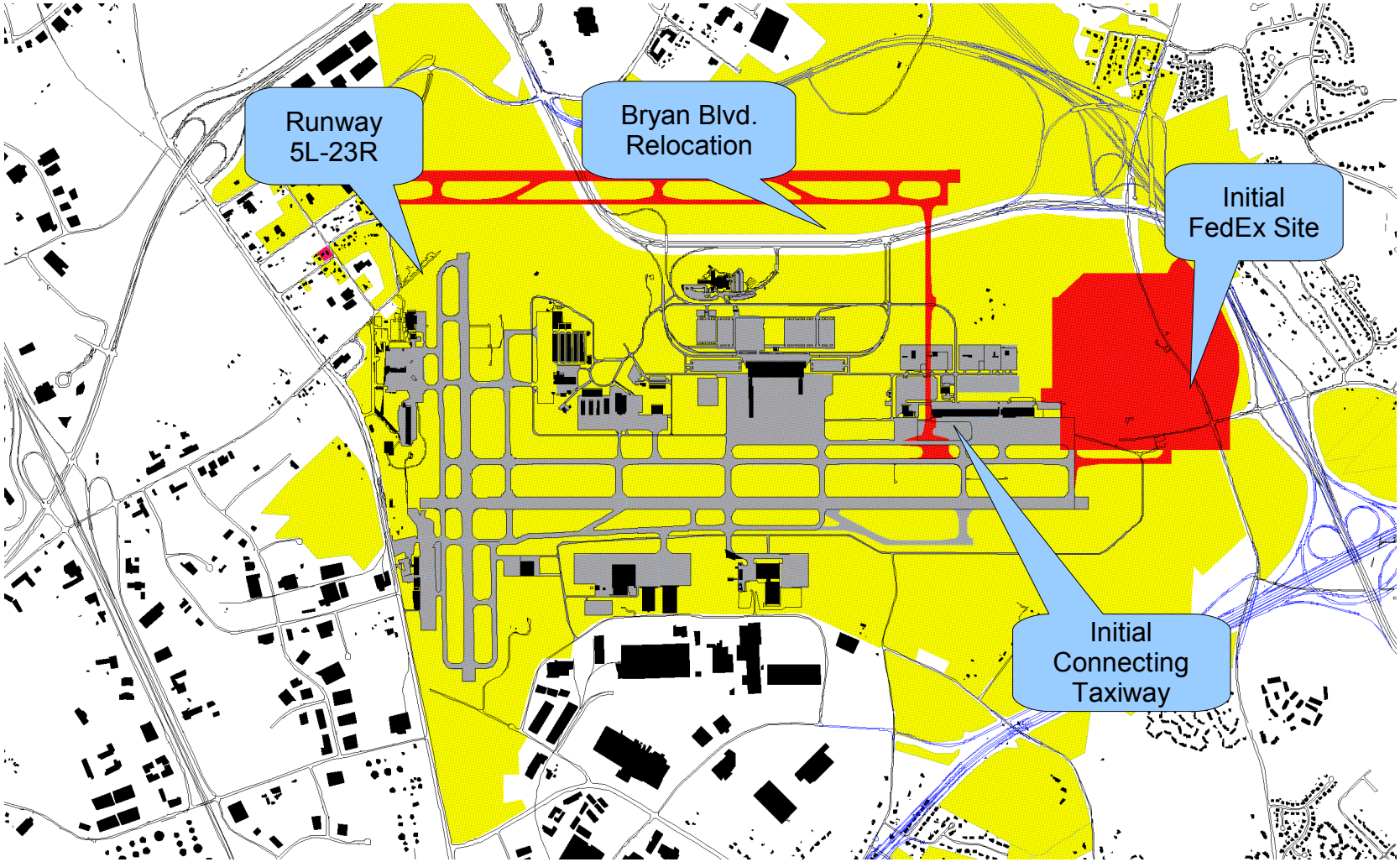
Source: Piedmont Triad Airport Authority.

Exhibit 2.3
PROPOSED NOISE CONTOURS WITH NEW RUNWAY



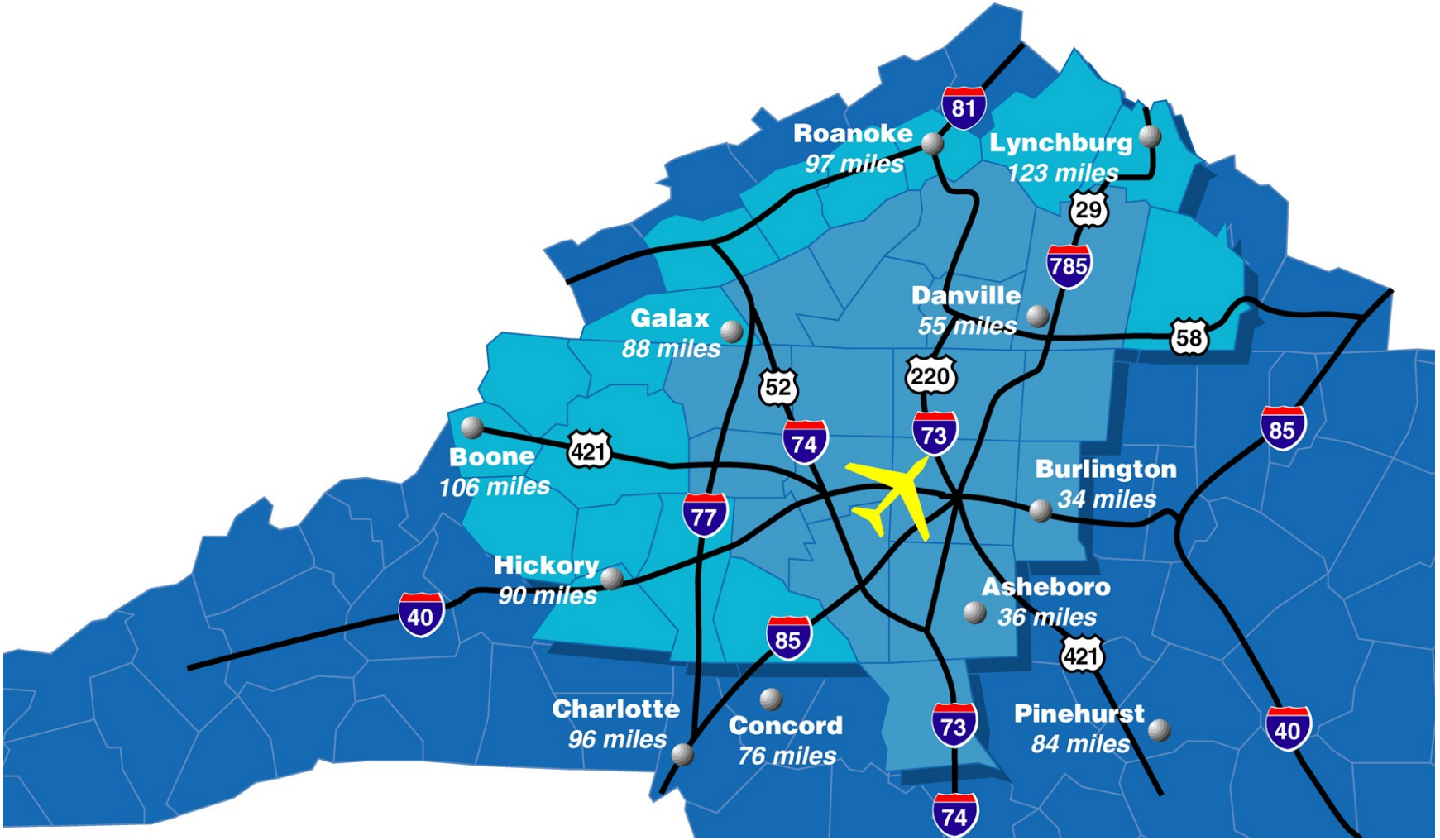
Source: Piedmont Triad Airport Authority.

Exhibit 2.4
INITIAL FEDEX-RELATED DEVELOPMENT PROGRAM



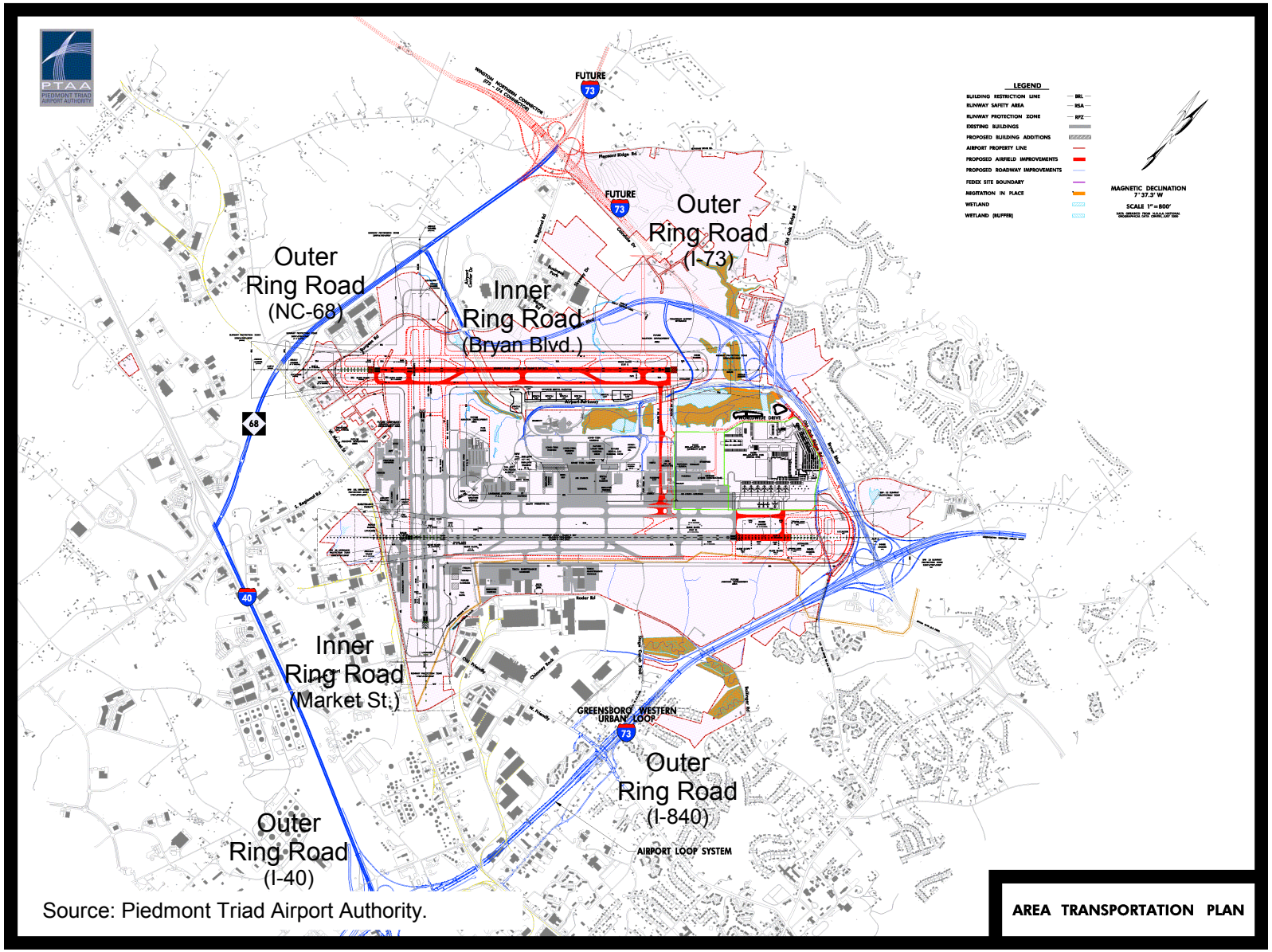
Source: Piedmont Triad Airport Authority.

Exhibit 2.5
PTI's EXCELLENT HIGHWAY CONNECTIVITY, CURRENT AND NEAR-TERM



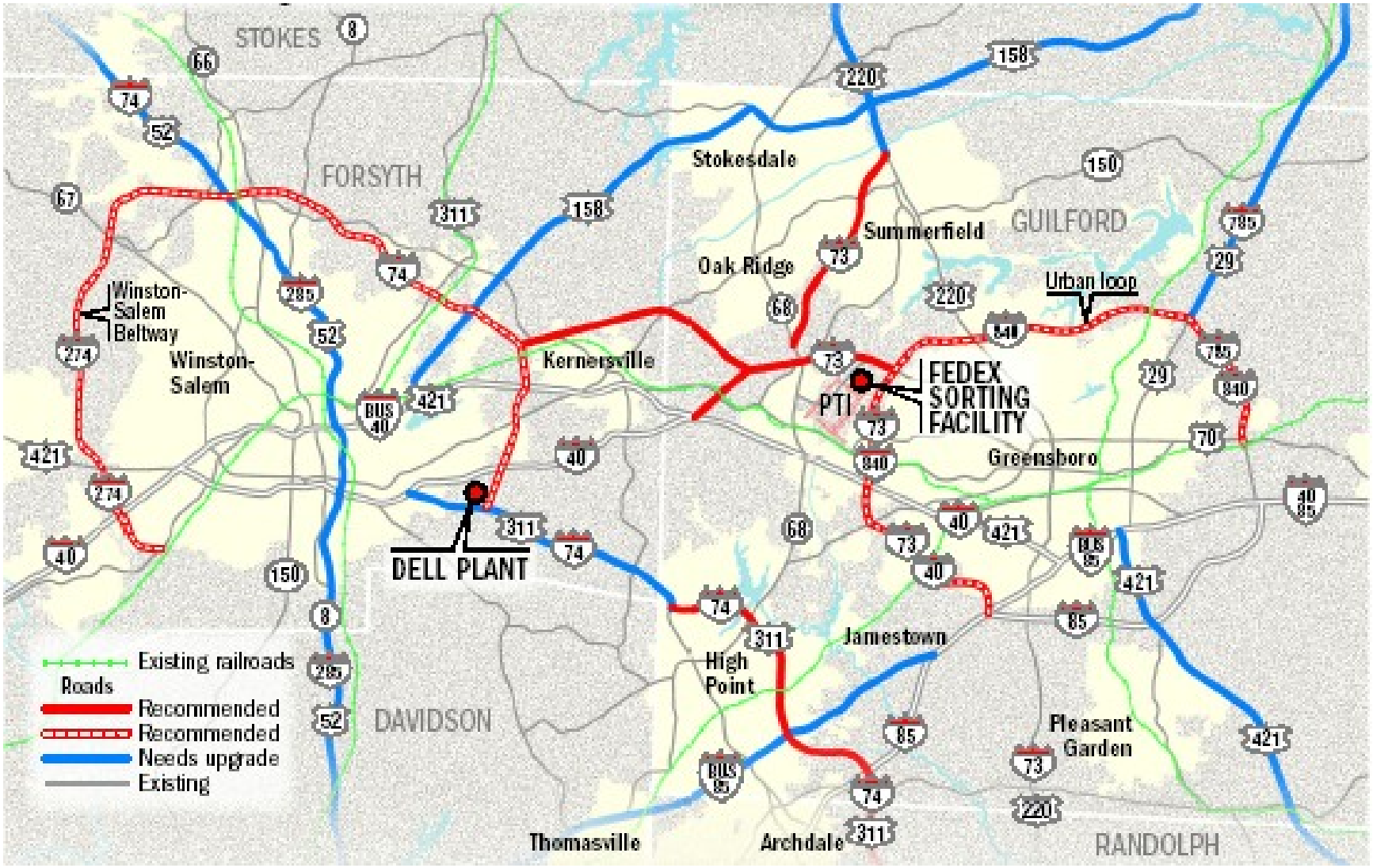
Source: Piedmont Triad Airport Authority.

Exhibit 2.6
PTI AREA FUTURE TRANSPORTATION PLAN
SHOWING PROPOSED OUTER AND INNER RING ROADS



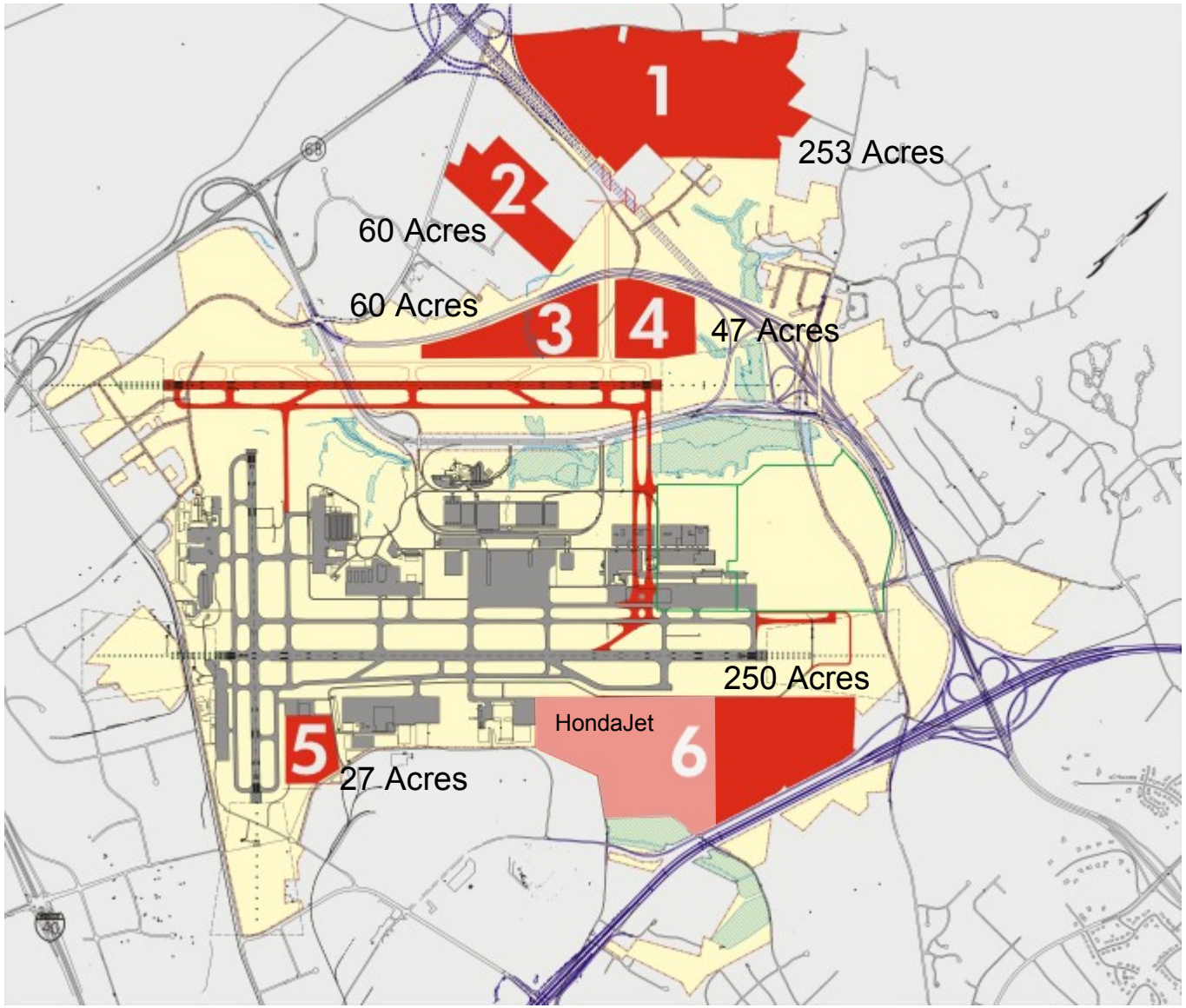
Source: Piedmont Triad Airport Authority.

Exhibit 2.7
SELECTED RAIL AND ROAD IMPROVEMENTS PROPOSED IN THE PIEDMONT TRIAD REGION



Source: Piedmont Triad Airport Authority, and
Piedmont Authority for Regional Transportation.

Exhibit 2.8
AVAILABLE LAND TRACTS FOR COMMERCIAL AND INDUSTRIAL DEVELOPMENT ON PTI CAMPUS



Tract #1: 253 acres
- Pleasant Ridge Rd. access; near Regional Rd., Caindale Dr., NC-68 and proposed I-73.
- Site terrain features rolling hills cut by small streams and lakes, large portion has already been cleared.
- Access to utilities

Tract #2: 60 acres
- North Regional Rd. and Skyway Dr. access; near NC-68 and proposed I-73.
- Totally undeveloped site consisting of large forested areas, meadows, streams and partially cleared tracts.
- Access to utilities.

Tract #3: 60 acres
- Bryan Blvd. Access; near NC-68 and the proposed I-73, adjacent to Tract #4.
- Site has been rough graded, has access to utilities and will be cleared, leveled and ready for development.
- Possible airfield access, adjacent to future western parallel taxiway that will serve Runway 5L/23R.

Tract #4: 47 acres
- Bryan Blvd. Access; near NC-68 and the proposed I-73, adjacent to Tract #3.
- Site has been rough graded, has access to utilities and will be cleared, leveled and ready for development
- Possible airfield access, adjacent to future western parallel taxiway that will serve Runway 5L/23R.

Tract #5: 27 acres
- Radar Rd. access connecting to both Friendly Ave. and Chimney Rock; near I-40 and future I-840 Western Urban Loop.
- Site is mostly cleared and ready for development, adjacent to Taxiway C.
- Access to utilities.

Tract #6: 250 acres
(Large portion taken by HondaJet)
- Stage Coach Trail, Ballinger Rd. and Chimney Rock access; near Bryan Blvd., I-40 and the future I-840 Western Urban Loop.
- Tract consists of rolling hills, forested areas, two steams, partially cleared and graded land. Airfield access via Taxiway M along with additional taxiway frontage.
- Access to utilities.

Source: Piedmont Triad Airport Authority.

Exhibit 2.9
ADDITIONAL LAND TRACTS TO BE CONSIDERED FOR
FUTURE ACQUISITION

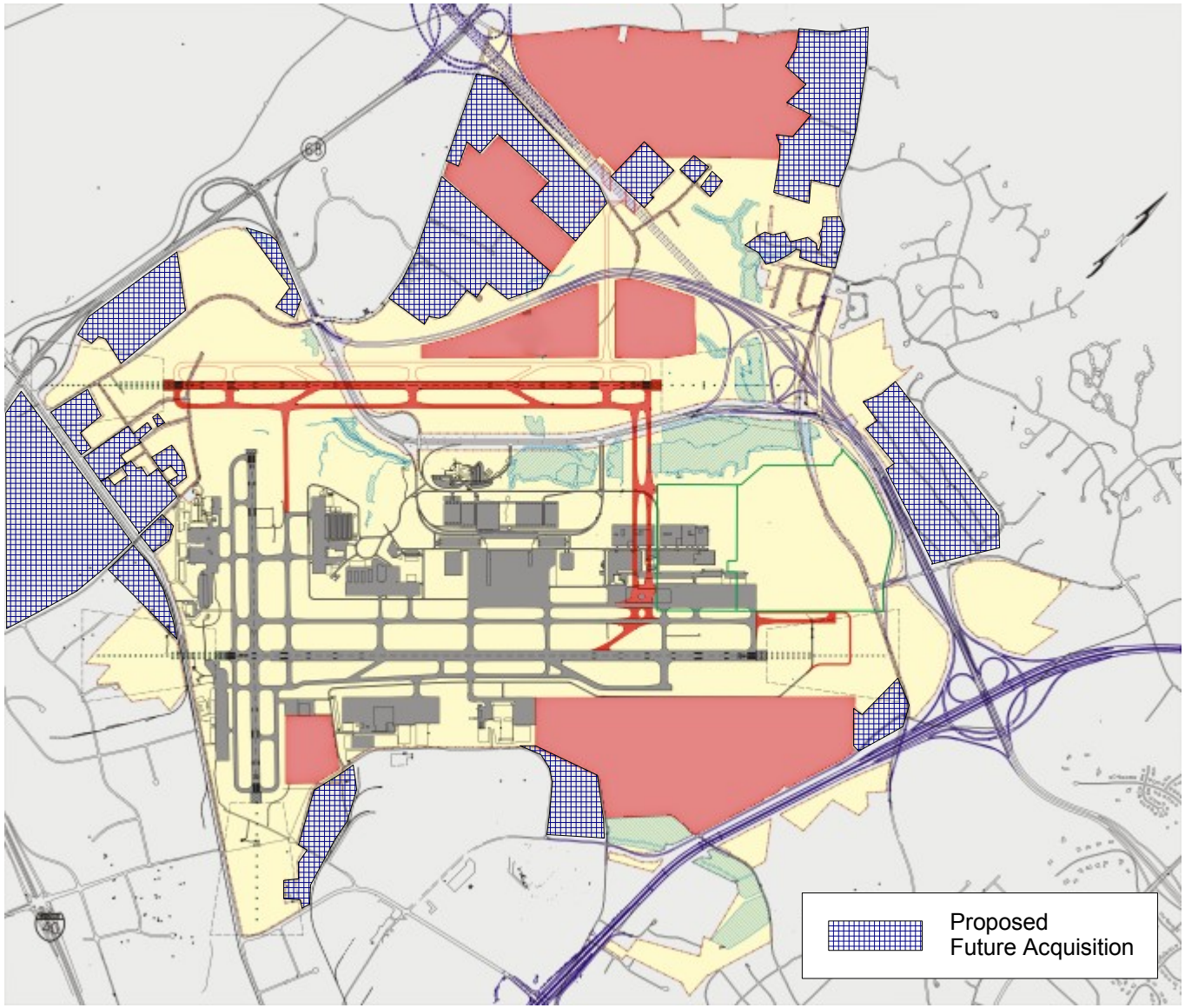


Exhibit 2.10
PTI AT ULTIMATE PHASE DEVELOPMENT

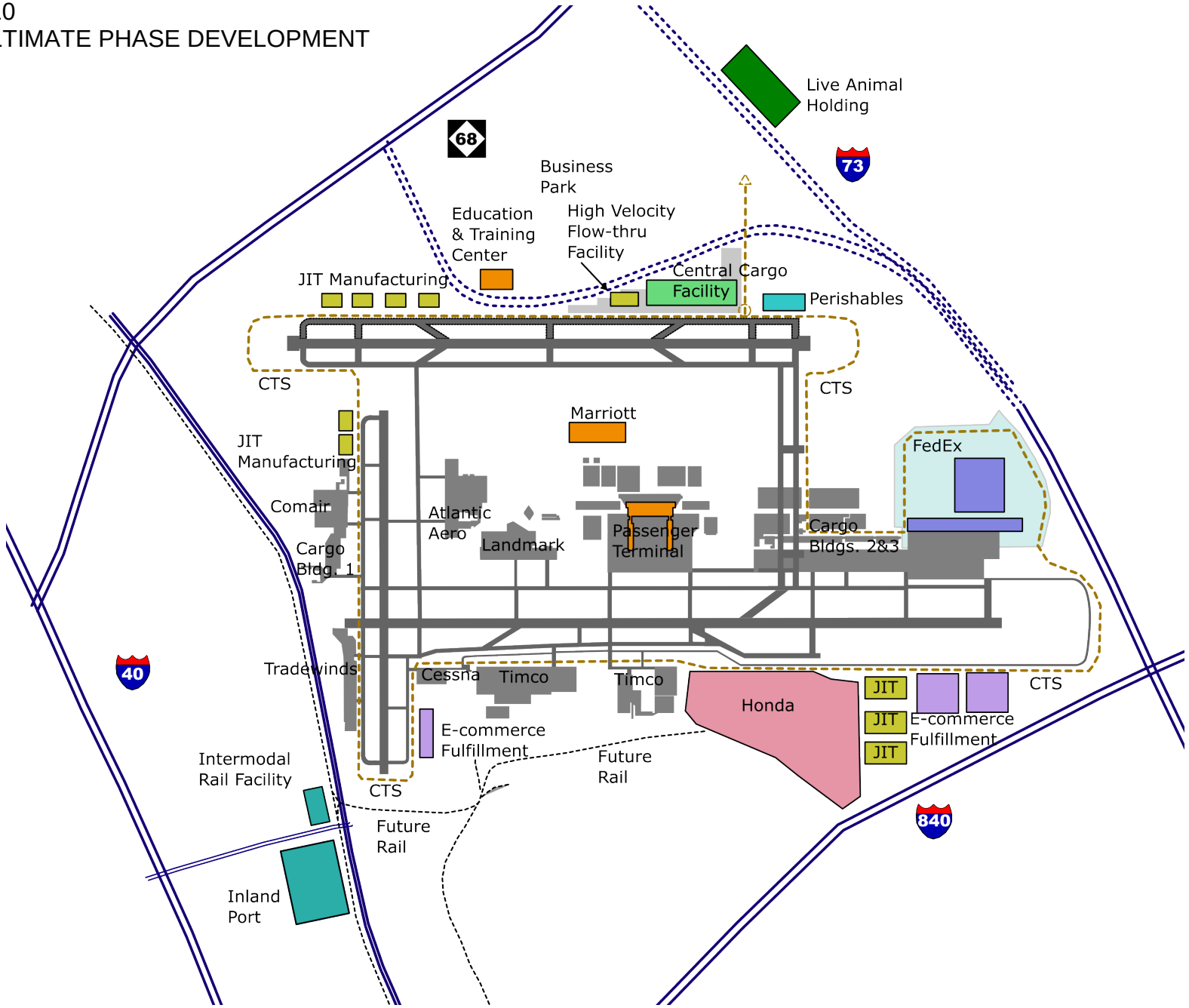


Exhibit 2.11
PROPOSED PTI CENTRAL CARGO FACILITY

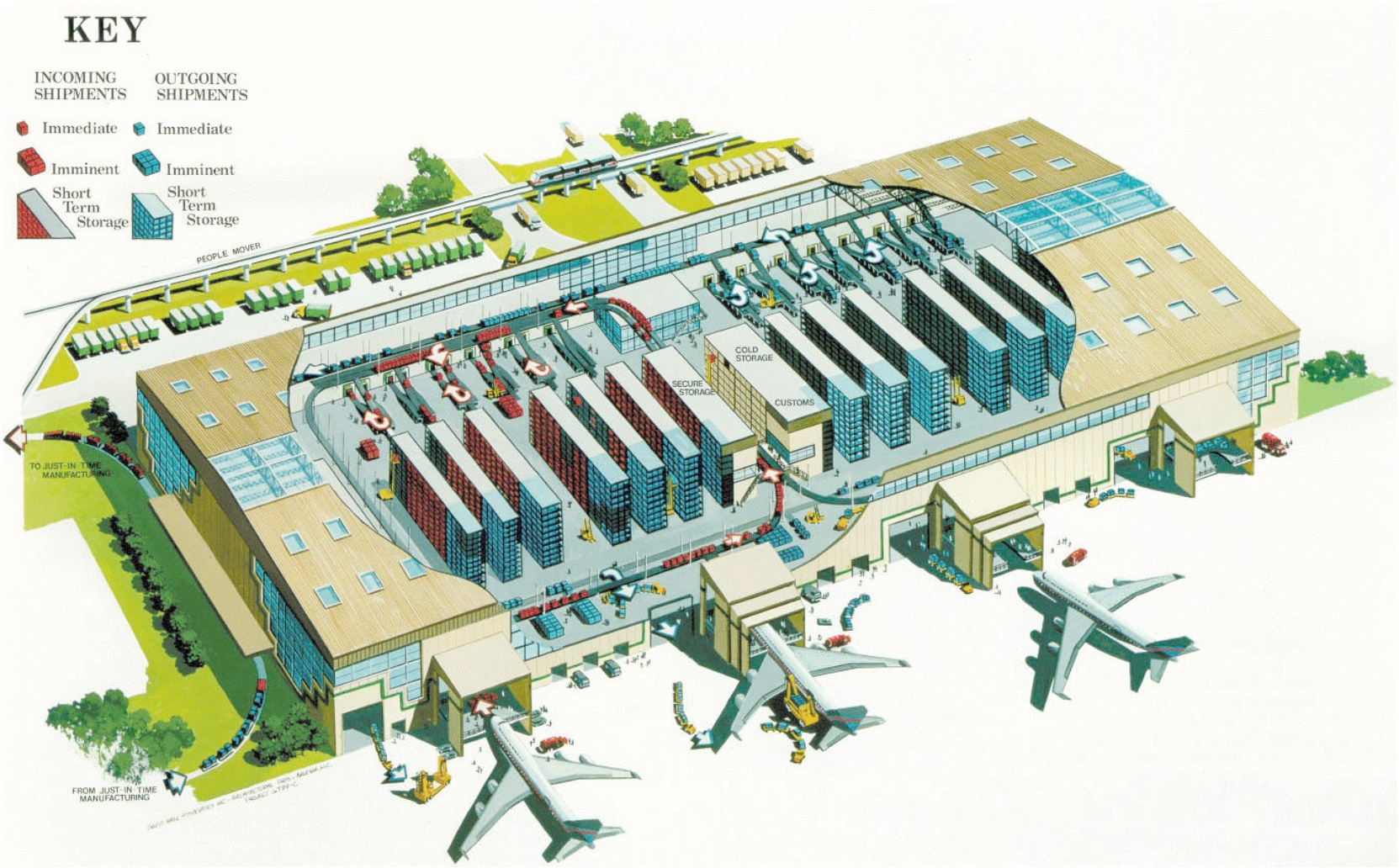


Exhibit 2.12
PROPOSED PTI INTERMODAL INTERFACES AT FULL BUILD-OUT

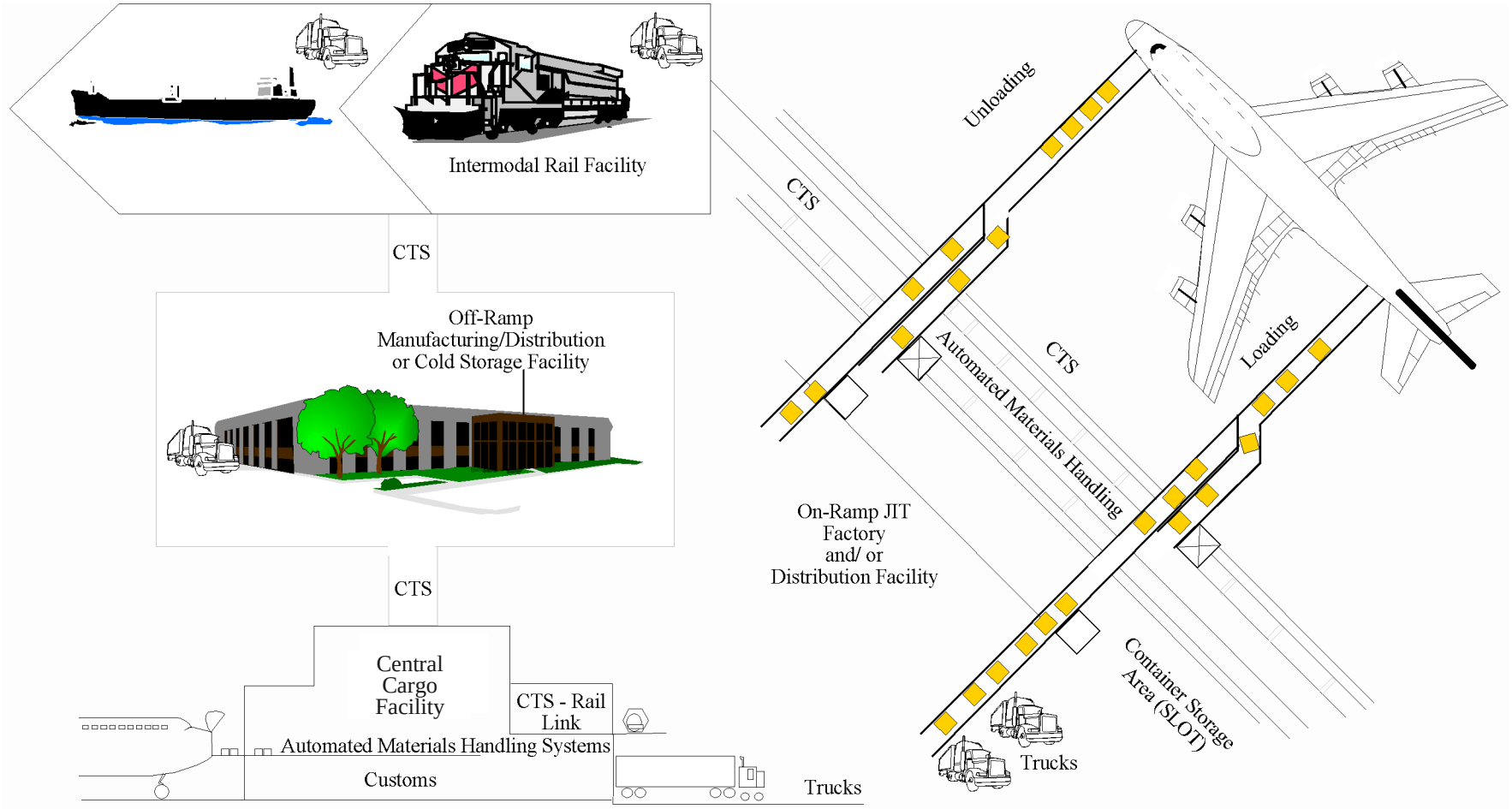


Exhibit 2.13
TRANSPORTATION LINKAGES BETWEEN
THE PTI AIR LOGISTICS HUB AND DOMESTIC AND
INTERNATIONAL CARGO NETWORK.

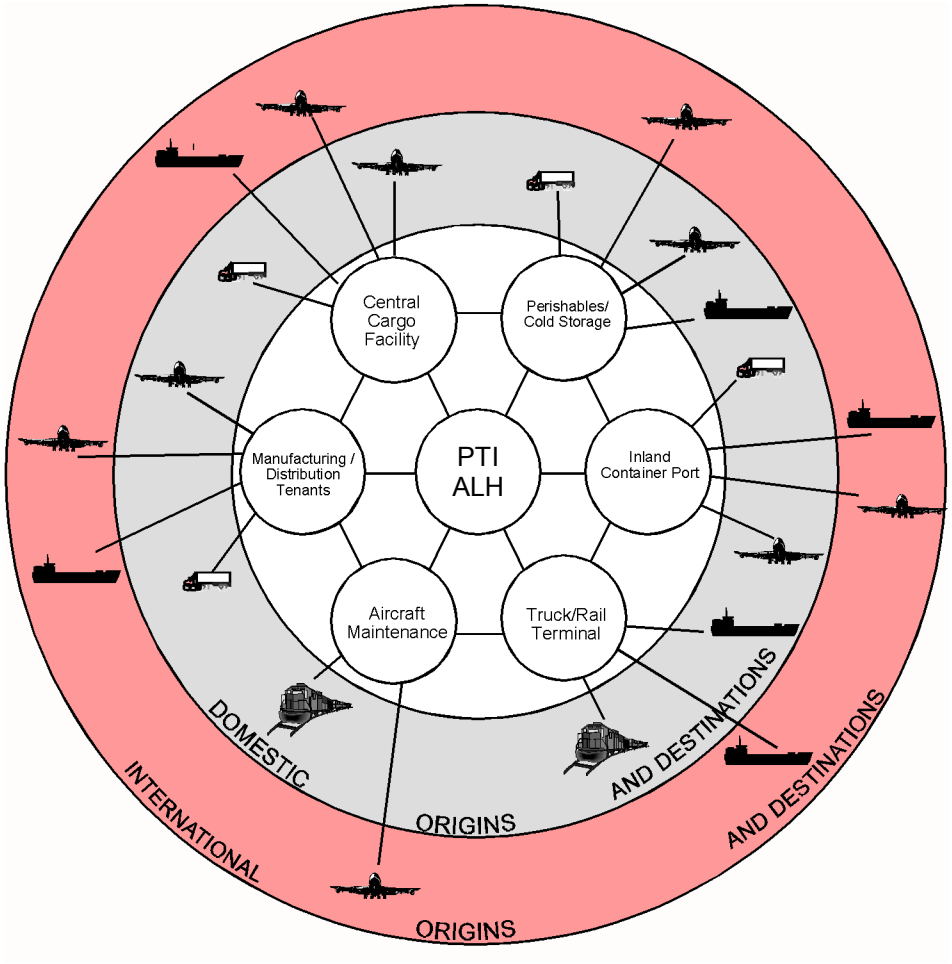
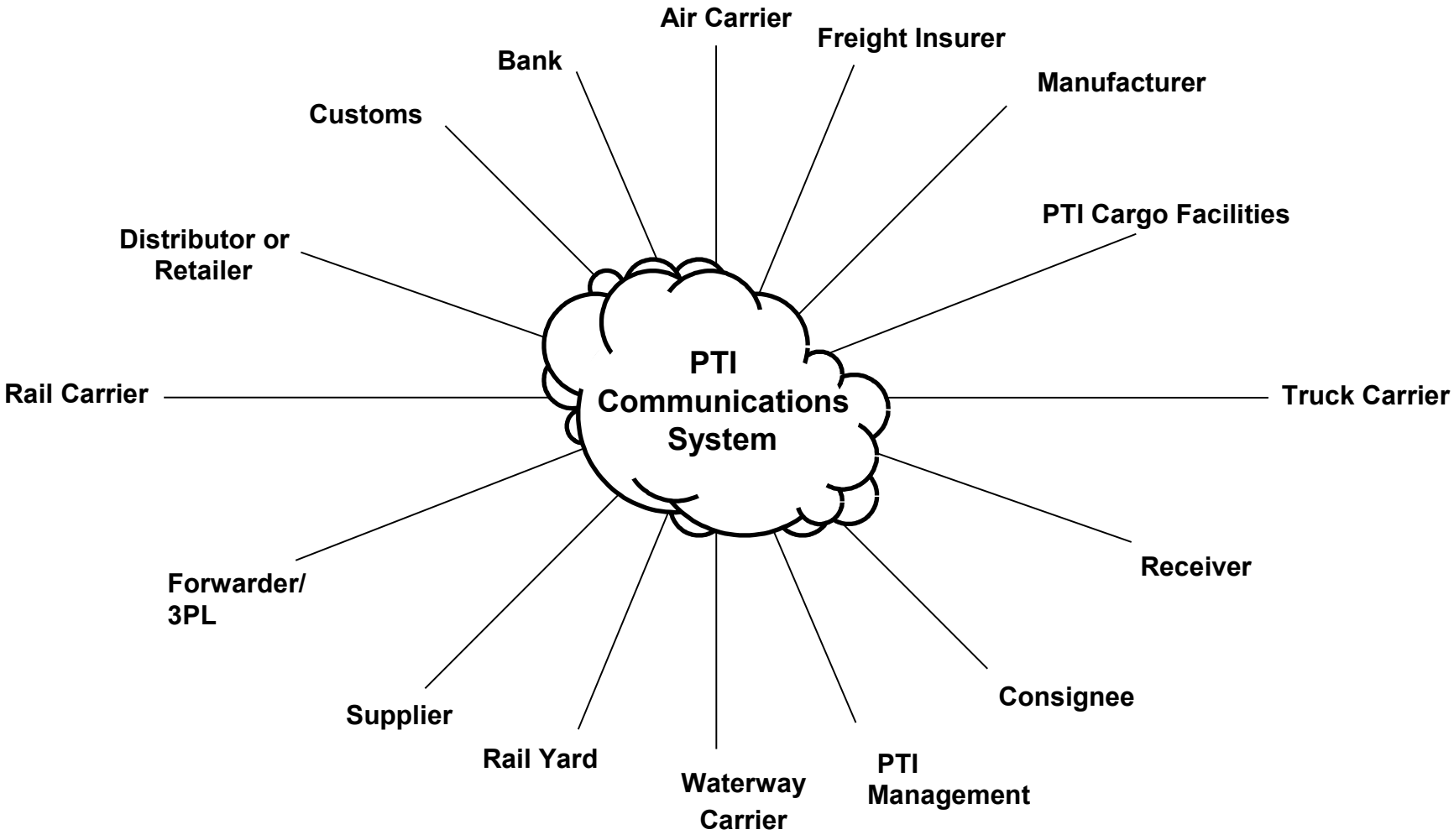


Exhibit 2.14
OVERVIEW OF THE PTI AIR LOGISTICS HUB COMMUNICATIONS SYSTEM.



Chapter 3

PTI Air Logistics Hub Business Plan Guidelines

I. Introduction

In Chapter 1, I described how connectivity, speed, and agility have become the 21st century mantra for commercial success. The ability of Piedmont Triad companies to respond rapidly and flexibly to market opportunities will depend not only on internal management and operational changes but also on the creation of the external business environment that makes time-critical commercial practices effective. Exhibit 3.1 identifies the key resource needs for a successful time-critical business environment at PTI and broader Piedmont Triad Region.

II. Business Resource Needs

First, logistics success depends on multi-modal transportation systems for fast and flexible supply chain management. Seamlessly connected multi-modal transportation systems have become a key to efficient business logistics. Raw materials, perishables, manufacturing inputs, and finished products must flow among geographically dispersed firms in a continuous and synchronized fashion. Air cargo facilities that are integrated closely with good highways and railways are needed to support the development of logistics providers, industrial parks, distribution centers, and to more efficiently link them to their sourcing, production and customer networks. For example, the ability of agribusiness firms, restaurants, and supermarkets to get fresh fish, produce, and meat products to and from distant markets quickly and reliably requires cross-docking facilities that link regional surface transport with aircraft serving national and international markets. Similarly, microelectronics manufacturers require truck cross-docking facilities that bring parts, components, and semifinished goods efficiently to production sites, and facilitate the rapid shipment of assembled products to customers, nationally and globally.

Second, the PTI air logistics hub and regional logistics system require an integrated telecommunications network (as described in the previous chapter) to obtain information on markets and orders, trace, track and manage materials and

inventory, and control movements of goods to customers. Such a network is also essential to assisting, support, and attracting sophisticated third-party logistics (3PL) companies and 4PLs (advanced logistics integrators) to the Piedmont Triad Region that can provide state-of-the-art logistics services to PTI air logistics hub users and tenants. The PTI ALH telecommunications system should feature information technologies served by fiber optics loops, RFID, Wi-Fi, and GPS satellite linkages that connect companies in the airport area and throughout the Region to their suppliers and customers and to their own branches, offices, and partners around the country and the world. A teleport with advanced information and telecommunications management systems can serve customer premises equipment, including rapid worldwide communication, electronic data interchange (EDI) systems, B2B exchanges, and video conferencing equipment through broadcasting and communications satellite networks. Operations research is showing that telecommunications infrastructure external to a firm now heavily influences the effectiveness and efficiency of internal firm processes.

As international air express and international air cargo evolve at and near FedEx's Mid-Atlantic hub, this telecommunications system must also support express customs clearance and efficient trade data processing. As discussed in Chapter 2, automated, paperless customs clearance is a key attribute of the air logistics hub concept. PTI should be used as a laboratory for new expedited customs clearance procedures and electronic data interchange to achieve high-speed, barrier-free international flows of parts and components, and manufactured goods. In the future, to speed customs clearance, the ALH should build upon a PTI automated customs environment and accelerate inspections and, through joint determination with U.S. Customs and Border Protection (US CBP) of appropriate technology, procedures, and staffing levels, it should take the lead in creating the nation's most efficient and effective express customs clearance, 24 hours a day, 7 days a week. The sales proposition of the PTI ALH will be speed and agility in moving high value-to-weight components and products to and from the Region, providing the Piedmont Triad with a competitive edge in fast-cycle logistics.

Third, the new business environment requires modern commercial services support. Globally-linked manufacturers, assemblers, and distributors must have access to foreign trade zones operators (which already exist at PTI) and in-transit bonded warehouses at and near the airport, financial institutions, marketing, sales and employment agencies, legal services, and trade and exhibition centers. As noted above, expedited customs procedures are required to streamline and accelerate the import of raw materials, parts and components and the export of finished goods. One-stop government service centers (combining federal, state, and local agency requirements) are also necessary to expeditiously provide foreign investors with all required licenses, permits, and

investment promotion privileges. Additional trade and exposition facilities, such as the High Point Furniture Market, are needed to display and globally market products of the Region's and nation's firms. In addition, investors' ability to attract professional managers and highly-skilled younger workers requires a full array of community amenities including modern housing, quality public schools, good shopping and restaurants, nightlife, recreational, and cultural facilities. Much of this is currently available in the Piedmont Triad Region, but efforts to further improve nightlife, entertainment, restaurants, and cultural attractions will help attract and hold the new "creative class" of knowledge workers.

Fourth, many high-tech and other new economy industries need access to knowledge resources that can generate or stimulate innovation and provide a reliable source of trained workers and managers. Among the most important knowledge-based organizations on which innovative businesses depend are top-notch colleges and universities providing well-educated professionals and research capacities, and consultancy organizations that help commercialize technology, develop new products, and service local, national, and foreign firms more effectively. Such knowledge resources, which are well represented in the Piedmont Triad Region, have proven to be a strong asset in meeting these objectives as well as fermenting technology clusters geared toward the development of growing export industries, such as medical devices. Likewise, a PTI distance education and training facility drawing on the ALH's telecommunications network could provide real-time audio, video and tactile worker training on-site (or distributed education and training to facilities throughout the greater Piedmont Triad Region) from training centers in distant headquarter firm locations around the world. This distance education and training facility should tie into the entire community college network in the Region.

III. Functional Requirements to Leverage and Build upon the FedEx Hub

The FedEx Mid-Atlantic hub represents a unique opportunity for the Piedmont Triad to attract new investment to the Region while boosting the competitiveness of existing firms in the area. Full leveraging of the hub requires incorporating six broad functional capabilities targeted to these outcomes. For each functional (business) requirement, examples of key infrastructure elements are noted. Refer back to Chapter 2 for more detailed discussion and design/location of these elements.

1. *Multi-modal Transportation System with Access to Local, National and Global Transportation Networks*

   On-site terminals and inland ports with efficient intermodal capability must link to Piedmont Triad's interstate highways and rail systems with global sea and air transportation networks. The PTI ALH must provide a seamless interface between transportation modes and between local firms and air cargo and (via truck and rail) to ocean shipping routes so that goods and materials can flow uninterrupted through to and from the Region quickly, at low cost, and with a minimum of human handling. Efficiently bringing together all the various modes of transportation is important to establishing a competitive logistics infrastructure in the Piedmont Triad and to attracting substantial commercial investment.

   Examples of logistics infrastructure needs include:

   - New and improved highways (in progress) and eventually an intermodal rail facility with truck cross-dock facilities connecting quickly to interstate highways
   - Intermodal integrators for seamless connections between alternative modes
   - Harmonized electronic tracking capability from mode to mode for total asset visibility and real-time product control.

2. *On-site Cargo Processing Capability to Supplement the FedEx Hub*

   The FedEx Mid-Atlantic hub will provide superior air express connectivity, especially up and down the East Coast, putting PTI and the Piedmont Triad Region on the air cargo map, nationally and globally. As has already been done in Memphis, it is recommended that PTI begin planning for supplementary air cargo facilities on its property to leverage its other logistics assets, especially the FedEx regional hub. In this and the following sections, I further specify the guidelines for planning future air cargo infrastructure and facilities at PTI that will contribute to the unique business environment attracting firms. Whereas this infrastructure and associated support facilities may not be needed for at least a decade, it is recommended that land be reserved for such infrastructure and facilities and preliminary planning commenced.

   The pivotal component of the supplemental cargo infrastructure will be a new consolidated central cargo facility (as described in Chapter 2) that will serve a variety of other airlines and that can accommodate the needs of a variety of aircraft and materials handling activities. Flexibility

in both the processing capability and location of material handling activities is essential because of nonstandard aircraft and ground cargo-related equipment, and because of a dynamically changing cargo processing environment. Targeted mechanization at the PTI ALH for cargo operating processes, as discussed in Chapter 2, can be provided when it is productivity-driven and demand-justified.

Examples of future facility needs include:

- Central Cargo Facility (CCF) with advanced material-handling systems (MHS)
- High-velocity flow-through facilities with airside cargo access and truck cross-docking
- Automated express customs clearance procedures and facilities
- In-bound breakdown and delivery staging areas
- Cargo inspection, security, and holding areas
- Facilities for value-added service provision, such as temperature-controlled storage.

3. *On-site Cargo Transport System*

A third need is a cargo transport system that connects PTI with all transportation modes and terminals (air, road, rail and sea), with each mode to the other, and with the regional manufacturing and distribution facilities, as well as logistics support facilities. These systems can be fully automated, semi-automated or manual depending on eventual traffic flow profiles (cargo demand) and the specifics of the site.

Examples of such infrastructure elements include:

- Both low-tech and advanced materials handling capability
- Internal road and cargo tram network
- Automated storage/retrieval systems
- RFID tagging and tracking technologies and sortation systems.

4. *Shared Communications System with Transparent User Interface*

Computer-to-computer information transfer between companies (Electronic Data Interchange and B2B e-commerce) are largely replacing paper and fax transmissions and even most traditional face to face supply

chain transactions. This electronic interchange of information and data requires message standards, translation software and transmission capability. Recent technology developments have created new opportunities to enhance inter-company and inter-industry communications with more powerful work stations, improved data transportation mediums, Wi-Fi, global communications networks and faster routers for electronic data transmissions. These capabilities (some of which are already in place) and new technologies will greatly facilitate seamless relationships among PTI air logistic hub users/tenants and their suppliers and customers, regionally, nationally and worldwide. The net effect will be to accelerate materials handling and product transfers among commercial facilities, aircraft, trucks, rail cars, as well as to other U.S. and (eventually) global airports. A key planning challenge, as described in Chapter 2, is to design a communications system that is flexible enough to support the majority of PTI and Piedmont Triad area users, that offers rapid connection to regional, national and global networks, that maximizes functionality, and that allows for continuous improvement and innovation.

Examples of key electronic commerce elements include:

- Electronic data interchange (EDI) interoperability across transportation modes
- Wi-Fi, Fiber optic and satellite networks
- Wide-area broadband
- Web-based open architectures and message standards.

5. *Access to On-site and Remote Services for Commercial Support, Vocational Education and Worker Training*

In the new speed-driven economy, businesses are demanding access to a variety of support services that reduce the time and cost of logistical transactions. Desirable commercial support services noted earlier include a variety of legal, financial, and government services such as the securing of permits, customs clearances, and export licenses. Some of these services can be provided electronically. Co-location of these services at PTI or at a strategic point in the Piedmont Triad Region can provide a "one-stop-shop" support for regional companies (both foreign and domestic) as well as PTI campus tenants.

Similarly, electronic access to education and training facilities throughout the country and the world can provide substantial value to

PTI air logistics hub tenants and users. The proposed distance education facility at PTI would provide agile support for custom training local labor by offering tenant and area companies real-time audio, video, and tactile access to knowledge and training resources from around the world. For example, if Rolls-Royce wanted to locate a jet engine production facility at PTI or elsewhere in the Piedmont Triad Region, worker training could be conducted on site, via simultaneous audio, video, and tactile instruction from its European production headquarters.

Examples of such key infrastructure elements:

- Interactive two-way video capability
- Wide area broadband information exchange
- On-line interactive and/or automated support of negotiations and contracting
- Education and training center with distance-learning capabilities.

6. *Arterial Movements Unencumbered by Congestion*

I have repeatedly stressed that the battle for air cargo is won on the ground. Success of the PTI and its broader Region requires speed and agility of movement on local highway systems. As the area develops, the potential for congestion no doubt rises. Through the efforts of PART, planning is occurring to minimize choke points and insure that people and product movements remain fast and flexible throughout the greater Triad Region.

Examples of key infrastructure elements include:

- New interstate highway and upgrades to existing ones
- Additional lanes in high-volume traffic areas such as NC 68
- Intelligent highway system technologies
- Truck-only lanes on certain expressways
- Cluster as opposed to strip commercial development.

A number of specific proposals of this type are being developed for PART by consultants for the Heart of the Triad (HOT) development zone approximately five miles west of the airport that could serve as critical airport-linked commercial clusters. These will be elaborated in the next section.

IV. Population and Employment Forecasts around PTI

Based on data and information provided by NCDOT and other state agencies, the Piedmont Authority for Regional Transportation (PART) developed population and employment forecasts to the years 2015, 2025, and 2035 for small area traffic analysis zones (TAZ) in the Piedmont Triad Region. These TAZ population and employment forecasts were aggregated into two-, four-, and six-mile zones around PTI (see Exhibit 3.2). The forecasted figures for these zones are presented in Exhibit 3.3. Population is expected to to grow between 2002 and 2035 from 15,298 to 20,153 within a two-mile radius of PTI, from 58,412 to 97,291 within a four-mile radius, and from 133,627 to 207,064 within a six-mile radius. During the same 2002 to 2035 period, employment is forecast to expand from 33,662 to 71,892 within a two-mile radius of PTI, from 61,167 to 133,290 within a four-mile radius, and from 96,912 to 190,181 within a six-mile radius.

Demonstrating the importance of PTI as an employment growth node, observe that job expansion is expected to be considerably higher than population expansion in the zones closer to the airport. Moreover, the greatest job to population differential is in zones closest to the airport. Thus, within a two-mile radius from PTI, population is forecast to grow by 4,855 between 2002 and 2035 while employment is forecast to grow by 38,230. In the four-mile radius of PTI, the employment to population growth difference is 72,123 versus 38, 879. As one moves out to the six-mile radius, population and employment growth are nearly equal. Indeed, if one looks only at differences in growth amounts by distance from PTI, employment growth exceeds population growth by 33,375 (38,230 versus 4,855) in the two-mile radius, but population growth exceeds employment growth by 13,412 in the four- to six-mile radius [(73,437–38,879)–(93,269–72,123)]. In other words (and not surprisingly), employment is forecast to grow nearly eight times faster than population withing two miles of PTI, while population is forecast to grow 63 percent more than employment in the four- to six-mile radius.

Forecasted employment growth by distance radii around PTI are presented by industrial sector in Exhibit 3.4. These data show that the greatest employment growth is forecast in the service sector. This again is not surprising given that service sector growth dominates the overall economy and (as described in Chapter 1) airports have become major magnets for certain service. Yet, observe that strong growth is also expected in areas within two and four miles of the airport in industry, retail, and office employment.

The Heart of the Triad (HOT) planning study conducted for PART by HDR builds upon this broader growth phenomenon in a core area of the Region not far from PTI to foster economic development. Two key HOT employment

clusters are (1) technology (including large-scale bio-tech manufacturing, nano-manufacturing, medical diagnostic testing, and pharmaceuticals) and (2) logistics and transportation (including wholesale trade, transportation and warehousing, and logistics management and consulting).

Two other HOT employment clusters are recommended by HDR. These are a retirement lifestyle community for higher-income residents (including a resort town center consisting of conference facilities, hotels and time-share condos, and retail/food/entertainment) and an international "intellectual asset" center focused on specialized state and Federal facilities, advanced health care, and a combined university center.

Economic development research shows that industrial cluster development needs a strong driver. In this case, PTI can be that driver for the high-tech manufacturing and logistics clusters, but less so for the retirement lifestyle cluster and the collaborative international "intellectual asset" center. These will have to have their own drivers, which are currently less apparent, but can offer important community amenities and services attractive to Piedmont Triad area knowledge workers.

In my professional judgment, logistics clusters (already emerging in the Piedmont Triad) are the best bet for the Triad. Not only because they play to the location, highway transportation, and coming air express strengths of the Triad, but also (as described previously) excellent logistics services attract many other goods-processing industries, especially those in high-tech sectors. I will discuss the key industrial sectors to which Piedmont Triad economic development organizations should market in a later section of this chapter in light of the evolution of an air logistics hub at PTI. Before doing so, let me set the context by describing the set of critical success factors for a PTI air logistics hub to have the greatest economic impact on the Piedmont Triad Region.

V. Critical Success Factors for the PTI Air Logistics Hub

Effective leveraging of the FedEx Mid-Atlantic hub requires not only vision but also coordinated regional actions. Guiding the development of a business plan for the PTI ALH and Piedmont Triad Region should be a set of overarching themes that, if followed, will greatly facilitate their commercial success. Realizing these critical success factors will provide PTI and the Region with a major competitive edge in attracting business and industry over most other sites in the U.S.

Critical Factor #1
The PTI ALH/Aerotropolis Must Be Designed Around Emerging 21st Century Business Practices

Beginning with our frequently repeated fundamental point, planning of the PTI ALH/Aerotropolis must reflect the business practices and processes of 21st century global companies. I noted that dramatic changes are occurring in how companies transact their business, and especially in how today's most successful mega-retailers, manufacturers and logistics providers move goods and materials around the country and the world. Infrastructures can no longer be designed and built as isolated civil engineering investments or that reflect more traditional business practices. New business practices require new infrastructures. These must be geared to modern supply-chain management that fuse multi-modal transportation, advanced telecommunications, sophisticated materials handling systems, and state-of-the-art business support services to offer unmatched speed and agility to PTI tenants and users from throughout the Piedmont Triad Region.

Critical Factor #2
Development Plans for the PTI ALH/Aerotropolis Must Give High Priority to Quality of Life Considerations

Unlike most other air logistics complexes around the world, the PTI ALH/Aerotropolis should be developed as a multi-functional zone and area that will support not only manufacturing and distribution activities, but also professional, scientific and white-collar service functions, of growing importance to the Piedmont Triad's entire 12-county Region. This raises the importance of quality of life considerations with respect to their broader built environment such as that which is being proposed for HOT. Coordinated cross-jurisdictional planning is necessary to ensure development around PTI and along its transportation corridors is economically efficient, aesthetically pleasing, and socially and environmentally sustainable. Without such coordinated planning (and actions), development around the hub and throughout much of the larger Piedmont Triad Region will likely be spontaneous, haphazard, unsightly, economically inefficient, and ultimately unsustainable.

Critical Factor #3
Master Plans for the ALH/Aerotropolis Must Be Flexible and Reconfigurable.

I stressed in Chapter 2 that planning for a PTI ALH should not be viewed solely as detailed site and civil engineering plans to guide construction and

development. Rather, the master plans for both the ALH and surrounding Aerotropolis should be developed as a flexible framework that can accommodate a wide variety of commercial facilities, tenants, and physical layouts. In order to create a sustainable future, master planning must look to the long-term, with a design that is environmentally, sociably, and economically sustainable and can adapt to new business needs and incorporate new technologies and infrastructure advances. A basic planning principle is that the PTI ALH/Aerotropolis itself be designed as a flexible system that can be adapted to current and future business requirements. While the features of the competitive landscape for the near term are clearly in focus, competitive strategies will undoubtedly change over time and the PTI ALH/Aerotropolis must be able to respond in a reasonable amount of time to these new logistical needs and infrastructure requirements. A 15- to 30-year development horizon is not unreasonable for this purpose.

Critical Factor #4
The PTI ALH/Aerotropolis Must Establish Synchrony with other Infrastructure Projects Around the Country and the World.

We are moving into an era in which networks of firms compete rather than individual companies. In this new extended enterprise environment, Piedmont Triad companies must be able to access their suppliers, partners and customers quickly and effectively. This requires synchrony with air cargo networks around the country and the world and with harmonized communications (trace and track) systems. FedEx has established one of the world's most extensive, efficient, and seamless international shipping networks. By aligning and integrating more closely into their network, Piedmont Triad businesses will be able to participate more quickly and efficiently in the rapidly growing global economy. It is critical that many of these firms form close partnerships with FedEx, including possibly using FedEx as their one-stop shop third party logistics provider. Eventually, as described previously, a consolidated central cargo facility used by other air cargo firms and logistics providers should be constructed to supplement the FedEx facility to provide facilities for non-FedEx shippers. Its materials handing systems must likewise be synchronized with other systems in place or being developed around the country and the world.

Critical Factor #5
The Triad Must Emphasize the Importance of Logistics-Based Capabilities in Assisting, Supporting, and Attracting Globally-Oriented Businesses.

As companies search around the world for quality parts and components at competitive prices, and as customers demand quick response and fast delivery, access to multi-modal air logistics hubs will be a major criterion for industrial location. Companies will certainly continue to require traditional economic incentives, such as local investment offsets for land or facilities, tax-based concessions and workforce training. However, as the competitive priorities of speed and efficient consumer response predominate, the relative importance of these traditional factors will lesson. Increasingly, investment decisions will be made as much on the basis of the logistical capabilities of the site and access to national and global networks, as on government incentives. The FedEx hub and its network could be the Piedmont Triad's trump card.

Critical Factor #6
Master Plans Must Demonstrate Regional and Statewide Benefits of the FedEx Mid-Atlantic Hub and PTI's Cargo Capabilities.

In order for the PTI ALH to obtain long-term public and governmental support, its development must be positioned as a vehicle for greater Piedmont Triad regional economic growth. There is little doubt that the creation of the FedEx Mid-Atlantic hub at PTI will attract and advantage commercially successful companies to the airport environs and throughout the 12-county Region. As noted, it already has begun to do this. But, ultimately, the success of the hub will depend on how its capabilities can leverage businesses throughout the entire Piedmont Triad Region. In this regard, it is critical that PTI planning recognize and highlight the growing integration of its primary commercial and transportation corridors and clusters and develop an integrated logistics system plan that builds synergies among regional and state-wide commercial sites.

VI. Marketing Strategy for the PTI ALH/Aerotropolis

Let me now offer some guidelines for a marketing strategy to build upon leveraging the FedEx hub to assist, support, and attract commercial investors and service providers to PTI and its environs. I assume that for at least the near future, PTI, as well as organizations such as the Piedmont Triad Partnership, will continue to have the lead role and responsibility for promoting the FedEx Mid-

Atlantic hub and for identifying and attracting viable tenants and users to the complex and Piedmont Triad Region. In the next chapter, I will make recommendations regarding potential future organization and management of some specific functions. Here, I will raise the prospect that within the next ten years or so, PTI should consider (i) partnering with a private sector firm to operate the shared-use (non-FedEx) multi-modal logistics infrastructure and facilities, and (ii) partnering with major commercial real estate developers to attract further firms to the airport and nearby properties. This may well require new enacting legislation or an innovative financial partnership with private sector investors. Among the core functions of the partnership would be the promotion of the PTI air logistics complex and commercial development, from the creation of a marketing program for the complex, complete with public relations, advertising and publicity brochures and materials, to the identification, contact and "sales" effort with potential tenants and users. If a commercial site developer is feasible and chosen by the Piedmont Triad Airport Authority, it would be expected to have its own approach and techniques to marketing the project. The reason for this suggestion is simple. The core business of PTI management is aviation, not commercial real estate development.

In view of these assumptions, in the present section I first concentrate on the immediate marketing strategy tasks that fall to PTI and the Piedmont Triad Partnership for the period prior to the possible involvement of a private-sector developer and operator. However, it is also understood that the Piedmont Triad Airport Authority and PTI management may retain responsibility indefinitely for inside the fence projects. Recognizing this possibility, I also address longer-term marketing goals and issues for the air logistics hub that would be relevant either to a private-sector developer/operator or to PTI management should the latter continue to be the entity to promote and to develop airport property for the foreseeable future.

1. *PHASED MARKETING THEMES*

The ultimate objective of PTI is to serve as a major regional multi-modal air logistics hub and airport-driven commercial complex offering tenants and users state-of-the-art logistics, knowledge resources, and commercial support. Based on experience with similar multi-modal logistics complexes elsewhere, achievement of this goal will mean the PTI complex will likely evolve through a series of phases. In each phase, the marketing effort should be designed to attract a nucleus of facility users, which in turn serves as a catalyst to pull additional complementary companies to the complex and the airport environs. The kinds of tenants likely to be attracted to PTI will vary with each phase of the complex's development.

Marketing activities should be planned to match these anticipated development stages and tailored to the kinds of tenants that are most suitable to each stage, and not outrun actual or realistic development headlights.

a. Near Term

The near term represents a period from the present through the next 1 to 6 years. Strong efforts must continue to insure that all road and utility improvements and other infrastructure improvements are completed to keep the FedEx regional hub opening on schedule. In addition, PTI should build upon its previous efforts to attract other nationally and internationally networked air carriers.

It is important to reiterate that, during the near term period, marketing efforts should correspond to infrastructure development and other improvements at PTI. If marketing gets ahead of these improvements, credibility will be lost and the targeted tenants could become disenchanted.

b. Mid-Term

The mid-term for PTI development represents roughly the years 6 through 12 with some earlier overlay with near-term activity. This period's marketing strategies should be designed to further boost the air cargo demand at PTI and then to expand this demand by progressively widening and deepening the nature of activities located at and around the airport. These strategies are:

- facilitating the expansion of the FedEx hub while continuing to market to other air cargo service providers
- targeting industrial and commercial users of those air services
- encouraging improved logistics management, and
- further fostering the integration of production and logistics.

While these strategies are broadly sequential, there would naturally be an overlap from one stage to another in implementing them. Most important, the impact of this marketing will be cumulative, with efforts in one stage preparing a network of contacts and a PTI operating reputation to make it possible to begin moving the complex toward its next phase of evolution.

(1) Helping Expand the FedEx Complex while Attracting Charter Air Cargo Service Providers (years 3 to 12)

Being an integrated air express regional sort hub, FedEx's east coast network will generate much of its cargo throughput. This may expand during this period to international service by FedEx. For PTI to attract other point to point (airport to airport) air cargo service providers, a critical mass for air cargo demand (load) is necessary on a regular basis. Previous surveys have indicated that charter air cargo operators (e.g., Atlas Air, Cargolux, Evergreen, and Polar) serve airports where they can be assured of a significant volume of airfreight. The key to building a critical mass of cargo demand will be to focus on promoting the PTI air logistics hub to all industries within a 150-mile radius that are airfreight dependent. The intent here will not be to persuade the firms to relocate to the Piedmont Triad Region or nearer to PTI, but to use PTI rather than trucking their freight to Atlanta, Charlotte, JFK or Washington Dulles. I have not seen PTI's air cargo leakage statistics to other airports, but my hunch is that this leakage is substantial. To capture a significant portion of regional air cargo-leakage may require closer working relationships with major freight forwarders and third-party logistics service providers.

Initial marketing targets should focus on 3PL's, freight forwarders and shippers of time-sensitive products in the 150 mile radius of PTI, including the Charlotte area, which is aggressively developing its own multi-modal air logistics infrastructure but does not have an air express hub. Target firms include microelectronics companies, pharmaceutical firms, medical instruments and supplies, fresh produce, and seafood, and other high value to weight products. Marketing strategies geared to shippers, freight forwarders, 3PL's and air cargo firms should emphasize the value-added that PTI can mean in terms of lower cost and more efficient shipment services. During this phase of development, PTI will become a much more significant air cargo airport, featuring highly efficient cargo handling and transshipment capabilities.

(2) Attracting Additional Air-Intensive Commercial Users to PTI and the Piedmont Triad Region Aerotropolis (years 3 to 12)

As PTI's air cargo service capability expands significantly, reciprocal marketing should focus on attracting shippers (i.e., manufacturers and assemblers of products) and more national forwarders and third party logistics providers (3PLs) to locate at and around PTI and surrounding

Region. The goal will be to begin generating on-site origin/destination cargo shipments in terms of in-bound raw materials and components and out-bound intermediate and final goods flowing to and from the time-sensitive manufacturers and distributors that operate at or near PTI. Again, the emphasis should be on demonstrating a set of cost, speed, and service quality advantages to firms locating near or using PTI that are compelling to shippers, forwarders, and 3PLs.

c. Mid to Longer Term

The mid to longer term (years 6 to 25 and beyond) will focus on developing a full-scale, advanced PTI air logistics complex and attracting the complete complement of manufacturers, logistics managers and service providers to accomplish ultimate development objectives.

(1) Improved logistics management (years 6 to 16)

Once a core of air cargo firms, shippers, forwarders or 3PLs have located and successfully operated at and around PTI, the marketing emphasis will shift to promoting an extension of the range of value-added logistics management services PTI offers. Pointing to the importance of these features for cost-effective logistics, plus the record of efficiency that PTI will have established for its tenants and users to that date, marketing programs will begin to focus more on the advantages of PTI and the Piedmont Triad Region in overall logistics management. The marketing emphasis will be on helping industrial and commercial shippers and 3PLs find opportunities at PTI and the surrounding Region to coordinate the movement of materials and finished goods so that they can rapidly and flexibly respond to customer's needs as well as to cut costs and improve supply-chain management efficiency. The possibilities of performing value-added logistics functions such as sequencing, pick and pack, product labeling and assembly of knock-down product kits should be stressed. The marketing targets during this phase will be the companies already located outside the Piedmont Triad but in a 150 mile radius of PTI, plus the whole spectrum of major freight forwarders and third-party logistics providers that serve shippers nationally and globally. PTI's capabilities in automated warehousing/distribution, electronic data interchange, and electronic tracing-tracking will be underlined for these logistics specialists. PTI's sales proposition during this phase will not only emphasize cost and quality of service advantages, but also the

enhancements to the speed and agility of supply chain operations that PTI could provide shippers and 3PLs.

(2) Full integration of production and logistics (years 6 to 25 and beyond)

Once the hub is fully operational and PTI has developed a reputation for world-class cargo handling and logistics management, a final stage of ALH marketing can begin. The emphasis at this stage would be essentially an intensification of the "improved logistics management" marketing theme set forth above, whereby the marketing program will concentrate on supporting shippers and 3PLs to find ways to integrate production and logistics so as to substantially reduce inventories and further improve manufacturers' supply chain management. Building on the growing reputation of the FedEx hub, new interstate highways, and additional logistics assets, promotional materials will continuously need to differentiate PTI and its environs from other industrial-commercial-logistics locations as sharply as possible in terms of the connectivity, speed and agility benefits that it offers. PTI and the entire Piedmont Triad Region will at this point be marketed internationally to the most sophisticated shippers and 3PLs as a site where air freight dependent manufacturers fully coordinate their supply chains and overall production capacity with changing customer demands. The marketing message will also stress the Region's world-class standards in total logistics management practices including fusion of transportation modes (air, road, and rail), integrated telecommunications, sophisticated materials handling systems, and state-of-the-art commercial and knowledge support services.

2. TARGET INDUSTRIES

At every stage of marketing, the PTI's and the Piedmont Triad Region's promotional strategies should be grounded in solid business research and planning. This will involve market research of a generic nature on likely PTI tenants and users, given its stage of development, as well as market research specific to the greater Piedmont Triad Region. Research on commercial shippers from around the world points to five generic types of shipments where air transport is the consignees' mode of first choice. These are when:

- Flexible and customized production is the norm
- The high value of the product compared to its weight justifies the extra cost of airfreight

- The product is highly perishable—either in the physical or economic sense
- Short production cycles and/or "just-in-time" inventories require fast delivery
- Immediate delivery of spare parts, time sensitive documents or products is required

Target industry analysis for air logistics hubs conducted by UNC's Kenan Institute of Private Enterprise identified eleven industrial groups that are most likely to utilize the air express and air cargo facilities. Most of these would no doubt also be the best target industries for the larger Piedmont Triad Region, as well. They include:

- Logistics service providers
- Semi-conductor and computer chip manufacturers
- Pharmaceuticals and contract biotech and pharmaceutical lab testing facilities
- Computer and electronic sub-assembly manufacturers
- Aircraft assembly, aircraft parts suppliers and aircraft maintenance services
- Fashion, garments and accessory suppliers
- Scientific and medical instruments manufacturers, particularly those supplying small volumes of high value products, for example aromatics
- Optics and small precision equipment manufacturers
- Suppliers of perishable products—for example, fresh seafood, live animals, fresh fruit and flowers
- Digital automotive component manufacturers and related spare parts suppliers
- Jewelry and watch manufacturers.

In targeting these and other industries noted above, there are a number of services that need to be highlighted in a marketing plan for PTI and the Region. Many have already been discussed and some already exist, but let me provide a summary list of the key support services to be implemented and leveraged in marketing PTI and the greater Piedmont Triad Region.

- Expedited customs clearance and pre-clearance procedures

- Full electronic data interchange capability
- Foreign Trade Zone, FTZ operators, and bonded warehouses
- New roadway and rail access to PTI and with port connectors
- State-of-the-art materials handling services
- Reliable utility services (e.g., electricity, water, sewer)
- Industrial support services such as repair and maintenance and machine shops
- Quality of life—good housing, schools, recreation, nightlife, low crime
- Knowledge and education support, including a distance education and worker training facility at or near PTI
- Enhanced one-stop servicing for foreign investors
- Expedited site and building permit approvals

All of the above need to be woven into both the business plan and the implementation plan for greater success of PTI and the Piedmont Triad Region. They are not only essential to the marketing effort, but also to developing an effective multi-modal air logistics hub and regional network.

Exhibit 3.1
PROPOSED BUSINESS ENVIRONMENT FOR A PTI AIR LOGISTICS HUB AND TRIAD LOGISTICS NETWORK.

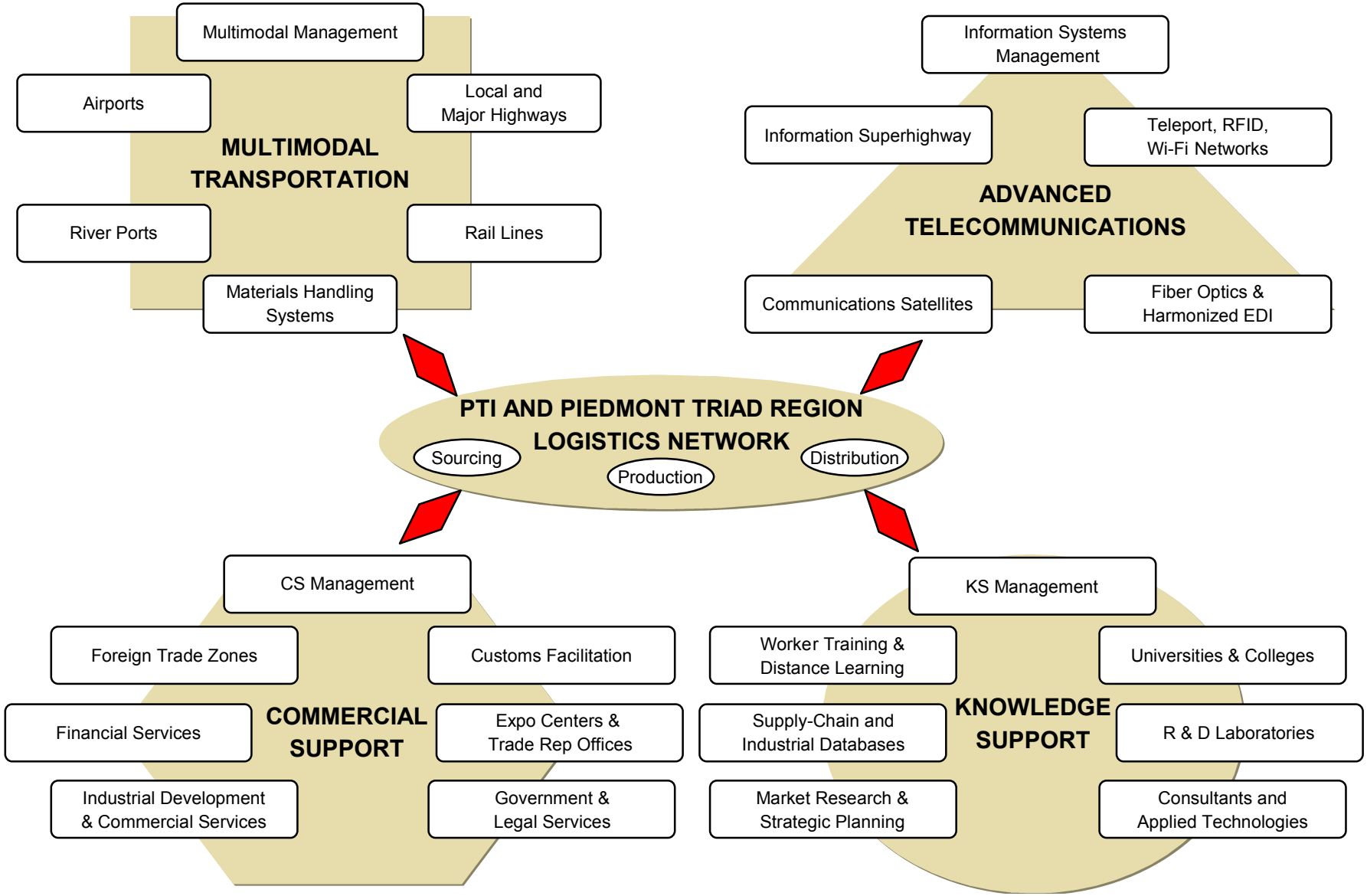
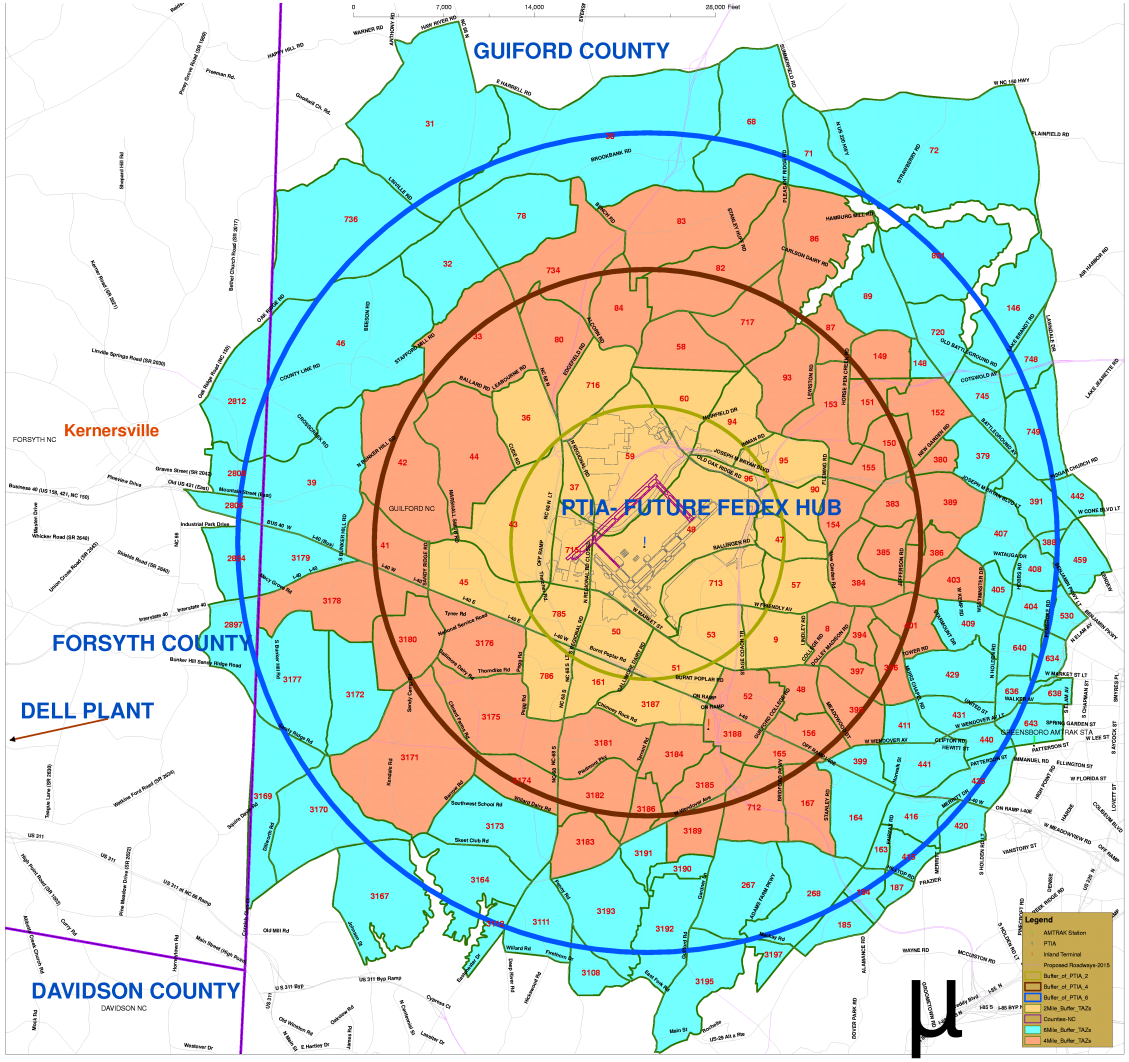


Exhibit 3.2
TRAFFIC ANALYSIS ZONES AROUND PTI
(2, 4 AND 6 MILES)



Source: Piedmont Authority for Regional Transportation.

Exhibit 3.3
POPULATION & EMPLOYMENT CHANGE IN AGGREGATED TRAFFIC ANALYSIS ZONES (TAZ)
WITHIN 2, 4, AND 6-MILE BUFFERS AROUND PTI:
2002 TO 2015, 2025 AND 2035

Population

Radius	Area (sq. mi.)	Total Population				Change Total Population					
		2002	2015	2025	2035	2002–15	% 2002–15	2002–25	% 2002–25	2002–35	% 2002–35
2 Miles	22.77	15,298	17,040	18,434	20,153	1,742	11.4%	3,136	20.5%	4,855	31.7%
4 Miles	70.69	58,412	71,367	82,770	97,291	12,955	22.2%	24,358	41.7%	38,879	66.6%
6 Miles	144.26	133,627	158,664	180,256	207,064	25,037	18.7%	46,629	34.9%	73,437	55.0%

Employment

Radius	Area (sq. mi.)	Total Employment				Change Total Employment					
		2002	2015	2025	2035	2002–15	% 2002–15	2002–25	% 2002–25	2002–35	% 2002–35
2 Miles	22.77	33,662	48,714	60,337	71,892	15,052	44.7%	26,675	79.2%	38,230	113.6%
4 Miles	70.69	61,167	87,170	109,432	133,290	26,003	42.5%	48,265	78.9%	72,123	117.9%

Source: Piedmont Authority for Regional Transportation, 2007.

Exhibit 3.4
EMPLOYMENT BY SECTOR TYPE AND DISTANCE FROM PTI:
2002, 2015, 2025, AND 2035

Sector	Year	Distance from PTI (radius)		
		2 Miles	4 Miles	6 Miles
Industry	2002	17,379	23,313	32,047
	2015	23,079	30,433	41,242
	2025	27,283	36,064	48,341
	2035	29,509	39,204	52,370
	Change 2002 to2035	6,430	8,771	11,128
Retail	2002	7,314	15,966	28,123
	2015	10,159	22,268	36,144
	2025	12,577	28,260	43,677
	2035	15,687	36,145	53,420
	Change 2002 to2035	8,373	20,179	25,297
Office	2002	2,023	6,533	10,095
	2015	3,498	10,109	14,912
	2025	4,628	13,312	19,141
	2035	6,269	17,620	24,746
	Change 2002 to2035	4,246	11,087	14,651

Sector	Year	Distance from PTI (radius)		
		2 Miles	4 Miles	6 Miles
Service	2002	6,711	13,523	23,672
	2015	11,705	22,043	34,989
	2025	15,563	29,307	44,459
	2035	20,130	37,751	55,054
	Change 2002 to2035	13,419	24,228	31,382
Other	2002	235	1,832	2,975
	2015	273	2,317	3,693
	2025	286	2,489	4,053
	2035	297	2,570	4,591
	Change 2002 to2035	62	738	1,616
Total	2002	33,662	61,167	96,912
	2015	48,714	87,170	130,980
	2025	60,337	109,432	159,671
	2035	71,892	133,290	190,181
	Change 2002 to2035	38,230	72,123	93,269

Source: Piedmont Authority for Regional Transportation, 2007.

Chapter 4

Guidelines and Recommendations for a PTI and Regional Logistics Implementation Plan

I. Introduction

In the previous two chapters, guidelines were provided for PTI air logistics hub (ALH) infrastructure and facility design and for the development of a PTI ALH and regional logistics business plan. Building on these two chapters, this chapter will present guidelines for an implementation plan, including (1) site and surrounding area infrastructure improvements, (2) needed institutional and local jurisdictional cooperation, (3) elaboration of infrastructure and marketing phasing, (4) incentives to attract and leverage additional airlines, air cargo service providers and industry, (5) coordination and harmonization with multi-modal air logistics hubs elsewhere, and (6) alternative institutional mechanisms for financing and managing PTI ALH development and operation. I will also discuss public/private sector cooperative approaches to generating a broader Piedmont Triad aerotropolis that can leverage development over the 12-county Region. The chapter concludes with recommendations for the Piedmont Triad Airport Authority, the Piedmont Triad Partnership, PART, and local governments to improve prospects for successful development of the PTI air logistics hub, the PTI, and the entire Piedmont Triad Region.

II. Infrastructure Phasing and Industrial Development Timetable

Whereas the PTI ALH/Aerotropolis is conceived ultimately as a fully integrated multi-modal transportation, telecommunications, manufacturing, and logistics support complex, the reality is that it will likely evolve over a 5- to 25-year period through a series of overlapping development stages. Understanding this is necessary for marketing and for making prudent investments in infrastructure timed to industry demand. Below I summarize key stages of an infrastructure, institutional and facilities implementation plan.

Stage I

Stage I will be when PTI access roadways are completed, other key access road ways planned, and additional highway improvements commence. It is also this near-term stage when a local government cooperative environment is established that will affect greater Piedmont Triad development. This includes cross-jurisdictional planning, joint recruitment of industry, tax benefit sharing, and other institutional mechanisms.

During Stage I (which can last two to five years), PTI airfield improvements should be completed including construction of a crossfield connector taxiway, high-speed taxiways extension of Runway 14/32, and extension of Runway 5/23 to ultimate length. Communications infrastructure should be updated and utilities (water and sewer) extended to/from surrounding areas. Additional acquisition of land adjacent to or near the airport should commence along the lines that were illustrated in Exhibit 2.9. Plans should be completed for intermodal rail on the PTI campus including potential future extension to industrial sites such as the HondaJet facility. Layout of new commercial facility sites should be completed and plans generated for a future connecting cargo transit system to each facility site.

It is during early phases of Stage 1 when a local government collaborative environment needs to be established that will limit local jurisdictional competition and conflicts in industrial recruitment and likely result in greater prosperity for each local government. This includes cross-jurisdictional infrastructure and facility planning, joint recruitment of industry, tax benefit sharing, and other regional development partnering mechanisms.

Zoning issues must also be immediately addressed. Residential encroachment around PTI should be restricted and land-uses designated for airport-oriented industries and their supporting services. In all cases, future residential development in aircraft noise contours must be limited with eventual acquisition by the airport of existing residential units in the highest (70dB) noise contours.

Stage II

Stage II (estimated to be a 3 to 6 year period following commencement of Stage I) will involve the expansion of integrated air express services and new international air cargo service at PTI, a critical step to the development of a successful ALH. In addition to FedEx and Tradewinds (which currently offers 3 or 4 flights a week to Puerto Rico via L-1011 and A300 freighters), international heavy-lift charter cargo carriers (Atlas Air, Polar Air, Cargolux, Evergreen, etc.)

should be recruited, along with international freight forwarders supporting cargo airlines and shippers. At this stage, the ALH would still serve primarily as a regional air express sort facility, cargo handling and perishables transshipment center, with limited on-site pick and pack, consolidation and break-down, kit assembly, and cold storage.

The PTI ALH can move beyond a basic passenger and air cargo airport once a number of requisites are implemented during Stage II to attract new businesses and industry. These include completion of the PTI Ring Road, expedited customs clearance and pre-clearance procedures, in-transit bonded facilities and improved north-south state highway access to the airport, a fully developed internal road system, and all utilities in place.

One of the critical paths to attracting new manufacturing and distribution tenants to the PTI ALH will be by offering tenants and users quicker, cheaper and more efficient site plan and building approvals, state-of-the art electronic data interchange (EDI) support, as well as high quality but rapid cargo security clearance.

As noted, improving surface connectors is critical to moving PTI and its aerotropolis Region to the fast-cycle logistics and time-critical manufacturing-assembly stage, so further infrastructure and materials handling improvements should be implemented during Stage II. These include completion of I-73, the Winston-Salem connector, the loop from Bryan Blvd to US 29, improvements to NC 68 north and to secondary roads such as Pleasant Ridge, Sandy Ridge and Highway 150.

Stage III

During Stage III (at least six years and possibly as much as twelve years from project commencement), an inland container yard should be developed. This may be at the intermodal truck terminal that services the port of Wilmington. Other facilities to be implemented during Stage III include a central cargo facility, a cold storage/perishables center, and a state-of-the-art distance education and worker training facility allowing specific skills transfer to firms locating at or near the ALH from virtually any location in the world. It is during this stage that larger numbers of third party logistics providers (3PLs) will likely set up operations at PTI to serve growing cargo movements to and from and through its ALH. Internal roads and utility connections will be developed or extended throughout the entire ALH (the automated cargo transfer system described in the ultimate ALH development stage will not yet likely be justified at this stage based on its high cost). The PTI Ring Road and all surface

transportation links should be completed by this stage, including those to the intermodal rail facility where additional truck cross-docking should be provided.

Stage IV

Stage IV (the full-scale ALH) will be reached when sufficient manufacturing and distribution tenants and multi-modal transportation and third party logistics providers reach a critical convergent mass so that production and logistics becomes fully integrated at and around PTI. At this stage, estimated to be in the 12- to 25-year time frame, all the elements of the ultimate ALH will be put in-place, including a fully functioning central cargo facility, intermodal rail yard and inland container port with road and rail connections to the PTI intermodal rail facility and truck connections to the Central Cargo Facility providing off-ramp and off-site manufacturers and distributors with efficient air freighter access. Both long-range runways may need to be expanded by this stage with additional on-site time-sensitive manufacturers, distributors, and third-party logistics providers located along their taxiway. Toward the end of this stage, the automated cargo transfer system (CTS) will likely be justified linking all logistics, manufacturing, and distribution facilities on the PTI campus.

As the ALH evolves through its stages, it will drive greater and greater amounts of commercial and industrial development on site and throughout the PTI Aerotropolis and the entire 12-county Piedmont Triad Region. This outside-the-fence development, in turn, will generate increased volumes of cargo and passengers at PTI in a reinforcing airport-Aerotropolis regional synergy. Such synergy will make PTI competitive in attracting additional passenger and cargo carriers of all types.

III. Providing Appropriate Investor Incentives

Since the PTI ALH will be designed to attract and grow industry beyond as well as on the PTI campus, incentives will play an important role. To date, Piedmont Triad communities, the North Carolina Department of Commerce, the Federal Aviation Administration, and the North Carolina Department of Transportation have provided financial incentives for airport area development through financial incentives where investors enjoy tax advantages and certain promotional privileges such as improved public infrastructure. Virtually all states and local areas are in the incentives game, though, so the relative advantage in attracting major industry is declining. New incentives to attract

and grow industry must be pursued. The PTI ALH, itself, can be one of the most powerful incentives. This is because operational incentives will be at least equally important, and in the longer term likely even more significant, than tax incentives in attracting goods-processing and distribution industries.

What the PTI ALH is meant to accomplish is to provide Piedmont Triad Region industries with connectivity, speed, and agility in their supply chain management, unmatched at other locations. Of first-order importance on the international commerce front is customs, as exporters and importers across the U.S. and around the world have consistently argued. Components of products assembled in the United States are often manufactured in several other countries and imported on a just-in-time basis. Likewise, international orders for these products are also increasingly time-definite requiring that assembled goods flow out rapidly and efficiently. At many large international airports, massive amounts of freight arrive from abroad, are broken down, sorted, or consolidated, then often again shipped abroad quickly and seamlessly.

According to the US-ASEAN Business Council, "The productivity and profitability of a manufacturing plant depends in large part on cycle time – that is, its ability to process inputs into outputs as quickly as possible. Decreased cycle time leads to lower inventories, with correspondingly lower inventory costs. In order to support world-class manufacturing, customs clearance time must be measured not in weeks, or even days, but in hours. Any customs administration that can provide reliable, timely customs clearance, or immediate release based on pre-clearance, creates an enormous competitive advantage in attracting manufacturing."

As Stage II in the ALH development cycle progresses, expedited, paperless customs procedures should be put in place. The PTI ALH must not only have fully implemented its automated customs environment, but also, as noted previously, have in place a quick and efficient cargo security system. Planning for this now could bring considerable benefits to PTI and the Piedmont Triad Region down the road.

At the federal level PTI representatives should support open skies agreements for air cargo and lobby for two other government incentives to attract air cargo service providers to PTI. These are change of gauge rights and co-terminal rights. Unlimited change of gauge rights will permit foreign-owned cargo aircraft of any size to fly into PTI and for cargo to continue its journey on smaller aircraft of the same airline. For maximum effectiveness, there must be no limits on the number of flights, the timing between arrivals and departures, aircraft gauge, or the cargo carried. Unrestricted change of gauge rights are particularly important to international hub and spoke logistics operations that the PTI ALH would be eventually suited to serve.

Unlimited co-terminal rights would permit foreign carriers to stop at any point in the U.S. to drop off shipments which originated outside the U.S. or to pick-up shipments for points outside the U.S. In order to maximize payload and in order to effectively operate an international air logistics hub, it is important that foreign carriers be given such rights without restriction. This fully liberalized environment at PTI and other U.S. airports would be reciprocated for U.S. carriers in the countries of the foreign-based carriers.

Finally, it is important that PTI maintain its low landing fees for air cargo carriers. Air freight is a highly cost-competitive industry and such an incentive could be a differentiating inducement for FedEx to substantially expand at PTI or major air cargo carriers to select PTI for service. Lower landing fees and other aeronautical costs are also important to attracting and maintaining additional passenger service. As the PTI campus develops its non-aeronautical revenues, those can be used to cross-subsidize aeronautical costs, making PTI highly cost competitive for airlines of all types.

IV. Coordination and Harmonization with Similar Facilities Elsewhere

If parts, components, and finished goods are to flow rapidly and seamlessly between PTI and other transportation modes to and from industries throughout the Piedmont Triad Region and around the nation and world, it is essential that their information technologies and materials handling systems be harmonized. This requires using standardized EDI messages with compatible, open architecture software systems, as described in the prior chapter.

Containerization, as noted, must also be standardized across shipping modes so, for example, that containers arriving at PTI's proposed future intermodal rail facility can be transferred efficiently by truck to the inland container yard near PTI. Since at a future point, some of these containers may also be air freighted via heavy-lift aircraft from PTI, they must also be made compatible with materials handling equipment for loading on all-cargo aircraft. Multi modal materials handling harmonization will require close coordination between the PTI ALH and other modal points.

When purchasing material-handling equipment, and building key infrastructure such as the central cargo facility or the inland port, careful consultations should be made with major air cargo, sea cargo, and surface cargo handlers throughout the U.S. and, indeed, the world. It would be a terribly expensive mistake not to coordinate design of future facilities at the PTI ALH with the predominant technologies, materials handling equipment and space

utilization standards at major ports and airports which will serve as Piedmont Triad Region trading partners.

In terms of recruiting additional air cargo service providers to PTI, it is recommended that executives of the Airport Authority, PART, and Piedmont Triad Partnership work with major freight-forwarders, and 3PLs and visit major air cargo hubs at Rickenbacker, Ontario California, and Memphis to examine non-FedEx systems being put in operation there. Through these visits, an excellent vision can be obtained of the direction that air cargo handling is taking with a variety of automated and semi-automated cargo operations as well as other processes and procedures being implemented at these airports to speed the flow of goods through the airport.

Piedmont Triad officials are well aware that air express companies like FedEx have their own facility design firms. Contact should be made with these companies and advice received before any such future facility development contracts are signed.

V. Institutional and Management Plan for the PTI ALH Development and Operation

Option 1: Have the Piedmont Triad Airport Authority Develop/Market/Operate the ALH

Considerable thought and work has been done to date on appropriate institutional and management plans for developing and operating a multi-modal air logistics hub. One approach implemented elsewhere is to create a special public authority to develop, market, and operate the ALH. For PTI, such an organization would be superfluous since the Piedmont Triad Airport Authority already exists to accomplish virtually all of this Thus, option 1 really is to keep the PTAA as the organization fully responsible for PTI ALH development.

The advantages of this institutional option (Option 1) include the following:

- A single organization such as the PTAA should be better able to coordinate and manage all aspects of the development of the project.

- A single line of authority would perform agency coordination, contact with engineers, designers, construction contractors, tenants, users and suppliers to the PTI ALH.
- The development of the project could be constructed in a series of phases which reflect market demands with limited multiple organizational conflicts.
- The creation and hiring of paid staff and management positions can be flexible according to need, recognizing that some political clout will be necessary to accomplish ALH development objectives.

The disadvantages of this option include the following:

- The PTAA may not have the experience or time to effectively develop, market and operate the ALH.
- There is no element of privatization and government funds would be utilized for most shared infrastructure and facility development.

Option 2: Private Enterprise Builds, Operates, and then Transfers the ALH to the Piedmont Triad Airport Authority.

A private enterprise could build and operate the PTI ALH for a stipulated concessionary period (say 30 years) then, in accordance with an agreement with appropriate public sector agencies, maintain concessions but transfer ownership of the ALH back to PTI. This option would eliminate the requirement for the Airport Authority to undertake the initial construction with its own or borrowed resources. The Airport authority would provide an exclusive contract with a private enterprise to design, build and operate the ALH complex for a given period of time.

In this option, the private sector could develop the air logistics hub (complementary to FedEx) using private-sector financing with or without government involvement. They would operate the complex, collect income from the operation and pay a limited concession fee to the Airport Authority for a determined period of time before transferring the ALH back to the Piedmont Triad Airport Authority.

With Option 2, onsite construction would be performed by the private sector and offsite infrastructure (e.g., highways) and utilities (e.g., water lines) would be provided by appropriate agencies. This may require a mandate from

local governments to the selected firm in this build, operate and transfer (BOT) approach to provide full cooperation to the project.

The advantages of Option 2 include the following:

- The project would be implemented by private enterprise, which may be more efficient, flexible, responsive and productive than government agencies.
- The timing of the development of the project could be accelerated to meet market demand.
- No new organization would have to be established.
- There would be no requirement for local public sector or other government financial resources to the project other than to support the provision of offsite services and external infrastructure.

The disadvantages of Option 2 include the following:

- New legislation may be required to enable private sector BOT.
- The private sector could have difficulty securing adequate financing for development and operating cash flow due to the size and complexity of the project.
- The private sector would expect to make an adequate return on its investment prior to the transfer back of the complex, leading to high service fees and long concessionary periods.
- Local jurisdictions might not be able to provide adequate offsite infrastructure to facilitate the operation of the complex.

Option 3: Public Sector Builds and Transfers to Private Enterprise

This option is a reversal to the previous alternative. The Piedmont Triad Airport Authority would be responsible for the construction of the project and would then transfer it to a private enterprise for operation and maintenance. Government resources finance initial development of the project but would then utilize the market-driven expertise and related financial strength of a private enterprise to market and operate the ALH.

The advantages of Option 3 include the following:

- Public resources can be used to immediately jump-start construction of ALH facilities.
- No special legislation would likely be needed and no new government structure would have to be established.
- The private sector would not be required to secure significant financing for the construction phase of the project.
- The specific expertise of local and state public agencies could be employed in the design and construction phase.
- These agencies would have only limited responsibilities for marketing or operating the ALH, which would be done mostly by the private sector whose core competency would include logistics and for commercial real estate development.

The disadvantages of Option 3 include the following:

- Extensive up-front public resources would have to be allocated to the project.
- It would be difficult to construct the project as a phased development. There could eventually be conflict between the private developer and the public agency if construction continued after transfer.
- The need for close and significant coordination during the design and build phase between the private developer and public agencies could create delays and added costs, which in turn could create problems during the transfer process.
- The efficiency, flexibility, relative high productivity and responsiveness of the private enterprise are utilized only during the operating phases of the project.

Promoting and Developing the Piedmont Triad Aerotropolis

An aerotropolis will inevitably emerge around PTI in the coming decades. The critical question is: will it form and grow intelligently, achieving the full benefits to Piedmont Triad Region residents, businesses and communities discussed in prior chapters or in a spontaneous, haphazard, unsightly and less than efficient manner that has characterized much airport-area development elsewhere in the U.S.

Intelligent development built on airport assets such as the FedEx regional hub and PTI's rich nearby interstate highways needs to be planned to avoid the latter outcomes. The stakes are high for PTI and the entire Piedmont Triad Region. Delay in commencing with an aerotropolis planning process to be outlined below could likely preclude PTI and the Piedmont Triad Region from realizing the full economic potential that the new FedEx hub and nearby interstate highways offer.

Aerotropolis master planning should therefore commence as soon as feasible in a coordinated cross-jurisdictional manner. Already, I noted a number of residential projects have been encroaching on land very near PTI far better suited for commercial and industrial development, and some commercial projects that are highly unlikely to be leveraged by their proximity to the airport have been completed or are underway. In short, little effort is being made to assess if developments in the PTI environs are consistent with airport-area land-use optimization.

Apropos the above, before the opportunity to plan and develop a Piedmont Triad Aerotropolis is lost, it would seem prudent that an Aerotropolis strategic planning group be formed and that the prospects of creating an Aerotropolis Development Authority be considered. Such an authority (with potential fiscal responsibilities) could work hand-in-hand with the PTAA, PART, the Piedmont Triad Partnership and city and county executives to ensure coordination and integration of inside and outside the airport fence development over a broad airport-linked area.

In absence of an Aerotropolis Development Authority, it may be possible to expand PTAA's responsibilities to serve as a lead or core organization. In this way, an additional layer of government could be avoided.

Another possible option would be for PART to establish an interagency and interjurisdictional task force to integrate capital and operational planning and activities in the airport area. This task force would focus on the most needed transportation projects to enhance airport area accessibility and in cooperation with Piedmont Triad governments help prioritize projects for inclusion in state and Federal transportation plans and budgets.

Not only is this type of integration lacking today, but also broader aerotropolis development is rarely coordinated since the territory frequently crosses numerous jurisdictions. In the absence of aerotropolis-wide coordination and planning, the efficiency and true functional integrity of the aerotropolis area is compromised, generating counterproductive local competition and limiting businesses and communities from achieving their full competitive and positive development potential.

There are lessons to be learned by PTI and Piedmont Triad leadership from some innovative development approaches elsewhere. For example, recognition by local jurisdictions in the Netherlands that Amsterdam Schiphol Airport was at the center of an expanding territorial complex of airport-linked industrial and commercial development led to the establishment of a public-private partnership to oversee the development of available sites near the airport and along its connecting expressways. This organization—the Schiphol Area Development Corporation (SADC)—directly manages some of these projects while coordinating all of them. It operates like a quasi-development authority for the broader Schiphol Aerotropolis. It is suggested that PTI, PART, and the Piedmont Triad Partnership closely examine this model.

While creating such an inter-jurisdictional authority would be favored to coordinate and optimize airport-driven development in the broader airport area, it is recommended that interim measures be implemented to improve chances of this outcome. One would be to institute periodic working sessions with local city and county officials and planners in the Piedmont Triad Region to inform them better about the nature of airport-linked development and explore how their specific jurisdiction might complement and leverage this new form of development. A larger picture view of the Piedmont Triad Aerotropolis and their role in its evolution could reduce local jurisdictional competition for entering businesses, encourage more effective and mutually beneficial place marketing and branding for business recruitment, and lead to more coordinated actions to address airport-induced problems and realize more beneficial development outcomes.

Related to this would be periodic convening of all land-use decision-makers within the Piedmont Triad Aerotropolis area (including airport executives, planners, developers, and local community officials) for transparent discussions and information exchange on each other's real and perceived needs and goals to prevent (or at least reduce) future conflicts and improve prospects for sustainable Piedmont Triad Aerotropolis development. Potential arterial congestion, pollution, noise, unsightly construction, and other disamenities negatively impacting the quality of life of residents and the image of the Aerotropolis must be addressed. Architecturally appealing, high-quality building construction, improved site planning, green-space, signage regulation, attractive thoroughfare lighting, and other "image" or impression-making features need to be incorporated into consistent development structures. Aerotropolis gateways, defining the project area, should be planned and designed with appropriate signage and corridors beautified through aesthetic lighting, themed electronic art, and landscaping that includes screenage of large parking areas and unsightly structures. Consistent with aerotropolis principles,

cluster rather than strip development should characterize commercial land-use planning, with maintained green-space between clusters.

One of the most promising institutional models for promoting aerotropolis development is the DIA (Denver International Airport) Partnership. The DIA Partnership (DIAP) is a consortium of public, private, and community leaders dedicated to promoting economic opportunity and quality of life in the Denver International Airport District, which includes portions of Denver and Aurora as well as the communities of Brighton and Commerce City and includes portions of Adams, Arapahoe and Denver Counties.

Priority areas of the DIA Partnership are:

- Making the DIA District a premier business location
- Leveraging business and investment
- Promoting quality community development.

Represented by the airport district's most visible and influential business people and government officials, DIAP is exceptionally well networked, informed and can be an effective advocate for new business prospects. DIAP offers assistance with

- Economic and demographic information
- Incentive possibilities
- Regulatory Approvals
- Master-planned location options within the District
- Design/build considerations
- Relocation services
- Metro area business practices and requirements.

The Partnership works closely with DIA to develop complementary efforts locally and regionally to maintain and support DIA's strategic business plan and air service, development objectives (e.g., the completion of a new on-airport hotel, cargo development, retail, entertainment, and hospitality). Along with encouraging both on-airport and off-airport development, DIAP pursues regional headquarters and professional service firms whose workers frequently travel by air.

In addition to its development objectives, DIAP works with the airport to recruit additional cargo and passenger service. For example, two years ago, it helped develop an action plan that optimized air cargo development at DIA, improved local infrastructure in support of cargo development and promoted the use of incentives directed towards attracting international cargo flights.

DIAP has an annual budget of approximately $1.2 million with $850,000 derived from membership fees (75% private, 25% public), $150,000 from events, and $200,000 in-kind. Guided by a board of directors, an executive committee (both of which meet bi-monthly) and a fulltime president, DIAP represents the Region at national and international trade shows, with government and the media, with prospective investors, and with site selection consultants strongly advocating the merits of DIA and the DIA Region. Exhibit 4.1 shows the basic organizational structure of the DIA.

Finally, as described in Chapter 1, Rickenbacker in Columbus , Ohio, really took off in the early 1990s once the Greater Columbus Inland Port Commission was established there to promote economic development at and around the airport by developing and leveraging logistics services and intermodal infrastructure. Piedmont Triad government and business leaders might consider also establishing such a port authority focused on enhancing multi-modal logistics and infrastructure centered around a major inland port.

Getting the PTI ALH Started

At an appropriate point in the not-too-distant future, the Piedmont Triad Airport Authority should consider the possibility of soliciting an appropriate feasibility study that would include assessing the merits and liabilities (including legality) of contracting with a third party to build and operate the PTI ALH. The Airport Authority would prepare the Terms of Reference and supervise the feasibility study. Assuming the ALH was found feasible and development recommended, the Airport Authority would do the following:

- Prepare and issue Terms of Reference necessary for PTI ALH design
- Draft bid and tender documents for the design
- Market the procurement opportunities
- Select the PTI ALH design consultant
- Negotiate and award a contract to the consultant

- Initiate dialogue and, if appropriate legislation is enacted, possibly put out to bid for potential private sector developers and operators of the PTI ALH
- Create and approve the arrangements for private sector and Piedmont Triad Airport Authority participation predicated on the development and management options selected
- Tender the proposals for PTI ALH development and operation
- Select a successful tenderer
- Prepare finalist contracts and concessionary arrangements.

As the primary governing organization, the Piedmont Triad Airport Authority must ultimately determine whether to move forward with a multi-modal air logistics hub. If so, it needs to select the best public, private or public-private venture structure to build, operate, and manage the PTI ALH as well as work with local governments to create effective logistical synergies throughout the Piedmont Triad Region.

VI. Summary Recommendations and Action Steps

Let me conclude by presenting a set of recommendations and action steps for the Piedmont Triad Airport Authority, PART, the Piedmont Triad Partnership, and other local business and government organizations to consider to assist, support, and attract the type of commercial and industrial development to and around PTI and the Piedmont Triad Region that has been sought for at least the past two decades. I will begin with strategic recommendations for the Region and the proposed PTI Air Logistics Hub and Piedmont Triad Aerotropolis, then move to more focused operational and management issues.

1. To compete nationally and globally, Piedmont Triad local governments must work together as a single entity reflecting the fact that the Region is a single integrated market economy. Without such cross-jurisdiction cooperation with established protocols among local governments, companies desiring to locate in the Piedmont Triad will play cities / counties off one another to the detriment of the local jurisdictions, their tax bases and their residents.
2. Anchored by the FedEx Mid-Atlantic hub, air logistics represents the Piedmont Triad's best opportunity to create a world-class, differentiating

competency that both complements the Region's traditional manufacturing economy and drives the transition to a new regional economy based on high tech / knowledge / multi-modal infrastructure. The confluence of location, excellent interstate highways, PTI and FedEx provide the Piedmont Triad competitive capabilities that can help brand the Region globally in the same manner that RTP has branded the Research Triangle Region and financial services have branded Charlotte.

3. Beyond branding, the Triad's powerful combination of multi-modal logistics assets (which should be the Triad's unique selling proposition) provides the Piedmont Triad with a real economic advantage that can attract investment, generate tens of thousands of new jobs, and raise the image and awareness of the Piedmont Triad, nationally and globally. Again, this will happen only if the Piedmont Triad comes together as an integrated Region to embrace a collaborative model of marketing and promoting the Region as a whole to create economies of scale and to plan and coordinate activities to maximize regional ROI.

4. As with the development of the Research Triangle Park (which adds substantial value to Raleigh, Durham, Chapel Hill and the entire 13-county Research Triangle Region, PTI-area development will not compete with municipality efforts elsewhere in the Region (e.g., downtown revitalization). It will complement such efforts and, over time, make them more successful. A good example is Boeing, which located its world headquarters in the Chicago Region because of O'Hare and its two primary airline customers hubbed there (American and United) but located its headquarters offices in downtown Chicago.

5. It will be increasingly difficult in the future for the Piedmont Triad Region to attract new industry and generate quality jobs on cost factors and traditional government incentives. Competitive advantage will come through strategic focus on connectivity, speed, and agility. Fast-cycle logistics should become the Region's new competitive tool, building on PTI's FedEx facility but going beyond it to develop a full-fledged multi-modal air logistics hub.

6. This multi-modal air logistics hub will integrate air, highway, and rail transportation modes with advanced telecommunications, sophisticated materials handling systems, and state-of-the-art support services to provide PTI tenants and users superior capability to respond rapidly and flexibly to changing markets nationally and worldwide. Upgraded local highways and new interstates and extended rail lines are required to integrate PTI with regional business clusters and major national and international transport modes. Similarly, state-of-the-art broadband,

fiber optics, Wi-Fi, and satellite uplinks and downlinks are needed for the Region's companies to trace, track, and control product movements, which in the future will increasingly be monitored and managed through RFID (radio frequency identification), GPS (Global Positioning System), and intelligent software agents (via computer chips imbedded in products, parcels, and containers).

7. Apropos the above, substantial improvements need to be made in the Region's highway system. This would include construction and completion of I-73; completion of a PTI ring road from Bryan Blvd to US 29 and on to I-73. Completion of the Winston-Salem Northern Connector is required and secondary roads also require upgrading. For example, Pleasant Ridge, Sandy Ridge, 68 North, and Highway 150 need improvements to provide better PTI access from surrounding cities. These roads would serve as needed secondary accesses from major highways (68, 29, 220). Better PTI access is also required from points south of the airport.

8. To plan for future commercial growth and allow PTI's infrastructure and flight schedule to expand, it is important for the Airport Authority to consider acquiring additional land. There are some existing housing areas along the eastern boundary of the airport that should be carefully evaluated at for potential acquisition as well as a number undeveloped sites near the airport that may be purchased to meet longer-term airport needs.

9. Elected officials and planners of areas around PTI must understand that they have a long-term fiduciary responsibility to manage land-uses near the airport for the benefit of the entire Region. Encroachment of residential and other non-compatible land uses threatens the huge potential future impact that PTI and the Piedmont Triad Aerotropolis can have on the entire 12-county Region.

10. It is thus further recommended that all undeveloped property in the vicinity of the airport be carefully examined by local zoning authorities to make sure that non-conflicting development occurs. In particular, new residential developments that may conflict with future PTI expansion needs and operation should be discouraged or prohibited while new zoning should encourage the location of airport-oriented businesses and industries in the vicinity of PTI.

11. Just as today's most successful businesses are innovative, flexible, and rapidly responsive, so too must infrastructure and facility planning and design at PTI. Master planning at PTI and its surrounding area thus

should not be so much a fixed physical plan as it is a flexible framework for accommodating a wide variety of tenants, users, facilities, and layouts that can be modified when new technologies, industries, and infrastructure emerge. For example, the future central cargo area should employ a modular layout for maximum flexibility and phased development. On-site cargo processing facilities should employ flex-tech principles and be reconfigurable to allow for expansion (or even contraction) as demand warrants. Ground transportation systems should incorporate redundant routings to minimize the impact of congestion or accidents both within PTI and its connecting transport systems. PTI management itself must be agile, prepared to respond rapidly and creatively to evolving tenant and user needs and to coordinate "one-stop-shop" support from a variety of government and institutional sectors.

12. PTI's intermodal transportation infrastructure should be designed to allow seamless and flexible flows of materials among convergent transportation modes and industrial and other commercial facilities both in the core and peripheral areas of PTI. A cargo transfer system (CTS) must be planned to eventually link the future Central Cargo Facility (CCF) to cargo-related tenants throughout the PTI campus, as well as to an on-site intermodal rail facility and via traditional rail connectors to an inland port, likely off-site. The CCF would provide off-ramp PTI tenants and off-site production facilities, warehouses, and distribution centers with efficient sorting capability, customs clearance, and air freighter access.

13. Planning for the PTI ALH and Piedmont Triad Aerotropolis should give high priority to aesthetics and environmental sustainability. PTI must support not only logistics activities but also leisure and business air travelers. To the extent possible, logistics, manufacturing, trucking, and cargo handling should be physically separated from flows of business and leisure travelers. High quality design standards should be maintained at and surrounding the ALH for buildings, landscaping, and site improvements. Entranceways and signage should be aesthetically pleasing. Since first impressions are often enduring, physical appearance is extremely important. Therefore, to the degree feasible, PTI and immediate surrounding areas should be designed to look more like a university campus or research park than a traditional industrial or logistics park.

14. Strong efforts must continue to attract additional passenger and air cargo service to PTI. Airlines must be viewed not just as companies, but more

as basic transportation infrastructure, no different from roadways and rail. Airlines, like public infrastructure, are shared by all (business, tourists, etc) providing "highways in the sky" that rapidly connect the Region to the world. These highways in the skies are "public good" infrastructures that do not have to be maintained by public money as do roadways and much other public infrastructure. To the extent possible low charges to airlines must be maintained to attract more air service, and additional incentives should be considered as well.

15. To compensate for its lower airline fees, the Airport Authority should explore further non-aeronautical revenue sources. Following *airport city* and *aerotropolis* principles, PTI must be thought of more in terms of a multifunctional commercial entity. This would involve developing more revenue generating activities in the terminal ala Philadelphia, Pittsburgh, Detroit, and Amsterdam Schiphol, possibly bringing in a private-sector operator to promote and manage on-site commercial real estate development, and generating other non-aeronautical revenues. Innovative revenue-generating relationships might also be developed with off-site businesses and industries that would substantially benefit from expanded passenger and air cargo airline service.

16. Marketing of the PTI ALH should emphasize the importance of its logistics-based capabilities in attracting time-sensitive goods-processing businesses. Such businesses will certainly continue to seek traditional investment incentives such as tax relief, investment offsets for land or facilities and workforce training. However, as noted above, as the competitive priorities of connectivity, speed and agile market response grow in importance, the relative power of traditional government incentives will lessen. Increasingly, firm siting decisions will be made at least as much on the basis of logistical capabilities of the site and access to global networks as on traditional government incentives. Such logistics-based marketing must be based in development realities of the PTI ALH, though, and phased, predicated on its stage of logistics capabilities. In each phase, the marketing effort should be designed to attract a targeted segment of ALH tenants and users based on capabilities offered at the phase which, in turn, would serve as a catalyst to attract additional complementary firms to the PTI, the Piedmont Triad Aerotropolis, and surrounding Piedmont Triad Region.

17. Attracting time-sensitive manufacturing and distribution industries will also require a thorough understanding of modern supply chain management principles and the fast-cycle logistics. To offer a truly marketable competitive advantage, PTI management, with the assistance

of local and regional economic development organizations, should bring together experts in logistics and supply chain management, multi-modal infrastructure development and information technology to help design specifications that would properly integrate and leverage all PTI elements for fast-cycle logistics. Few locations in the U.S. are doing this, so the PTI ALH can have a first-mover advantage in attracting high tech and other time-critical industries if it takes the lead in seizing this opportunity.

18. Logistics curricula concentrations such as those offered at Forsyth Tech, Guilford Tech, UNC-Greensboro and North Carolina A&T need to continue to expand and improve. Faculty possessing logistics expertise should be among the recruitment priorities of Piedmont Triad colleges and universities.

19. To ensure that firms being recruited to the Piedmont Triad Region have appropriately skilled workers and managers, a wide range of worker training, management education and technology transfer functions should be provided through a state-of-the-art education and training center (ETC). A key feature of the ETC should be distance-learning capability, providing recruited firms with real-time audio, video, and tactile worker training customized to their skill needs, from virtually anywhere in the world. Such headquarters-direct training capability would provide remarkable flexibility in firm recruitment and could distinguish the Piedmont Triad Region in rapid-response customized work-force training.

20. The Piedmont Triad Airport Authority and Piedmont Triad Partnership should establish a close working relationship with major corporate relocation and site selection consultants, making them aware of the PTI ALH's and Region's assets and regularly updating them on development progress. In most cases, large companies looking to expand or relocate rely on site selection specialists to provide them with a short-list of potential locations to choose from, along with their strengths and weaknesses. Likewise, major commercial real estate firms such as Colliers International, CB Richard Ellis, Hines, and Jones, Lang, LaSalle and Real Estate Investment Trusts (REIT), such as Prologis, AMB Properties, Highwoods, and Liberty Property Trust often work closely with corporations in their site selection and eventual commercial development.

21. Because entry appearance, project architecture and other symbols also send an important message, all PTI gateway entrances should receive special emphasis in design and image appearance. These entries must set

the tone for the development within which the airport's identity will be reinforced through distinctive building architecture, signage, landscaping, and roadway configuration. New electronic art technologies with laser lighting designs might be used to project the airport's and PTI's and Region's image in a futuristic, but non-gaudy manner. Design standards need to be incorporated into surrounding local communities' plans as well as the PTI's site design standards. This "image-making" or branding is a pivotal marketing strategy.

22. There are lessons to be learned by the Piedmont Triad Airport Authority and Piedmont Triad economic development organizations from commercial development approaches around Amsterdam Schiphol Airport and Denver International Airport. For example, recognition by local jurisdictions in the Netherlands that Amsterdam Schiphol Airport was at the center of an expanding territorial complex of airport-linked industrial and commercial development led to the establishment of a public-private partnership to oversee the development of available sites near the airport. This organization—the Schiphol Area Development Corporation (SADC)—directly manages some of these projects while coordinating all of them. It operates like a quasi-development authority for the broader Schiphol airport city. Likewise, as was described previously in this chapter, a public-private partnership has been established to foster economic development at and around Denver International Airport (the DIA Partnership). It is recommended that Airport Authority, PART, the Piedmont Triad Partnership and other economic development organizations in the Region take a close look at these models.

23. Whereas creating an inter-jurisdictional development organization such as SADC and DIAP may not be well received in a Region already served by a number of economic development organizations, it is recommended that a non-bureaucratic alternative be implemented to improve chances of coordinated efforts. One would be to institute periodic working sessions with Piedmont Triad municipal and county officials and their planners to inform them better about the nature of airport-linked development and explore how their specific jurisdiction might complement and leverage this new form of development. A better understanding by local government leaders of a PTI Air Logistics Hub / Aerotropolis and their community's role in its evolution could reduce local jurisdictional competition for entering businesses, encourage more effective and mutually beneficial place marketing and branding for business recruitment, lead to more coordinated actions to address

airport-induced problems, and realize more beneficial development outcomes.

24. Piedmont Triad city and county leaders should convene and produce an action plan with necessary resources committed to guide and assist both the near-term and longer-term development of the Piedmont Triad Aerotropolis. One of the biggest failures in the past has been a lack of a comprehensive multi-year plan that clearly defines roles and who carries them out, along with providing the necessary short and long-term organizational funding.

25. Consideration should be given to establishing an interagency task force within PART to integrate capital and operational planning and activities in the broader PTI airport area. The task force would focus on needed transportation priorities to enhance airport area accessibility to the Region and nation and, in cooperation with Piedmont Triad city and county governments, rank projects for inclusion in state and Federal transportation plans.

26. The FedEx regional sort at night and the early morning hours will require a massive flow each night of part-time employees. To save on parking space and provide better access to lower income people, it is recommended that PART establish multiple bus routes from locations throughout the Piedmont Triad Region to bring the surges of part-time sort employees to and from the FedEx sort facility each night.

27. If speed and agility are going to be the selling points for the PTI ALH and Piedmont Triad Aerotropolis, local governments will have to move quickly and flexibly when a tenant expresses interest. Often prospective tenants cannot afford to wait a year or more (or even six months) to get their site plan and building permits approved. It is therefore recommended that Piedmont Triad cities and counties establish an accelerated site and building plan approval process that can be completed more quickly than present.

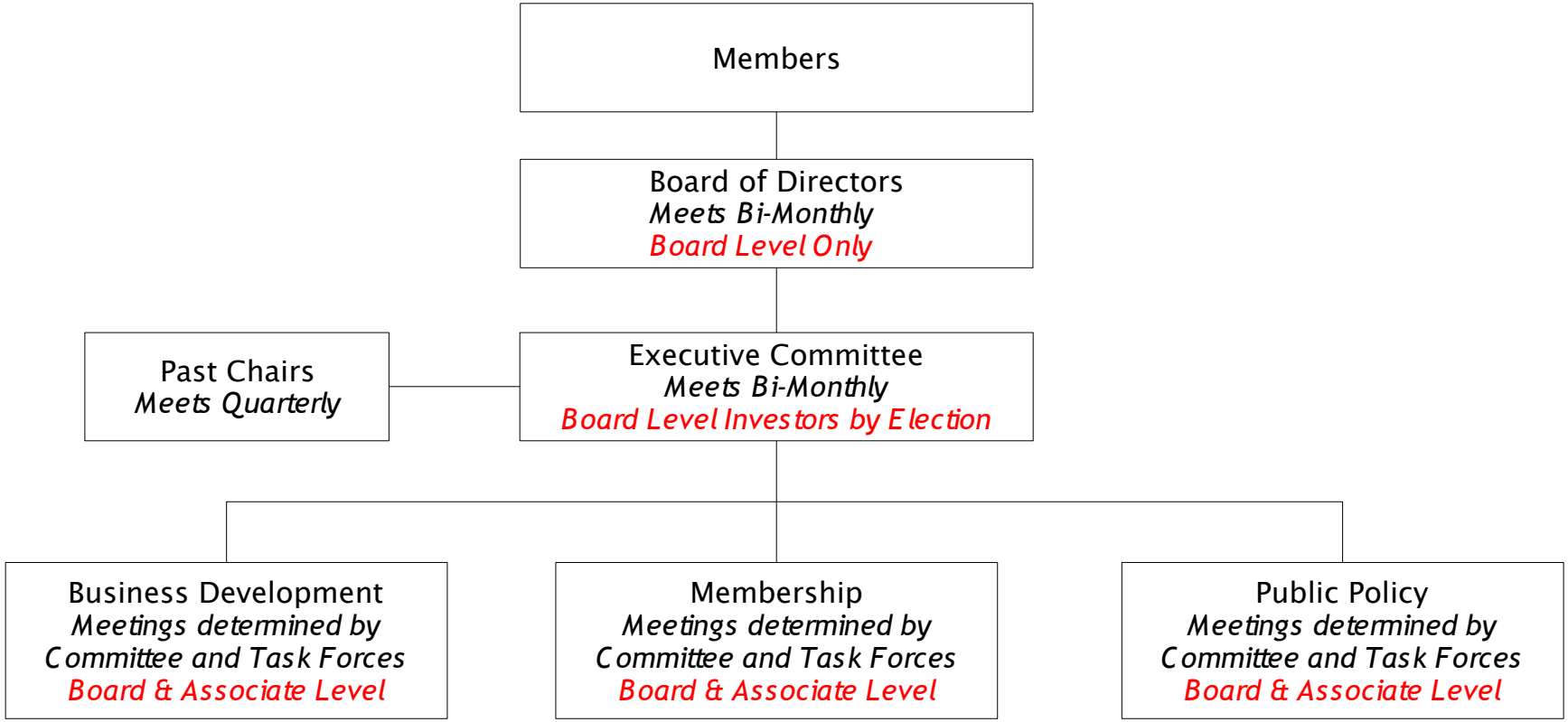
28. PTI management should remain focused on improving the airport's aeronautical infrastructure and service. Their core competency is not logistics services or commercial real estate development. The Airport Authority should therefore consider bringing in a private-sector master developer for the entire PTI ALH in the form of a public-private sector development partnership.

29. Since several Heart of the Triad (HOT) clusters will be greatly facilitated by PTI, coordinated planning of airport development and HOT development should be emphasized. HOT could be a major component

of and contribute substantially to Piedmont Triad Aerotropolis development.

30. The Piedmont Triad Airport Authority and Piedmont Triad economic development organizations may wish to take a bold step by immediately "branding" the PTI ALH and/or Piedmont Triad Aerotropolis. To some extent, the media is the message. Such branding could be instrumental in creating "buzz" in marketing to potential outside investors, developers, tenants, and users. It will also provide an excellent framework for local organizations to promote the greater Piedmont Triad Region and its competitive future.

Exhibit 4.1
ORGANIZATIONAL STRUCTURE OF DIA PARTNERSHIP.



Glossary

3PL: third party logistics providers. An independent organization that provides everything from basic transportation to sophisticated inventory management to manufacturers, distributors, and other shippers.

Aerotropolis: A new urban development form wherein the airport serves as a multimodal hub and commercial nexus for strings and clusters of airport-linked businesses and industries stretching outward up to 30 kilometers from the airport.

ALH: Air Logistics Hub.

Agility: Adapting quickly and effectively to constantly changing but unpredictable environments.

AOA: Airport operating area.

ASEAN: Association of Southeast Asian Nations.

B2B: Business-to-business.

B2C: Business-to-consumer.

BAX: Rickenbacker Airport (Columbus, Ohio).

CBD: Central business districts.

CBP: United States Customs and Border Protection (US CBP).

CTS: Cargo Transfer System. Internal network of dedicated rights-of-way to carry materials, components, and finished products throughout the Agile Logistics Hub.

CCF: Central Cargo Facility. A major cross-docking and materials-handling facility located along a main airport taxiway providing off-ramp and off-site factories, warehouses, distribution centers, and logistics providers with efficient sorting capability, customs clearance, and air freighter access.

CCA: Central Cargo Area. The zone of logistics infrastructure and cargo handling facilities that constitute operational core of the agile logistics hub.

CCC: Customs clearance center.

DIAP: Denver International Airport Partnership.

EDI: Electronic Data Interchange. Computer to computer exchange of information and data providing an interface between all parties involved in arranging and conducting a transaction and product shipment.

ERP: Enterprise resource planning.

ETC: Education and training center.

FAA: Federal Aviation Administration.

FTZ: Foreign Trade Zone.

GPS: Global Positioning Systems. Satellite monitoring of routes and location of product movements.

GTP: Global TransPark.

HOT: Heart of the Triad.

ICT: Information and communications technology.

IRF: Intermodal Rail Facility. An intermodal terminal with multiple rail sidings, loading platforms, and truck cross-docking.

ISO 14000: International standards that enable companies to systematize and improve their environmental management efforts.

LAN: Local area network.

LAX: Los Angeles International Airport.

LTL: Less-than-load.

MHS: Material-handling systems.

NCDOT: North Carolina Department of Transportation.

PART: Piedmont Authority for Regional Transportation.

PC: Perishables center.

PTAA: Piedmont Triad Airport Authority.

PTI: Piedmont Triad International Airport.

RDU: Raleigh Durham International Airport.

RFID: Radio Frequency Identification. Electronic system to trace, track, and control product movements.

ROI: Return on investment.

RTP: Research Triangle Park.

SADC: Schiphol Area Development Corporation.

SCLA: Southern California Logistics Airport.

TAZ: Traffic analysis zone.

VLJ: Very light jet.